Second Year – March 2015

Time : 2 Hours
Cool-off time : 15 Minutes

Part – III

PHYSICS

Maximum : 60 Scores

General Instructions to Candidates :

● There is a 'cool-off time' of 15 minutes in addition to the writing time of 2 hrs.

● You are not allowed to write your answers nor to discuss anything with others during the 'cool-off time'.

● Use the 'cool-off time' to get familiar with questions and to plan your answers.

● Read questions carefully before answering.

● All questions are compulsory and only internal choice is allowed.

● When you select a question, all the sub-questions must be answered from the same question itself.

● Calculations, figures and graphs should be shown in the answer sheet itself.

● Malayalam version of the questions is also provided.

● Give equations wherever necessary.

● Electronic devices except non-programmable calculators are not allowed in the Examination Hall.

നിർദ്ദേശങ്ങൾ :

● നിർദ്ദിഷ്ട സമയത്തിന് പുറമെ 15 മിനിറ്റ് 'കൂൾ ഓഫ് ടൈം' ഉണ്ടായിരിക്കും. ഈ സമയത്ത് ചോദ്യങ്ങൾക്ക് ഉത്തരം എഴുതാനോ, മറ്റുള്ളവരുമായി ആശയവിനിമയം നടത്താനോ പാടില്ല.

● ഉത്തരങ്ങൾ എഴുതുന്നതിന് മുമ്പ് ചോദ്യങ്ങൾ ശ്രദ്ധാപൂർവ്വം വായിക്കണം.

● എല്ലാ ചോദ്യങ്ങൾക്കും ഉത്തരം എഴുതണം.

● ഒരു ചോദ്യനമ്പർ ഉത്തരമെഴുതാൻ തെരഞ്ഞെടുത്തു കഴിഞ്ഞാൽ ഉപചോദ്യങ്ങളും അതേ ചോദ്യനമ്പരിൽ നിന്ന് തന്നെ തെരഞ്ഞെടുക്കേണ്ടതാണ്.

● കണക്ക് കൂട്ടലുകൾ, ചിത്രങ്ങൾ, ഗ്രാഫുകൾ എന്നിവ ഉത്തരപേപ്പറിൽ തന്നെ ഉണ്ടായിരിക്കണം.

● ചോദ്യങ്ങൾ മലയാളത്തിലും നൽകിയിട്ടുണ്ട്.

● ആവശ്യമുള്ള സ്ഥലത്ത് സമവാക്യങ്ങൾ കൊടുക്കണം.

● പ്രോഗ്രാമുകൾ ചെയ്യാനാകാത്ത കാൽക്കുലേറ്ററുകൾ ഒഴികെയുള്ള ഒരു ഇലക്ട്രോണിക് ഉപകരണവും പരീക്ഷാഹാളിൽ ഉപയോഗിക്കുവാൻ പാടില്ല.

1. (A) Permanent magnets should have

   (a) high retentivity and low coercivity.

   (b) low retentivity and high coercivity.

   (c) high retentivity and high coercivity.

   (d) low retentivity and low coercivity.   (Score : ½)

   (B) Distinguish between Para, Ferro and Diamagnetism.   (Scores : 1½)

2. (A) Work function of a metal is the

   (a) energy required by an electron to get absorbed in the metal surface.

   (b) minimum energy required by an electron to escape from the metal surface.

   (c) energy required by an electron to be retained in the metal surface.

   (d) maximum energy required by an electron to escape from the metal surface.

   (Score : ½)

   (B) Write Einstein's Photo-Electric Equation and explain the terms in it.   (Scores : 1½)

   (C) All Photo electrons are not emitted with the same energy as the incident photons. Why ?   (Score : 1)

3. The truth table of a logic gate is given below :

A	B	Y
0	0	1
0	1	0
1	0	0
1	1	0

   (A) Identify the gate.   (Score : ½)

   (B) Draw the logic symbol of the gate.   (Score : ½)

   (C) Explain why NAND gate is known as universal gate.   (Score : 1)

4. (A) The electric field of a plane electromagnetic wave travelling in the +ve Z-direction is described by

(a) $Ex = E_0 \sin (kz + \omega t)$

(b) $Ex = E_0 \sin (kz - \omega t)$

(c) $Ex = E_0 \sin (2kz)$

(d) $Ex = E_0 \sin (kz)$ **(Score : ½)**

(B) We feel excessive sweating on a cloudy day. Why ? **(Score : 1)**

5. Electric field lines are a pictorial representation of the electric field around charges.

(A) State Gauss's Law in Electrostatics. **(Score : 1)**

(B) Using this law derive an expression for the electric field intensity due to a uniformly charged thin spherical shell at a point.

(i) Outside the shell **(Scores : 2)**

(ii) Inside the shell **(Score : 1)**

(C) Suppose that you are in a cave deep within the earth. Are you safe from thunder and lightning ? Why ? **(Score : 1)**

6. (A) Interference of light from two sources can be observed if

(a) the sources are independent

(b) the sources are of different frequencies and random phases

(c) the sources are of different frequency

(d) the sources are coherent **(Score : ½)**

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(B) Draw Young's arrangement to produce interference pattern.   **(Score : 1)**

(C) Derive an expression for the fringe width of interference pattern formed on the screen.   **(Scores : 2½)**

(D) Write the condition to produce good interference bands.   **(Score : 1)**

7. (A) Range of an electronic communication system is the

   (a) distance to the nearest TV station.

   (b) distance to the nearest radio station.

   (c) largest distance the signal can travel.

   (d) largest distance between a source and destination up to which the signal is received with sufficient strength.   **(Score : 1)**

   (B) If the height of TV transmitting antenna is increased its coverage increases. Why ?   **(Score : 1)**

8. Transformers either increase or decrease AC voltage.

   (A) State the principle of a transformer.   **(Score : ½)**

   (B) Explain with the help of a labelled diagram the working of a transformer.

   (Scores : 2)

   (C) Explain briefly any three energy losses in a transformer.   **(Scores : 1½)**

9. (A) A device to store electrical charge is called

   (a) Transformer

   (b) Capacitor

   (c) Resistor

   (d) Inductor   **(Score : ½)**

(B)   What is meant by energy density of a parallel plate capacitor ?   (Score: 1)

(C)   Derive an expression for the energy stored in a parallel plate capacitor.   (Scores : 2)

(D)   What is the area of the plates of a 0.1 μF parallel plate air capacitor, given that the separation between the plates is 0.1 mm.   (Scores : 1½)

10.   [The following is a choice question. Answer any **one**]

(A)   A convex lens

(a)   is thicker at the edges than at the middle.

(b)   is thicker at the middle than at the edges.

(c)   diverges rays of light.

(d)   is of uniform thickness everywhere.   (Score : 1)

(B)   With the help of a ray diagram sketch the image formation of a convex lens when the object is between C and F.   (Score : 1)

(C)   Derive the lens maker's formula.   (Scores : 2)

OR

(A)   A ray of light travels from a denser to a rarer medium then, the ray

(a)   doesn't bend at all.

(b)   bends towards the normal.

(c)   bends away from the normal.

(d)   goes along the normal.   (Score : 1)

(B)   Draw a diagram showing the path of a monochromatic light through a triangular prism.   (Score : 1)

(C) Using this diagram obtain the relation $n_{21} = \dfrac{\sin\left(\dfrac{A + D_m}{2}\right)}{\sin\left(\dfrac{A}{2}\right)}$ **(Scores : 2)**

11. (A) Potentiometer measures the potential difference more accurately than a voltmeter, because the potentiometer

   (a) does not draw current from external circuit.

   (b) has a wire of high resistance.

   (c) draws a heavy current from external circuit.

   (d) has a wire of low resistance. **(Score : 1)**

   (B) With the help of a diagram explain the principle of a potentiometer. **(Scores : 1½)**

   (C) Using a potentiometer how do you determine the internal resistance of a cell ?

   (Scores : 1½)

12. (A) What is de Broglie hypothesis ? **(Score : 1)**

   (B) Write the formula for de Broglie wavelength. **(Score : 1)**

   (C) Calculate de Broglie wavelength associated with an electron accelerated by a potential difference of 100 volts.

   Given mass of the electron = 9.1×10^{-31} kg, h = 6.634×10^{-34} JS, 1 eV = 1.6×10^{-19} J

   (Scores : 1½)

13. A current carrying wire produces a magnetic field in its surrounding space.

   (A) The S.I. unit of magnetic flux density is

      (a) henry

      (b) tesla

      (c) Am^2

      (d) A-m   (Score : 1)

   (B) With the help of a diagram, derive an expression for the magnetic field at a point
       on the axis of a circular current loop.   (Scores : 2)

   (C) Consider a tightly wound 100 turn coil of radius 10 cm, carrying a current of 1A.
       What is the magnitude of the magnetic field at the centre of the coil ?   (Scores : 2)

14. [The following is a choice question. Answer any **one**.]

   (A) Draw the circuit diagram of transistor as an amplifier in common emitter
       configuration.   (Scores : 2)

   (B) Obtain the expression for the voltage gain.   (Scores : 2)

                                   OR

   (A) What do you mean by barrier potential of a diode ?   (Score : 1)

   (B) With the help of a diagram explain the working of a full wave rectifier.   (Scores : 3)

15. When the magnetic flux associated with a coil changes an emf is induced in the circuit.

   (A) State Faraday's law of electromagnetic induction.   (Score : 1)

   (B) Mention the physical significance of Lenz's law with an example.   (Score : 1)

   (C) When an electrical appliance is switched off, sparking occurs. Why ?   (Score : 1)

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16. (A) Obtain an expression for the number of radioactive nuclei present at any instant in terms of the decay constant and initial number of nuclei. **(Scores : 2)**

(B) The half life of radioactive radon is 3.8 days. Find the time during which $\frac{1}{20}$ of radon sample will remain undecayed. **(Scores : 2)**

17. Kirchhoff's rules are very useful for analysis of electrical circuits.

(A) State Kirchhoff's junction rule. **(Score : 1)**

(B) Find the effective resistance of the circuit given below : **(Scores : 2)**