

Code No. 7015

For Scheme-I Candidates only

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 ചോദ്യനമ്പറിൽ 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) $E_x = E_0 \sin(kz + \omega t)$
 - (b) $E_x = E_0 \sin(kz - \omega t)$
 - (c) $E_x = E_0 \sin(2kz)$
 - (d) $E_x = E_0 \sin(kz)$ (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)

- (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 $0.1 \mu\text{F}$ parallel plate air capacitor, given that the separation between the plates is 0.1 mm . **(Scores : $1\frac{1}{2}$)**

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 $n_{21} = \frac{\sin\left(\frac{A + D_m}{2}\right)}{\sin\left(\frac{A}{2}\right)}$ **(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, $h = 6.634 \times 10^{-34}$ JS, $1 \text{ eV} = 1.6 \times 10^{-19}$ 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)

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)

