Reg. No. : .....

Name : .....

Code No. 7015

Second Year – JUNE 2017
SAY/IMPROVEMENT

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 ആശയ വിനിമയം നടത്താനോ പാടില്ല.
- ഉത്തരങ്ങൾ എഴുതുന്നതിന് മുമ്പ് ചോദ്യങ്ങൾ ശ്രദ്ധാപൂർവ്വം വായിക്കണം.
- എല്ലാ ചോദ്യങ്ങൾക്കും ഉത്തരം എഴുതണം.
- ഒരു ചോദ്യനമ്പർ ഉത്തരമെഴുതാൻ തെരഞ്ഞെടുത്തു കഴിഞ്ഞാൽ ഉപചോദ്യങ്ങളും അതേ ചോദ്യ നമ്പരിൽ നിന്ന് തന്നെ തെരഞ്ഞെടുക്കേണ്ടതാണ്.
- കണക്ക് കൂട്ടലുകൾ, ചിത്രങ്ങൾ, ഗ്രാഫുകൾ, എന്നിവ ഉത്തരപേപ്പറിൽ തന്നെ ഉണ്ടായിരിക്കണം.
- ചോദ്യങ്ങൾ മലയാളത്തിലും നല്കിയിട്ടുണ്ട്.
- ആവശ്യമുള്ള സ്ഥലത്ത് സമവാക്യങ്ങൾ കൊടുക്കണം.
- പ്രോഗ്രാമുകൾ ചെയ്യാനാകാത്ത കാൽക്കുലേറ്ററുകൾ ഒഴികെയുള്ള ഒരു ഇലക്ട്രോണിക് ഉപകരണവും പരീക്ഷാഹാളിൽ ഉപയോഗിക്കുവാൻ പാടില്ല.

1. Pick the correct material suited for exhibiting photoelectric effect from the following :

Arsenic, Copper, Zinc, Gold, Argon **(Score : 1)**

2. If 'h' represents Planck's constant, 'c' the velocity of light and $\bar{\nu}$ is Wave number, then the unit of h c $\bar{\nu}$ is

(i) Newton (ii) Watt

(iii) Electron Volt (iv) Pascal **(Score : 1)**

3. Which of the following relation is correct for a transistor ?

(i) $I_C = I_B + I_E$ (ii) $I_B = I_C + I_E$

(iii) $I_E = I_B - I_C$ (iv) $I_E = I_B + I_C$ **(Score : 1)**

4. The mass of an electron is $\frac{1}{1840}$ part of mass of a proton. When they are subjected to a uniform electric field, they start accelerating.

(a) Which of them will have large acceleration ? **(Score : 1)**

(b) If they start from rest and have the same De Broglie wavelength of 1 angstrom unit, then determine the ratio of their kinetic energies. **(Scores : 2)**

5. Match the following :

Diamagnetic Material	Faraday Effect
	Meissner Effect
	Raman Effect
	Joule-Thomson Effect

(Score : 1)

6. A series LCR circuit is connected to a DC source. The magnitude of inductive reactance is _____. **(Score : 1)**

7. A ray of light undergoes refraction when it enters from air to glass.

(a) Critical angle for glass liquid boundary is $\sin^{-1}(8/9)$. Determine the speed of light in liquid if speed of light in glass is 2×10^8 m/s. **(Scores : 2)**

(b) A picture is painted with blue, green and red colours. A glass slab is placed on this picture. Will the images of all these colours lie in the same plane in the slab when viewed from the top of the glass slab ? Why ? **(Scores : 2)**

(c) If a ray of unpolarised light is made to incident at the polarizing angle on a glass slab then show that the reflected and refracted rays will be along mutually perpendicular directions. **(Scores : 2)**

8. Young's double slit experiment is used to demonstrate interference of light.

(a) In Young's double slit experiments, 1 mm slit separation produces a bandwidth of 0.6 mm on a screen placed at a certain distance away from the slits. When the screen is moved further away from the slits through 0.25 m, the bandwidth becomes 0.75 mm. Find the initial separation between slits and screen.

(Scores : 2)

(b) If one of the slits is closed still dark and bright bands are observed on the screen. This is due to

(i) Interference (ii) Polarisation

(iii) Reflection (iv) Diffraction **(Score : 1)**

9. An electromagnetic wave propagates with the aid of time varying electric and magnetic fields.

(a) If ϕ_E is the electric flux and ϵ_0 is the permittivity in free space, the quantity represented by $\epsilon_0 \frac{d\phi_E}{dt}$ has the unit of

(i) voltage (ii) current

(iii) charge (iv) magnetic field **(Score : 1)**

(b) In a plane electromagnetic wave, the electric field oscillates with a frequency of 6×10^8 Megahertz. In which region of the electromagnetic spectrum this wave is found ? **(Score : 1)**

(c) The longest wavelength in Balmer series produced by atomic hydrogen is 656.4 nm. Find the shortest wavelength in this series. **(Scores : 2)**

10. Derive the relation $\eta = \frac{\sin\left(\frac{A+D}{2}\right)}{\sin\frac{A}{2}}$ for a glass prism. **(Scores : 4)**

OR

Derive lens maker's formula for a convex lens producing a real image. **(Scores : 4)**

11. (a) A and B are two isotopes having mass numbers 14 and 16 respectively. If the atomic number of A is 7, then how many neutrons will be there in B ? **(Score : 1)**

(b) The half-life period of a radioactive material is 5 hours. In how much time $\frac{15}{16}$ of the material will decay ? **(Scores : 2)**

12. (a) The value of angle of dip at the magnetic poles of the earth is

(i) zero (ii) 90^o

(iii) 30^o (iv) 45^o **(Score : 1)**

(b) A magnetic needle oscillates in a uniform magnetic field of strength B_1 with a time period of 10 seconds. The same magnetic needle oscillates in another uniform magnetic field of strength B_2 with a time period 20 seconds. Which magnetic field is strong, B_1 or B_2 ? Why ? **(Scores : 2)**

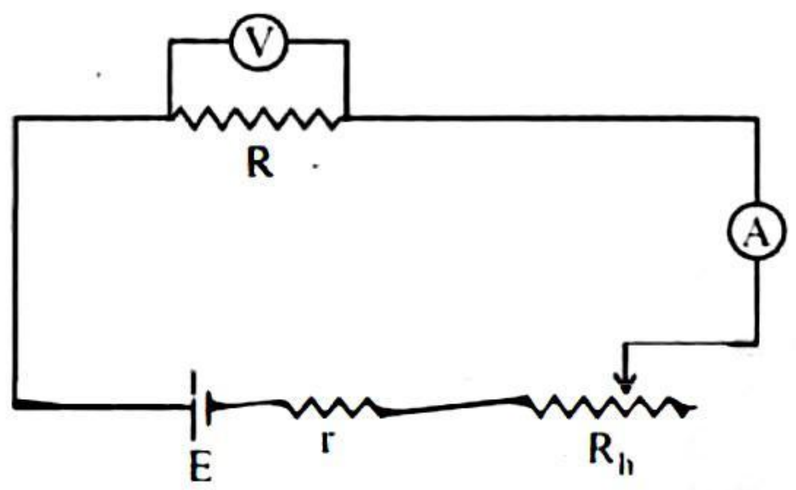
13. (a) State and explain Ampere's Circuital Theorem. **(Scores : 2)**

(b) Derive and expression for the magnetic field intensity produced at a point lying along the axis of a circular coil carrying current. **(Scores : 4)**

OR

Explain the theory and working of a moving coil galvanometer. **(Scores : 4)**

14. A resistance R is connected to a cell of EMF E and has an internal resistance r as shown in the figure. The voltage across R is measured using and ideal voltmeter and circuit current is measured by an ammeter. A rheostat of negligible resistance is used to vary the current in the circuit.



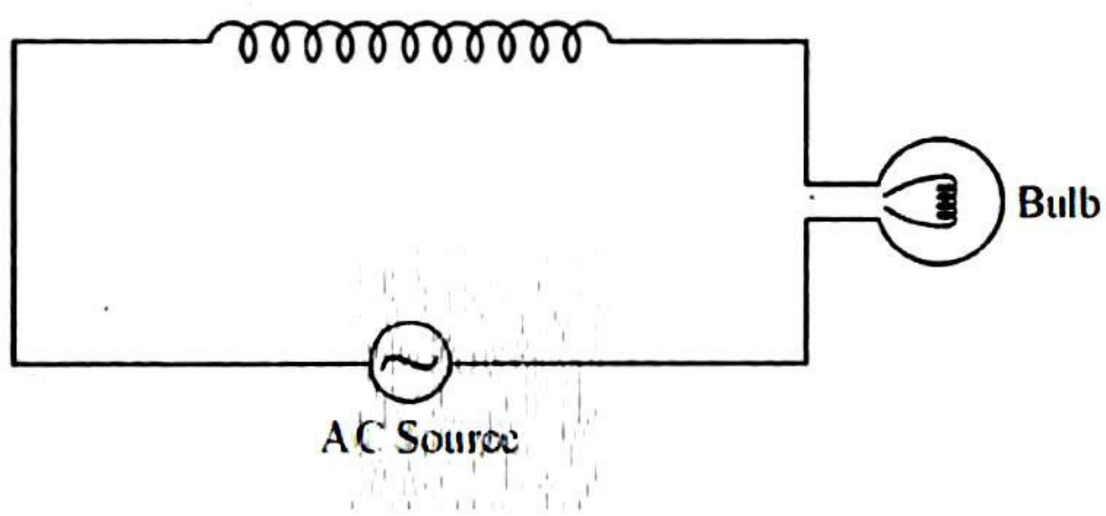
(a) Write down the expression for current in the circuit and voltage across R at any instant. **(Scores : 2)**

(b) Draw a graph connecting current in the circuit along X-axis and voltage across R along Y-axis. **(Scores : 2)**

(c) The quantity obtained from the slope of the graph is _____ . **(Score : 1)**

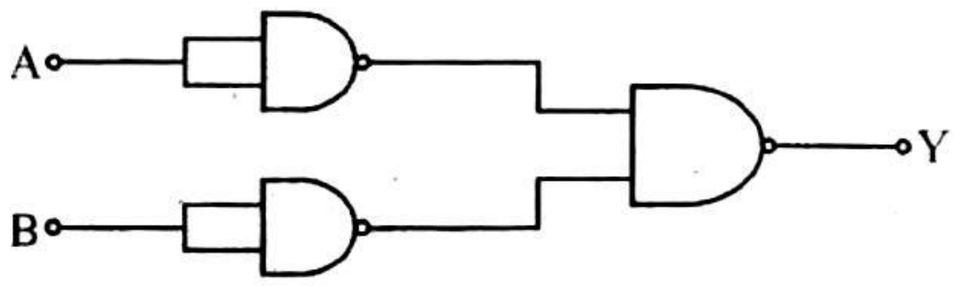
15. (a) What is eddy current ? Mention one application of it. **(Scores : 2)**

(b) An AC source is connected to a coil with negligible resistance and a bulb in series as shown in the figure. If an iron rod is gradually inserted in the coil, what happens to the brightness of the bulb ? Explain.



(Scores : 2)

16. A network of logic gates is shown in the figure.



(a) Identify the gates used in this circuit. **(Score : 1)**

(b) Write the truth table of this combination of gates. **(Scores : 2)**

(c) A carrier wave of peak voltage 12 Volt is used to transmit a message signal. Find the peak value of the voltage of the modulating signal in order to have a modulation index of 75%. **(Scores : 2)**

17. A capacitor is a device which can store electrostatic energy within the electric field set up between the plates.

(a) Write an expression for the energy stored in a capacitor in terms of charge Q and capacity C. **(Score : 1)**

(b) The electric lines of force never intersect one another Explain this statement.

(Scores : 2)

(c) Two capacitors of capacities C_1 and C_2 are connected in series and then in parallel. Obtain expressions for effective capacities in two cases. **(Scores : 4)**

OR

Obtain an expression for the capacity of a parallel plate capacitor with plate area A and plate separation d. **(Scores : 4)**

18. A p-n photodiode is fabricated from a semi-conductor with band gap energy of 2.8 eV. Can it detect a radiation of wavelength of 5000 nm ? Why ? **(Scores : 2)**

SECOND YEAR HIGHER SECONDARY EXAMINATION, JUNE 2017

PHYSICS

Qn. No	Sub Qns	Answer Key / Value points	Score	Total
1.		Zinc.	1	1
2.		(iii) electron volt	1	1
3.		(iv) $I_E = I_B + I_C$	1	1
4	(a)	electron	1	3
	b)	$P = \frac{h}{\lambda}$ $P_e = P_p$.	1	
		$E_e = \frac{P_e^2}{2m_e}$ $E_p = \frac{P_p^2}{2m_p}$ $\frac{E_e}{E_p} = \sqrt{\frac{m_p}{m_e}} = \frac{\sqrt{1840}}{1}$	1	
		OR		
		$\lambda = \frac{h}{P}$ OR $\frac{h}{\sqrt{2mE}}$ OR $\frac{h}{\sqrt{2meV}}$ (2)		
5		Any option	1	1
6		$X_L = L\omega$ OR $X_L = 0$	1	1
7	(a)	$\sin C = \frac{n_1}{n_2} = \frac{C_2}{C_1}$	1	
		$\frac{C_2}{C_1} = \frac{8}{9}$ $C_1 = \frac{9}{8} \times 2 \times 10^8 = 2.25 \times 10^8$ m/s	1	
		OR		
		$n = \frac{1}{\sin C}$ —— (2)	1	
	(b)	No		
		~~OR~~		
		speed of light depends on the colour or frequency or wavelength or apparent depth depends on speed of light or refractive index	1	

SECOND YEAR HIGHER SECONDARY EXAMINATION, JUNE 2017

Qn. No	Sub Qns	Answer Ke y / Value points	Score	Total
	c)	Figure Derivation	1 1	6
8.	a)	$\frac{\lambda D}{1\times10^{-3}} = .6\times10^{-3}$ $\frac{\lambda (D+.25)}{1\times10^{-3}} = .75\times10^{-3}$. $\frac{D+.25}{D} = \frac{5}{4}$ $D = 1m$. OR $\beta = \frac{\lambda D}{d}$ only give (2).	1 1	3
	b)	(iv) Diffraction.	1	
9.	a)	ii) Current	1	4
	b)	Visible region	1	
	c)	$\frac{1}{\lambda_1} = \frac{5}{36} R_H$ $\frac{1}{\lambda_2} = \frac{1}{4} R_H$ $\frac{\lambda_2}{\lambda_1} = \frac{5}{9}$ $\lambda_2 = \frac{5}{9}\times 656.4 = 364.67$ nm OR $\bar{\nu} = \frac{1}{\lambda} = R_H\left(\frac{1}{n_1^2} - \frac{1}{n_2^2}\right)$ only give score (2)	1 1	
10.	A	Figure Derivation OR	2 2	4
		Figure Derivation Final equation	1 2 1	

SECOND YEAR HIGHER SECONDARY EXAMINATION, JUNE 2017

Qn. No	Sub Qns	Answer Ke y / Value points	Score	Total
11	(a)	9	1	3
	(b)	$N = N_0 e^{-\lambda t}$ OR $\frac{N}{N_0} = \left(\frac{1}{2}\right)^{\frac{t}{T_{1/2}}}$	1	
		$\frac{1}{2} = e^{-5\lambda}$ $\frac{1}{16} = e^{-\lambda t}$ $t = 20$ hrs	1	
		OR $t = 20$ hrs (only give 2)		
12	a)	ii) 90^0	1	3
	b)	$T = 2\pi\sqrt{\frac{1}{mB}}$ OR $T \propto \frac{1}{\sqrt{B}}$	2	
		OR $B \propto \frac{1}{T^2}$ OR B_1 is higher		
13.	a)	Statement OR equation	2	6
	b)	Figure Derivation Final equation	1 2 1	
		OR.		
	(b)	Figure Derivation and working	1 3	
14.	a).	$I = \frac{E}{R+r}$	1	
		$V = IR$ OR $E - Ir$ OR $\frac{ER}{R+r}$	1	

Qn No	Sub Qns	Answer Key / Value Points	score	Total
	(b)	Any related attempt	2	5
	c)	Internal resistance OR Resistance	1	
15	a)	Definition	1	4.
		Application (any one)	1.	
	(b)	Bulb becomes less bright OR Inductive reactance increases OR $X_L = LW$ (give 1 score)	2	
16	(a)	Any related attempt	1	
	b)	Any related attempt	2	
	c)	$\frac{V_m}{V_c} = m$	1	5
		$\frac{V_m}{12} = 0.75$	1	
		$V_m = 12 \times 0.75 = 9V$		
17	a)	Energy = $\frac{Q^2}{2C}$ OR $\frac{1}{2}CV^2$ OR $\frac{1}{2}QV$	1	
	b)	Explanation	2	
	c)	Series OR parallel. Figure	1	7
		Derivation	2	
		Final equation	1	
		OR.		

QN NO:	Sub Quest.	Answer key / value points	Score	Total
		OR.		
	c)	Figure Derivation Final equation	1 2 1	
18.		NO $E_g = h\nu = \frac{hc}{\lambda}$ OR $\frac{hc}{\lambda} < E_g$ OR $\lambda = \frac{6.62 \times 10^{-34} \times 3 \times 10^8}{2.8 \times 1.6 \times 10^{-19}} = 443.3$ nm 5000 nm is higher 443.3 nm. It can't detect	1 1 2	2