Roll No. | | | | | | | Answer Sheet No._____

Sig. of Candidate._____ Sig. of Invigilator._____

PHYSICS HSSC–II

SECTION – A (Marks 17)

Time allowed: 25 Minutes

NOTE: Section–A is compulsory and comprises pages 1–2. All parts of this section are to be answered on the question paper itself. It should be completed in the first 25 minutes and handed over to the Centre Superintendent. Deleting/overwriting is not allowed. Do not use lead pencil.

Q. 1 Circle the correct option i.e. A / B / C / D. Each part carries one mark.

(i) It is required to suspend a proton of charge 'q' and mass 'm' in an Electric Field. The strength of field must be_____

A. $E = \frac{mg}{qv}$ B. $E = \frac{q}{mg}$

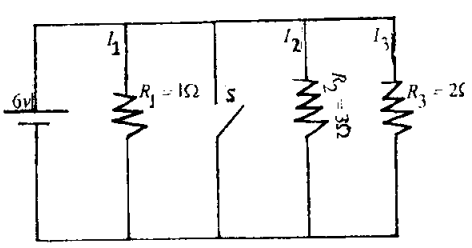
C. $E = \frac{mg}{q}$ D. $E = \frac{qv\sin\theta}{q}$

(ii) Two current carrying conductors are placed parallel to each other then_____

A. They attract each other for the same direction of currents
B. They attract each other for the opposite direction of currents
C. They repel each other for the same direction of currents
D. No force is present between them

(iii) In the given circuit when switch 'S' is closed, the current through all the branches are_____

A. $\begin{bmatrix} I_1 = 6A, \\ I_2 = 2A \\ I_3 = 3A \end{bmatrix}$ B. $\begin{bmatrix} I_1 = 0A \\ I_2 = 2A \\ I_3 = 6A \end{bmatrix}$



C. $\begin{bmatrix} I_1 = 3A \\ I_2 = 0A \\ I_3 = 0A \end{bmatrix}$ D. $\begin{bmatrix} I_1 = 0A \\ I_2 = 0A \\ I_3 = 0A \end{bmatrix}$

(iv) The energy stored per unit volume in the electric field between the plates of charged capacitor with dielectric is_____

A. $U = \frac{1}{2}\frac{\varepsilon_0}{\varepsilon_r}E^2$ B. $U = \frac{1}{2}\frac{\varepsilon_r}{\varepsilon_0}E^2$

C. $U = \frac{1}{2}\varepsilon_0\varepsilon_r E^2$ D. $U = \frac{1}{2}\frac{E^2}{\varepsilon_0\varepsilon_r}$

(v) A coil has an inductance 5.0 H. If current through it changes at the rate of $5AS^{-1}$, the emf induced in the coil will be_____

A. 2.5V B. 25V

C. 1.0V D. $\frac{1}{25}V$

(vi) The energy equivalent of 1u mass is_____

A. 931 J B. 9.31 J

C. 931 MeV D. 9.31 MeV

(vii) A charge 'q' is placed stationary in a region where both the electric and magnetic fields are present. The charge will experience_____

A. Both electric and magnetic forces B. Electric force

C. Magnetic force D. No force at all

(viii) The mathematical relation for NOR operation is_____.

A. $X = \overline{A.B}$ B. $X = \overline{A+B}$ C. $X = \overline{A}.B$ D. $X = A.\overline{B}$

(ix) The voltage gain of an inverting OP-Amplifier is_____.

A. $G = 1 - \frac{R_2}{R_1}$ B. $G = \frac{-R_1}{R_2}$ C. $G = 1 + \frac{R_2}{R_1}$ D. None of these

(x) The Compton shift "$\Delta\lambda$" is equal to the Compton wavelength, if the scattered X-ray is observed at an angle 'θ' for _____.

A. $\theta = 90^0$ B. $\theta = 180^0$ C. $\theta = 45^0$ D. None of these

(xi) If number of atoms in metastable state (E_2) is "N_2" and in ground state (E_1) is "N_1", the population inversion means_____.

A. $N_2 = N_1$ B. $N_2 < N_1$ C. $N_2 > N_1$ D. $\frac{N_1}{N_2} = \frac{E_2}{E_1}$

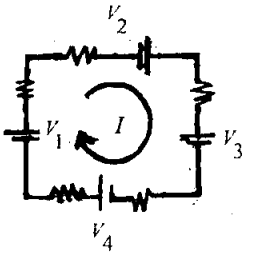
(xii) Which phenomenon proves the particle nature of electromagnetic waves?

A. Diffraction B. Polarization C. Interference D. Photoelectric effect

(xiii) The emission of α -particle from ${}^{226}_{88}Ra$ results into the formation of new element ${}^{A}_{Z}Y$ in a reaction $\left[{}^{226}_{88}Ra \rightarrow {}^{A}_{Z}Y + \alpha\right]$, where ${}^{A}_{Z}Y$ stands for _____

A. ${}^{230}_{88}Y$ B. ${}^{224}_{84}Y$ C. ${}^{222}_{86}Y$ D. ${}^{226}_{84}Y$

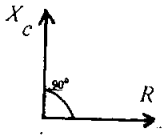
(xiv) The total applied voltage in the given circuit is_____.

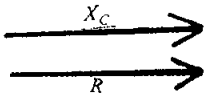


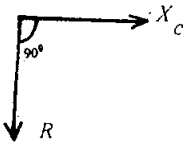
A. $[V_1 + V_2 - V_3 + V_4]$ B. $[V_1 + V_2 + V_3 + V_4]$

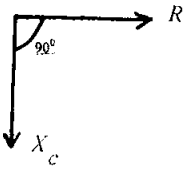
C. $[V_1 - V_2 - V_3 - V_4]$ D. $[-V_1 - V_2 + V_3 + V_4]$

(xv) Which phase diagram is true for RC-series circuit?

A. 

B. 

C. 

D. 

(xvi) The process of combining the low frequency signal with a high frequency carrier waves is called_____

A. Wave transmission B. Modulation

C. Resonance D. Beats

(xvii) Photon 'A' has twice the energy to that of photon 'B'. The ratio of momentum of 'A' to that of 'B' is_____.

A. $\frac{P_A}{P_B} = 1$ B. $\frac{P_A}{P_B} = \frac{1}{2}$ C. $\frac{P_A}{P_B} = 2$ D. $\frac{P_A}{P_B} = 4$

For Examiner's use only:

Total Marks: 17

Marks Obtained:

PHYSICS HSSC–II

Time allowed: 2:35 Hours **Total Marks Sections B and C: 68**

NOTE: Sections B and C comprise pages 1-2. Answer any fourteen parts from Section 'B' and any two questions from Section 'C' on the separately provided answer book. Use supplementary answer sheet i.e. Sheet–B if required. Write your answers neatly and legibly.

SECTION – B (Marks 42)

Q. 2 Answer any FOURTEEN parts. The answer to each part should not exceed 3 to 4 lines. (14 x 3 = 42)

(i) Does there exist any electric field inside a hollow charged shell? Prove your answer. How can a metal body act as electrostatic shielding for electronic devices?

(ii) What is the maximum power output theorem? Derive its formula.

(iii) A wire having total resistance of 32Ω, is cut into 4-equal lengths. Three of them are connected in parallel and one in series to them. Find total resistance of the combination.

(iv) What is one electron volt energy? Derive its formula.

(v) There exists a magnetic field of 0.30 T in space along +X-axis. What will be the magnetic force on a proton of $q = 1.6\times10^{-19}C$, when it is moving with velocity $3\times10^{4}\ ms^{-1}$ at an angle of 30^{0} to the field.

(vi) What is current sensitivity of a suspended moving coil galvanometer? How does it depend upon different factors? Describe by mathematical formula.

(vii) When the primary of a transformer is connected to a.c mains, the current in it:

a. is very low if the secondary circuit is open, but

b. increases when the secondary circuit is closed. Explain these facts.

(viii) In a certain region, the earth's magnetic field points vertically down $\vec{B} = -B_2\hat{K}$. When a plane flies due north with velocity $\vec{V} = V_y\hat{j}$, which wing of the plane is positively charged and why?

(ix) What is Reactance? Prove that the capacitive reactance $\left[Xc = \frac{1}{\omega C}\right]$ and inductive reactance $\left[X_L = \omega L\right]$ have the same units equal to that of resistance 'R', i.e. ohm.

(x) How is depletion region formed in PN-junction diode? What is the effect on the width of depletion region when:

a. Diode is forward biased

b. Diode is reverse biased

(xi) What will be the impedance of the R_c-series circuit when frequency of applied voltage is

a. $f = 0\ Hz$, b. $f = \infty\ Hz$

(xii) An electron and a proton moving with velocities V_1 and V_2 respectively have equal de.Broglies wavelengths. Find the ratio of their velocities. Which will be moving faster?

(xiii) How does an operational amplifier work as a comparator? Draw its circuit diagram and write down its two working conditions.

(xiv) An electron is to be confined in a box of the size of nucleus $(1.0\times10^{-14}m)$. What would be the speed of the electron if it were so confined?

(xv) If the speed of light were infinite, what would the equations of special theory of relativity reduce to?

(xvi) Differentiate between Spontaneous emission and Stimulated emission with the help of energy level diagram.

(xvii) Write the names and define three distinct ways of interaction of radiation with matter. Also give their energy range.

(xviii) Draw the circuit diagram of Wheatstone Bridge and derive its balanced condition to find the un-known resistance R_x.

(xix) If mass of proton $m_p = 1.6726\times10^{-27}\,kg$ and mass of neutron $m_n = 1.6749\times10^{-27}\,kg$, the experimental mass of dedutron $m_D = 3.3435\times10^{-27}\,kg$, find the Binding energy of deuteron nucleus.

SECTION – C (Marks 26)

Note: Attempt any TWO questions. **(2 x 13 = 26)**

Q. 3 **a.** What are the main parts of A.C. generator? Describe its principle and working. Also derive the equation of emf induced in its coils. **(07)**

b. It is desired to make an a.c. generator that can produce emf of maximum value 5.0 kV with 50 Hz frequency. A coil of area $1\,m^2$ and having 200 turns is used as armature. What should be the magnitude of magnetic field in which the coil rotates? **(04)**

c. Why is the core of transformer laminated? **(02)**

Q. 4 **a.** What is Electric Potential? Derive an expression of electric potential at a point due to a point charge. **(06)**

b. Using zero reference at infinity, determine the amount by which a point charge of $4.0\times10^{-8}C$ alters the electric potential at a point 1.2m away when (a) Charge is positive (b) Charge is negative. **(05)**

c. Write two similarities and two differences between Electric and Gravitational forces. **(02)**

Q. 5 **a.** Applying Bohr's Theory of Hydrogen Atom, derive: **(08)**

(i) Formula of Quantized Radii

(ii) Formula of Quantized Energies

b. An electron jumps from a level $E_i = -3.5\times10^{-19}J$ to $E_f = -1.20\times10^{-18}J$. What is the wavelength of the emitted light? **(05)**

Roll No. | | | | | | |

Answer Sheet No._____

Sig. of Candidate._____

Sig. of Invigilator._____

PHYSICS HSSC–II

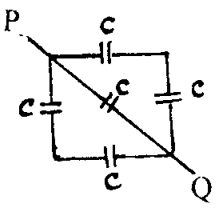
SECTION – A (Marks 17)

Time allowed: 25 Minutes

NOTE: Section–A is compulsory and comprises pages 1–2. All parts of this section are to be answered on the question paper itself. It should be completed in the first 25 minutes and handed over to the Centre Superintendent. Deleting/overwriting is not allowed. Do not use lead pencil.

Q. 1 Circle the correct option i.e. A / B / C / D. Each part carries one mark.

(i) The total capacitance of the given combination between P and Q is_____.



A. $\frac{C}{2}$ B. $2C$

C. $\frac{3}{2}C$ D. $\frac{2}{3}C$

(ii) The relation between emf and terminal potential difference of a battery is_____

A. $V = \varepsilon - Ir$ B. $\varepsilon = V - Ir$

C. $V = \frac{\varepsilon}{Ir}$ D. None of these

(iii) It is required to increase the current to double in a circuit of total resistance 'R'. For this purpose a new resistance R_x is connected to 'R' then_____.

A. $R_x = \frac{R}{2}$, (R_x in parallel to R) B. $R_x = 2R$, (R_x in series to R)

C. $R_x = R$, (R_x in parallel to R) D. $R_x = \frac{R}{2}$, (R_x in series to R)

(iv) The resistances of an ideal Ammeter and that of an ideal Voltmeter are respectively _____

A. $\begin{bmatrix} R_A = 0 \\ R_V = \infty \end{bmatrix}$ B. $\begin{bmatrix} R_A = \infty \\ R_V = 0 \end{bmatrix}$

C. $\begin{bmatrix} R_A = 0 \\ R_V = 0 \end{bmatrix}$ D. None of these

(v) The maximum value of emf induced in the coils of an A.C generator is_____.

A. NIAB B. $N\omega AB$

C. $NI\omega AB$ D. $NILAB\omega$

(vi) If turn ratio of an Ideal transformer is $\frac{N_s}{N_p} = 10$ then_____.

A. $\left[\frac{V_s}{V_p} = \frac{I_s}{I_p} = 10\right]$ B. $\left[\frac{V_s}{V_p} = \frac{I_s}{I_p} = \frac{1}{10}\right]$

C. $\left[\frac{V_s}{V_p} = 10, \frac{I_s}{I_p} = \frac{1}{10}\right]$ D. $\left[\frac{V_s}{V_p} = \frac{1}{10}, \frac{I_s}{I_p} = 10\right]$

(vii) In which of the following A.C circuits, the power dissipation is zero?

A. R.C-Circuit B. RL-Circuit

C. Only in Resistor "R" D. Only in Capacitor "C"

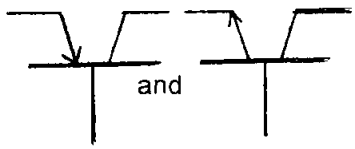
.....

(viii) Which of the Energy Bands may be either completely filled or partially filled but never be empty?

A. Conduction Band B. Valence Band

C. Forbidden Band D. Both A and B

(ix) Which pair of transistors is respectively represented by the given symbols



A. NPN and PNP B. PNP and NPN

C. Both are NPN D. Both are PNP

(x) A series of spectral lines emitted by the H-Atom according to the

formula $\frac{1}{\lambda_n} = R_H\left[\frac{1}{3^2} - \frac{1}{n^2}\right], n = 4,5,6.....$ represents _____.

A. Bracket series B. Pfund series

C. Balmer series D. Paschen series

(xi) Laser Process involves _____.

A. $\begin{bmatrix} Induced\ Absorption\ and \\ Spon\tan eous\ Emission \end{bmatrix}$ B. $\begin{bmatrix} Induced\ Absorption\ and \\ Stimulated\ Emission \end{bmatrix}$

C. $\begin{bmatrix} Spon\tan eous\ Absorption\ and \\ Spon\tan eous\ Emission \end{bmatrix}$ D. $\begin{bmatrix} Spon\tan eous\ Absorption\ and \\ Induced\ Emission \end{bmatrix}$

(xii) When Beta Particle $\left({}^{0}_{-1}e\right)$ is emitted by ${}^{234}_{90}Th$, the new element ${}^{A}_{Z}Y$ is formed in a reaction

${}^{234}_{90}Th \rightarrow {}^{A}_{Z}Y + {}^{0}_{-1}e$ where ${}^{A}_{Z}Y$ represents_____.

A. ${}^{234}_{91}Y$ B. ${}^{234}_{89}Y$ C. ${}^{233}_{90}Y$ D. ${}^{233}_{89}Y$

(xiii) A.C voltmeter used in A.C circuits always measures_____.

A. $V_{rms}\ and\ I_{rms}$ B. $V_{rms}\ only$ C. $V_{rms}\ and\ I_0$ D. None of these

(xiv) The Boolean expression $X = \overline{A.B}$ represents _____..

A. XNOR gate B. OR gate C. NAND gate D. AND gate

(xv) Einstein explained photoelectric effect by applying_____

A. Plank's Theory B. Bohr's Theory

C. de. Broglie's Theory D. Special Theory of relativity

(xvi) Dielectric placed between the plates of a charged capacitor can _____

A. Decrease the potential difference B. Reduce the electric Intensity

C. Increase the value of capacitance D. All of these

(xvii) The voltage gain of non-inverting OP-Amplifier is_____.

A. $1+\frac{R_2}{R_1}$ B. $1-\frac{R_2}{R_1}$ C. $1+\frac{R_1}{R_2}$ D. $1-\frac{R_1}{R_2}$

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Total Marks:	17
Marks Obtained:	

PHYSICS HSSC–II

Time allowed: 2:35 Hours **Total Marks Sections B and C: 68**

NOTE: Sections B and C comprise pages 1-2. Answer any fourteen parts from Section 'B' and any two questions from Section 'C' on the separately provided answer book. Use supplementary answer sheet i.e. Sheet–B if required. Write your answers neatly and legibly.

SECTION – B (Marks 42)

Q. 2 Attempt any FOURTEEN parts. The answer to each part should not exceed 3 to 4 lines. (14 x 3 = 42)

(i) Two equal charges are placed at some distance 'd' apart. Find electric potential at the mid point on a line joining these charges. When:

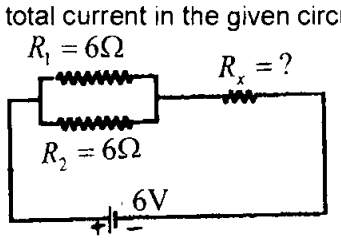
a. Both have the similar charge

b. Both have opposite charges

(ii) Two equal resistors are first connected in series and then in parallel to the same voltage source. Find the ratio of currents in both the cases.

(iii) What is Potential Gradient? Prove that the electric field intensity is equal to the negative of potential gradient i.e. $E = -\frac{\Delta V}{\Delta r}$?

(iv) Find R_x and total current in the given circuit if $\mathrm{Re} = 6\Omega$.



(v) The magnetic field in a certain region is given by $B = (40\hat{i} - 18\hat{k})Wbm^{-2}$. How much flux passes through a $5.0cm^2$ area loop in this region if the loop lies flat in the xy-plane?

(vi) Why should the resistance of Ammeter be very low and that of Voltmeter should be very high?

(vii) The energy stored in an inductor is given by $U_m = \frac{1}{2}LI^2$. Derive the relation between energy density and magnetic field. Where is this energy stored?

(viii) Prove that emf and $\frac{\Delta\phi}{\Delta t}$ have the same units.

(ix) What do you mean by impedance of an A.C circuit? Derive the impedance formula of R-C-series circuit. Also draw the impedance diagram.

(x) Distinguish between Intrinsic and Extrinsic semi-conductors. How would you obtain n-type and p-type materials from pure silicon?

(xi) What is resonance frequency of an A.C circuit? Applying Resonance condition in series resonance derive its formula.

(xii) Draw the schematic diagram, write Boolean expression and truth table of exclusive OR (XOR) gate.

(xiii) What is de-Broglie's wavelength? Find the wavelength of an electron when it is accelerated through a potential difference of 54 volt. $(m_e = 9.1\times10^{-31}kg,\ e = 1.6\times10^{-19}C)$

(xiv) What is Photoelectric Effect? What type of effect occurs on photoelectrons if:

a. Frequency of incident radiation increases?

b. Intensity of incident radiation increases?

(xv) Applying the second postulate of Bohr's Model of Hydrogen Atom, derive the relation for Quantized Radii of hydrogen atom.

(xvi) What is Mass Defect and Binding Energy of a nucleus? Write down their mathematical expressions.

(xvii) What is time constant of an RC-circuit? Prove that the product RC has units of time i.e. second.

(xviii) What is Fast Nuclear Reactor? Write down Nuclear Reaction in which $^{238}_{92}U$ is transmuted into $^{239}_{94}Pu$?

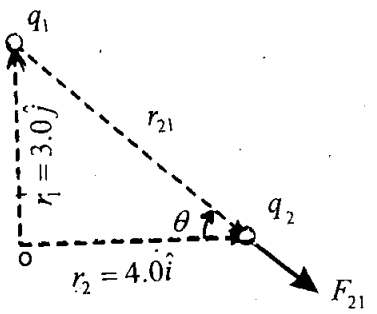
(xix) Describe briefly the function of Photodiode by circuit diagram.

SECTION – C (Marks 26)

Note: Attempt any TWO questions. **(2 x 13 = 26)**

Q. 3 **a.** State Gauss's Law. Find the Electric Flux through a closed surface enclosing a point charge. **(06)**

b. Two charges $q_1 = +100\,\mu C$ and $q_2 = +50\ \mu C$ are located in $xy-plane$ at position $r_1 = 3.0\hat{j}$ and $r_2 = 4.0\hat{i}$ respectively, where the distances are measured in metres. Calculate the force on q_2, its magnitude and direction. **(05)**



c. Do electrons tend to go to the region of high potential or lower potential? **(02)**

Q. 4 **a.** Describe the motion of an electron in uniform magnetic field and derive its expression of $\frac{e}{m}$ **(05)**

b. Alpha particles ranging in speed from $1000\,ms^{-1}$ to $2000\,ms^{-1}$ enter a velocity selector, where the electric field intensity is $300\ Vm^{-1}$ and magnetic induction is 0.20T. Which particle move undeviated through the fields and why? Find its velocity. **(05)**

c. Describe the change in the magnetic field inside the solenoid carrying a steady current I if : **(03)**

(i) The length of the solenoid is doubled but number of turns remains the same

(ii) The number of turns is doubled but the length remains the same.

Q. 5 **a.** Write down the postulates of Special Theory of Relativity. Briefly discuss its 3-main results. Why are these Relativistic effects not observed in daily life? **(08)**

b. A 50 Ke V photon is Compton scattered by quasi-free electron. If the scattered Photon comes off at 45^0, what is its wavelength. **(05)**