Version No.			
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ROLL NUMBER					

Answer Sheet No. _____

Sign. of Candidate _____

Sign. of Invigilator _____

Section – A is compulsory. All parts of this section are to be answered on this page and handed over to the Centre Superintendent. Deleting/overwriting is not allowed. Do not use lead pencil.

PHYSICS HSSC–II
SECTION – A (Marks 17)
Time allowed: 25 Minutes

حصہ اوّل لازمی ہے۔ اس کے جوابات اسی صفحہ پر دیے گئے نمبر کے سامنے دیے گئے دائرے کو پُر کریں۔ کاٹ کر دوبارہ لکھنے کی اجازت نہیں ہے۔ لیڈ پنسل کا استعمال ممنوع ہے۔

Fill the relevant bubble against each question:

ہر سوال کے سامنے دیے گئے درست دائرہ کو پُر کریں۔

1. Work done in moving a charge of $6C$ between two points is $10J$. What is the potential difference between two points?
   ◯ $60V$ ◯ $6V$ ◯ $0.6V$ ◯ $1.66V$

2. Four charges $+Q, -Q, +Q, -Q$ are placed at the corners of a square taken in order. At the centre of the square.
   ◯ $E = 0, V = 0$ ◯ $E = 0, V \neq 0$ ◯ $E \neq 0, V = 0$ ◯ $E \neq 0, V \neq 0$

3. A wire of resistance 'R' is stretched till its radius is half of the original value. The resistance of stretched wire is:
   ◯ 2R ◯ 4R ◯ 8R ◯ 16R

4. Energy consumed by a 60-watt bulb in 2 minutes is:
   ◯ 7.2 kJ ◯ 720 J ◯ 120 J ◯ 72000 J

5. The unit of magnetic flux is:
   ◯ $Wb.m^{-2}$ ◯ $Wb.m^{2}$ ◯ Wb ◯ Tesla

6. The working principle of galvanometer is based upon:
   ◯ Momentum ◯ Torque ◯ Force ◯ Impulse

7. If the motor is overloaded then the magnitude of back e.m.f:
   ◯ Increases ◯ Decreases ◯ Becomes zero ◯ Remains constant

8. The current in a coil of inductance 5H decreases at the rate of $2A/s$. The induced e.m.f is:
   ◯ 2.5V ◯ 0.4V ◯ 10V ◯ –10V

9. The phase difference between the current and voltage at resonance in R.L.C series A.C circuit is:
   ◯ 0 ◯ $-\frac{\pi}{2}$ ◯ $-\pi$ ◯ $\frac{\pi}{2}$

10. A body which breaks down just after crossing the elastic limit is known as:
    ◯ Elastic ◯ Hard ◯ Ductile ◯ Brittle

11. Which factor **does not** affect the conductivity of a PN junction diode?
    ◯ Doping ◯ Temperature ◯ Voltage ◯ Pressure

12.	Photon A has twice the energy of photon B. What is the ratio of the momentum of A to that of B?	◯ 4:1	◯ 2:1	◯ 1:1	◯ 1:2
13.	Pair production occurs only when energy of photon is at least equal to:	◯ 1.02 KeV	◯ 1.02 eV	◯ 1.02 MeV	◯ 1.02 GeV
14.	Which of the following series of hydrogen spectra lies in the ultraviolet region of the spectrum?	◯ Lyman series	◯ Balmer series	◯ Paschen series	◯ Pfund series
15.	If an electron jumps from second orbit to first orbit in hydrogen atom, it emits photon of:	◯ 3.40 eV	◯ 10.20 eV	◯ 13.6 eV	◯ 3.8 eV
16.	The quantity of uranium is 400g, the amount of uranium left after three half-lives is:	◯ 12.5 g	◯ 25g	◯ 50 g	◯ 100 g
17.	The particles that experience strong nuclear force are:	◯ Photons	◯ Leptons	◯ Bosons	◯ Hadrons

Important formulae

- $\phi = \frac{Q}{\varepsilon_o}$
- $q_o \Delta V = W_{BA}$
- $P = \frac{W}{t} = \frac{E}{t}$
- $R = \rho \frac{L}{A}$
- $\varepsilon = L \frac{\Delta I}{\Delta t}$
- $p = \frac{E}{c}$
- $E = E_n - E_p$
- $E_n = -\frac{E_o}{n^2}$
- $E_o = 13.6eV$
- $h = 6.63 \times 10^{-34} J.s$

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ROLL NUMBER						

PHYSICS HSSC–II

20

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

NOTE: Answer any fourteen parts from Section 'B' and any two questions from Section 'C'. Use supplementary answer sheet i.e. Sheet–B if required. Write your answers neatly and legibly. Statistical table will be provided on demand.

SECTION – B (Marks 42)

Q. 2 Attempt any FOURTEEN parts. All parts carry equal marks. **(14 x 3 = 42)**

(i) Why is it safe to stay inside an automobile during a light storm?

(ii) Two charges $5\times10^{-8}C$ and $-3\times10^{-8}C$ are located $16cm$ apart. At what point on the line joining the two charges is electric potential zero? Take the Potential at infinity to be zero.

(iii) Describe a circuit which will give a continuously varying potential.

(iv) State and prove maximum power transfer theorem.

(v) Will the two long, straight parallel wires carrying current in opposite direction attract or repel each other? Explain briefly.

(vi) What is galvanometer? How a $5mA, 100\Omega$ galvanometer is converted into 20V voltmeter?

(vii) Can an efficient step up transformer increase the power level?

(viii) State and prove the second postulate of Bohr Model of Hydrogen atom.

(ix) Prove that an ideal capacitor connected to an A.C source does not dissipate power.

(x) In a R.L series A.C circuit, will the current lag or lead the voltage? Illustrate your answer by a phasor diagram.

(xi) Differentiate between paramagnetic, diamagnetic and ferromagnetic materials with suitable examples.

(xii) Draw and explain the stress-strain curve for a ductile material.

(xiii) What is the working principle of magnetic levitation train? Explain how can it acquire high speed?

(xiv) Why is transistor called current amplification device?

(xv) Explain how a PN junction diode acts as a half wave rectifier?

(xvi) Deduce the relation between α and β of a transistor.

(xvii) The life time of electron in the excited state is about $10^{-8}s$. What is the uncertainty in energy during this time?

(xviii) What is the wavelength of the second line of Paschen Series?

(xix) What factors make a fusion reaction difficult to achieve?

(xx) Find the energy released when $\beta-$decay changes $^{234}_{90}Th$ into $^{234}_{91}Pa$. Given that

Mass of $^{234}_{90}Th = 234.0436u$, Mass of $^{234}_{90}Pa = 234.0428u$ and Mass of $^{0}_{-1}\beta = 0.00055u$

SECTION – C (Marks 26)

Note: Attempt any TWO questions. All questions carry equal marks. **(2 x 13 = 26)**

Q. 3 a. Describe the process of charging and discharging of a capacitor by sketching the graphs for the growth and decay of charge on the capacitor. **(05)**

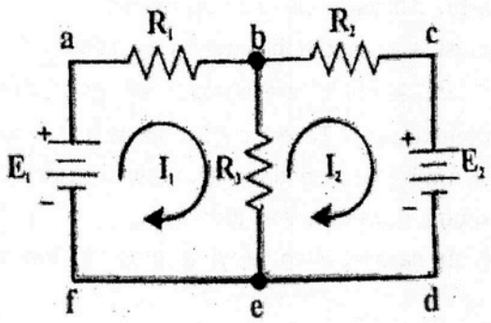
b. State Ampere's Law. Derive an expression for the magnetic field due to a current carrying solenoid. **(04)**

c. A long solenoid with 15 turns per cm has a small loop of area $2.0cm^2$ placed inside the solenoid normal to its axis. If the current carried by the solenoid changes steadily from 2.0A to 4.0A in 0.1s, What is the induced e.m.f in the loop while the current is changing? **(04)**

Q. 4 **a.** State the term impedance for an A.C circuit. Derive an expression for the impedance of R.L.C series A.C circuit. State the condition of resonance. **(05)**

b. What are X-rays? Discuss how inner shell transitions in heavy elements result into emission of characteristic X-rays. **(04)**

c. Determine the current in each loop of the given circuit. Given that, $R_1 = 1\Omega$, $R_2 = 2\Omega$, $R_3 = 3\Omega$, $E_1 = 5V$ and $E_2 = 10V$. **(04)**



Q. 5 **a.** State photoelectric effect. Discuss experimental results and photon theory of photoelectric effect. **(07)**

b. What is meant by nuclear fusion? Discuss how can energy be released in the fusion process? Illustrate with an example of proton-cycle. **(06)**

Important formulae

- $E = \frac{kq}{r^2}$
- $\phi = \vec{E}.\vec{A}$
- $\phi = \frac{Q}{\varepsilon_o}$
- $P = VI = I^2R$
- $V = IR$
- $\Sigma V = 0 \Rightarrow \Sigma IR = 0$
- $P = < VI >$
- $V = k\frac{q}{r}$
- $R_h = \frac{V}{I} - R_g$
- $\varepsilon = N\frac{\Delta\phi}{\Delta t}$
- $\varepsilon = L\frac{\Delta I}{\Delta t}$
- $\phi = NBA$
- $I_E = I_B + I_C$
- $V_S I_S = V_P I_P$
- $I = I_m \cos\omega t$
- $V = V_m \sin\omega t$
- $K.E_{max} = V_o e$
- $Z = \sqrt{R^2 + (X_L - X_C)^2}$
- $Elastic\ Modulus = \frac{Stress}{Strain}$
- $\frac{1}{\lambda} = R_h\left(\frac{1}{P^2} - \frac{1}{n^2}\right)$
- $(\Delta E)(\Delta t) = h$
- $\alpha = \frac{I_C}{I_E}$, $\beta = \frac{I_C}{I_B}$
- $L = mvr$
- $e = 1.602 \times 10^{-19} C$
- $k = 9 \times 10^9 Nm^2C^{-2}$
- $\mu_o = 4\pi \times 10^{-7} WbA^{-1}m^{-1}$
- $R_h = 1.0973732 \times 10^7 m^{-1}$
- $h = 6.63 \times 10^{-34} J.s$
- ${}^{A}_{Z}X \rightarrow {}^{A}_{Z+1}X + {}^{0}_{-1}\beta + Q$

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Version No.			
8	0	8	1

ROLL NUMBER					

Answer Sheet No._____

Sign. of Candidate _____

Sign. of Invigilator _____

Section – A is compulsory. All parts of this section are to be answered on this page and handed over to the Centre Superintendent. Deleting/overwriting is not allowed. Do not use lead pencil.

PHYSICS HSSC–II

SECTION – A (Marks 17)

Time allowed: 25 Minutes

حصہ اوّل لازمی ہے۔ اس کے جوابات اسی صفحہ پر دیے گئے مراکز کے حوالے کریں۔ کاٹ کر دوبارہ لکھنے کی اجازت نہیں ہے۔ لیڈ پنسل کا استعمال ممنوع ہے۔

Fill the relevant bubble against each question:

ہر سوال کے سامنے دیے گئے درست دائرہ کو پُر کریں۔

1.	A point charge $+q$ is placed at the centre of a cube of side 'a'. The electric flux emerging from the cube is:	○ Zero	○ $\frac{q}{\varepsilon_o}$	○ $\frac{q}{6\varepsilon_o}$	○ $\frac{q}{\varepsilon_o a^2}$
2.	The energy of an electron which accelerates through a potential difference of 1000 V is:	○ $1.6\times10^{-22}J$	○ $1.6\times10^{-20}J$	○ $1.6\times10^{-19}J$	○ $1.6\times10^{-16}J$
3.	A wire of uniform cross-sectional area 'A' and length 'L' is cut into two equal parts. The resistance of each part becomes.	○ Double	○ Half	○ Four time	○ Eight time
4.	The maximum output power is delivered to a load resistance 'R', when the internal resistance 'r' of the source is equal to:	○ ∞	○ 0	○ R	○ $\frac{R}{2}$
5.	The unit of magnetic flux density is:	○ $Wb.m^2$	○ $Wb.m^{-2}$	○ NAm^{-1}	○ NmA^{-1}
6.	Work done on a charged particle moving in a uniform magnetic field is:	○ Minimum	○ Maximum	○ Zero	○ Negative
7.	When carrying electricity on long distances, step-up transformers are used to:	○ Increase voltage, reduce current	○ Increase current, reduce voltage	○ Increase both voltage and current	○ Increase both voltage and power
8.	The capacitive reactance in a pure capacitive D.C circuit is:	○ Very small	○ Very large	○ Zero	○ Infinite
9.	An electromagnetic wave is generated by:	○ Any moving charge	○ Any accelerating charge	○ A charge with changing acceleration	○ A charge moving in a circle
10.	If both the length and radius of the rod are doubled, then modulus of elasticity will:	○ Increase	○ Decrease	○ Remains the same	○ Be doubled

PHYSICS HSSC–II

22

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

NOTE: **Answer any fourteen parts from Section 'B' and any two questions from Section 'C'. Use supplementary answer sheet i.e. Sheet–B if required. Write your answers neatly and legibly. Statistical table will be provided on demand.**

SECTION – B (Marks 42)

Q. 2 Attempt any FOURTEEN parts. All parts carry equal marks. **(14 x 3 = 42)**

(i) Explain why the capacitance of a parallel plate capacitor increases when a dielectric slab is placed between its plates?

(ii) Is E necessarily zero inside a charged rubber balloon, if balloon is spherical? Assume that charge is distributed uniformly over the surface.

(iii) Why the e.m.f of a cell is always greater than its terminal voltage?

(iv) What is Wheatstone bridge? Deduce the condition for which Wheatstone bridge is balanced?

(v) How can one sperate particles of different velocities moving in a magnetic field?

(vi) A copper wire of diameter 1.6 mm carries a current of 20A. Find maximum magnitude of magnetic field due to this current.

(vii) How are eddy current produced in an iron core of transformer and how can they be minimized?

(viii) An induced e.m.f has no direction of its own. Explain breifly.

(ix) When an A.C source is connected to an ideal inductor, show that the average power supplied by the source over a complete cycle is zero.

(x) What is the basic principle of generation of electromagnetic waves?

(xi) Briefly explain the working principle of magnetic levitation train.

(xii) Why charge carriers are not present in the depletion region?

(xiii) How a PN-Junction diode is used as a full-wave rectifier?

(xiv) What is a transistor? Discuss the operation of NPN transistor.

(xv) What is meant by wave-particle duality? Explain on the basis of de-Broglie hypothesis.

(xvi) Calculate the shortest and longest wavelength of radiation for the Brackett Series.

(xvii) How can the spectrum of hydrogen contain so many lines even though a hydrogen atom has only a single electron?

(xviii) Describe the construction and working of Helium-Neon Laser.

(xix) The mass of $^{14}_{7}N$ nucleus is $13.999234u$. Calculate its binding energy. Given that Mass of Proton $= 1.007276u$ and Mass of Neutron $= 1.008665u$.

(xx) How can energy be released in the nuclear fusion process?

SECTION – C (Marks 26)

Note: Attempt any TWO questions. All questions carry equal marks. **(2 x 13 = 26)**

Q. 3 a. State the principle of A.C generator. Explain by sketching graph, how is an A.C generator used to produce an alternating current? (05)

b. A current carrying loop is placed in a magnetic field. Derive an expression for the torque acting on it. (04)

c. Describe hysteresis loop for a magnetic material by drawing its curve for iron. (04)

PHYSICS HSSC–II

22

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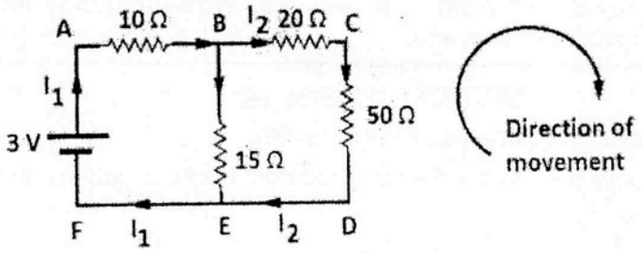
b. A current carrying loop is placed in a magnetic field. Derive an expression for the torque acting on it. (04)

c. Describe hysteresis loop for a magnetic material by drawing its curve for iron. (04)

Q. 4 **a.** Derive a relation for an impedance and resonant frequency in R.L.C series A.C circuit. **(05)**

b. State Gauss's law for electrostatics. Using Gauss's Law, derive a relation for the electric field intensity at a point due to a uniformly charged infinite plane sheet. **(04)**

c. Calculate the current in each branch of the circuit using Kirchoff's voltage law. **(04)**



Q. 5 **a.** What is a nuclear reactor? Give the principle, construction and working of a typical nuclear reactor. **(07)**

b. State the postulates of special theory of relativity. Discuss time dilation and length contraction as a consequence of special theory of relativity. **(06)**

Important formulae

- $E = \frac{kq}{r^2}$
- $\phi = \vec{E}.\vec{A}$
- $\Sigma V = 0 \rightarrow \Sigma IR = 0$
- $\varepsilon = N\frac{\Delta\phi}{\Delta t}$
- $P = VI$
- $V = IR$
- $V = V_m \cos\omega t$
- $Z = \sqrt{R^2 + (X_L - X_C)^2}$
- $P = VI\cos\phi$
- $I_E = I_B + I_C$
- $\lambda = \frac{h}{P} = \frac{h}{mv}$
- $\frac{1}{\lambda} = R_h\left(\frac{1}{P^2} - \frac{1}{n^2}\right)$
- $B.E(in\,MeV) = 931 \times \Delta m$
- $\Delta m = Zm_p + (A - Z)m_n - M_{(A,Z)}$
- $m_e = 9.109 \times 10^{-31} kg$ $= 5.485 \times 10^{-4}\,\mu$
- $k = 9 \times 10^9 Nm^2C^{-2}$
- $\mu_o = 4\pi \times 10^{-7} WbA^{-1}m^{-1}$
- $R_h = 1.0973732 \times 10^7 m^{-1}$
- $c = 3 \times 10^8 m/s$
- $m_p = 1.673 \times 10^{-27} kg$ $= 1.007u = 937MeV$
- $m_n = 1.675 \times 10^{-27} kg$ $= 1.008u = 938MeV$
- $e = 1.602 \times 10^{-19} C$
- $C_{med} = \frac{\varepsilon_o \varepsilon_r A}{d}$
- $E = \frac{V}{d} = \frac{Q}{\varepsilon_o A}$
- $F_m = qvB$
- $F_e = qE$
- $\varepsilon = IR + Ir$
- $B = \frac{\mu_o I}{2\pi r}$
- $F = NBIL$
- $\tau = Fl$
- $\sigma = \frac{Q}{A}$