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Roll No.

Date:

NORTHWEST ACCREDITATION COMMISSION, USA

HIGH SCHOOL DIPLOMA (Sr. Secondary/12TH)

Subject- Physics(theory)

Subject Code – P403

Question Paper No. :

Question Paper code:

Important Instructions

1. OPENING AND CHECKING OF THE QUESTION-BOOKLET

Break open the seal of the Question-Booklet only when the announcement is made by the Invigilator. After breaking the seal and before attempting the questions, student should immediately check for:

a) The number of the printed page in the Question-Booklet is the same as mentioned on the cover page of the Booklet and

b) Any printing error in the Booklet pages, if any.
Any discrepancy or error should be brought to the notice of the Invigilator who will then replace the Booklet.
No additional time will be given for this.

2. No student, without the permission of the Superintendent, or the Invigilator concerned, is to leave his/her seat or the Examination Room.

3. FILLING UP THE REQUIRED INFORMATION ON QUESTION-BOOKLET AND ANSWER SHEET

After breaking open the seal and checking the Booklet, student should:

a) Fill up the **Question Paper No.** and **Question Paper Code** (mentioned on the cover of Question-Booklet) in the space provided on the First Answer Sheet.

b) Fill up his/her Roll Number on the First Answer Sheet and on each Supplementary Answer Sheet, if taken.

C) Student should mention the total number of **Supplementary Answer Sheet**, if taken, in the space provided on the First Answer Sheet and also fill up the Serial Number mentioned on each **Supplementary Answer Sheet** along with his/her Roll Number in the register maintained by the Invigilator. Student must tie all the Answer Sheets with the thread provided by the Invigilator.

4. INSTRUCTIONS ABOUT QUESTION PAPER

This Question Paper is divided into three Sections – **A, B** and **C**. All Sections are compulsory. Attempt all Sections as per instructions.

a) Section A question No. 1 to 5 are very short questions carrying 2 marks each.

b) Section B question No. 6 to 15 are short questions carrying 3 marks each.

c) Section C question No. 16 to 21 are long questions carrying 5 marks each.

5. Student found in possession of Cellular Phone / Mobile Phone / Pager or any other Communication Device and/or any Book/Note whether using or not, will be liable to be debarred for taking examination(s) either permanently or for specified period or/and dealt with as per law or/and ordinance of the School/SERI according to the nature of offence, or/and he/she may be proceeded against and shall be liable for prosecution under the relevant provision of the Statutory Law.

TIME: 3 Hours.

TOTAL MARKS: 70

THE ANSWER SHEET IS TO BE RETURNED ON COMPLETION OF THE TEST

P.T.O.

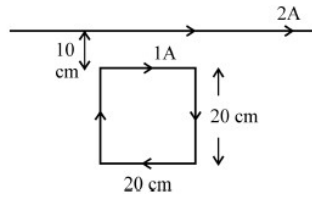
SECTION A

Total number of questions: 5	Marks allocated to each question: 2	Total marks: 10
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Question 1. Draw a plot showing the variation of de Broglie wavelength of electron as a function of its K. E.

Question 2. Why are electric field lines perpendicular at a point on an equipotential surface of a conductor?

Question 3. A square loop of side 20 cm carrying current of 1A is kept near an infinite long straight wire carrying a current of 2A in the same plane as shown in the figure.



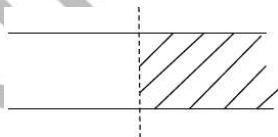
Calculate the magnitude and direction of the net force exerted on the loop due to the current carrying conductor.

- Question 4. Why is frequency modulation preferred over amplitude modulation for transmission of music?
- Question 5. Calculate the current drawn by the primary of a transformer which steps down 200 V to 20 V to operate a device of resistance 20Ω . Assume the efficiency of the transformer to be 80%.

SECTION B

Total number of questions: 10	Marks allocated to each question: 3	Total marks: 30
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- Question 6. Distinguish between n-type and p-type semi-conductors on the basis of energy band diagrams. Compare their conductivities at absolute zero temperature and at room temperature.
- Question 7. A closely wound solenoid of 2000 turns and cross sectional area $1.6 \times 10^{-4} \text{ m}^2$ carrying a current of 4.0 A is suspended through its centre allowing it to turn in a horizontal plane. Find (i) the magnetic moment associated with the solenoid, (ii) magnitude and direction of the torque on the solenoid if a horizontal magnetic field of $7.5 \times 10^{-2} \text{ T}$ is set up at an angle of 30° with the axis of the solenoid.
- Question 8. State Gauss's theorem in electrostatics. Apply this theorem to derive an expression for electric field intensity at a point near an infinitely long straight charged wire.
- Question 9. Explain, with the help of diagram, the principle and working of an a.c. Generator. Write the expression for the e.m.f. generated in the coil in terms of its speed of rotation.
- Question 10. Use Huygen's principle to verify the laws of refraction.
- Question 11. Define the SI unit of capacitance. As shown in the figure given below, a dielectric material of dielectric constant 19 is inserted in half portion between the plates of a parallel-plate capacitor. If its initial capacitance is $40 \mu\text{F}$, what will be the new capacitance?



P.T.O.

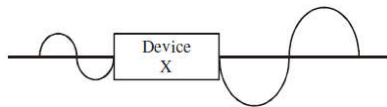
- Question 12. Write the principle of working of a potentiometer. Describe briefly, with the help of a circuit diagram, how a potentiometer is used to determine the internal resistance of a given cell.
- Question 13. Find the wavelength of electromagnetic waves of frequency $5 \times 10^{19} \text{ Hz}$ in free space. Give its two Applications
- Question 14. Draw a labelled diagram of compound microscope for the formation of image. Derive an expression for the magnifying power of a compound microscope.
- Question 15. Define the term 'resistivity' and write its S. I. Unit. Derive the expression for the resistivity of a conductor

in terms of number density of free electrons and relaxation time.

SECTION C

Total number of questions: 6	Marks allocated to each question: 5	Total marks: 30
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Question 16. (a) Figure shows the input waveform which is converted by a device 'X' into an output waveform. Name the device and explain its working using the proper circuit. Derive the expression for its voltage gain and power gain.



(b) Draw the transfer characteristic of a base biased transistor in CE configuration. Explain clearly which region of the curve is used in an amplifier.

OR

Explain the following terms in relation to the use of internet:

- (i) Internet surfing
- (ii) Social networking
- (iii) E-mail

Question 17. (a) In Rutherford scattering experiment, draw the trajectory traced by α -particles in the coulomb field of target nucleus and explain how this led to estimate the size of the nucleus.

(b) Describe briefly how wave nature of moving electrons was established experimentally.

(c) Estimate the ratio of de-Broglie wavelengths associated with deuterons and α -particles when they are accelerated from rest through the same accelerating potential V.

OR

State Biot-Savart law. Use it to derive an expression for the magnetic field at the centre of a circular loop of radius R carrying a steady current I. Sketch the magnetic field lines for such a current carrying loop.

Question 18. Derive the relationship between the peak and rms value of current in an ac circuit. For circuits used for transmission of electric power a low power factor implies large power loss in the transmission explain.

OR

Define diffraction. Deduce an expression for fringe width of the central maxima of the diffraction pattern, produced by single slit illuminated with monochromatic light source.

Question 19. Explain, with the help of a labelled diagram, the principle and construction of a cyclotron. Deduce an expression for the cyclotron frequency and show that it does not depend on the speed of the charged particle.

OR

P.T.O.

What are coherent sources of light? Why are coherent sources required to obtain sustained interference pattern?

State three characteristic features which distinguish the interference pattern due to two coherently illuminated sources as compared to that observed in a diffraction pattern due to a single slit.

Question 20. Draw forward and reverse characteristic curves of a PN junction diode. Explain briefly with the help of a circuit diagram, how a PN junction diode works as a full wave rectifier. If frequency of input ac signal is 'f' what is the frequency of output.

OR

Why is the base region of a transistor kept thin and lightly doped?

Draw the circuit diagram of the 'set-up' used to study the characteristics of a npn transistor in its common emitter configuration. Sketch the typical (i) Input characteristics and (ii) Output characteristics for this transistor configuration.

How can the output characteristics be used to calculate the 'Current gain' of the transistor?

Question 21. (a) Which part of the electromagnetic spectrum is suitable for RADAR systems used in aircraft navigation?

A parallel plate capacitor of capacitance $2 \mu\text{F}$ produces an instantaneous displacement current of 1 mA in the space between its plates. What should be the rate of change of potential difference required?

(b) Explain briefly, with the help of circuit diagram, the working of a full wave rectifier. Draw its input and output waveforms.

OR

Define the term 'wavefront'. Draw the wavefront and corresponding rays in the case of a (i) diverging spherical wave, (ii) plane wave.

Using Huygen's construction of a wavefront, explain the refraction of a plane wavefront at a plane surface and hence verify Snell's law.

END OF THE QUESTION PAPER