2020

PHYSICS (Honours)

Paper Code : VIII - A & B

[New Syllabus]

Full Marks : 90 Time : Four Hours

Important Instructions for Multiple Choice Question (MCQ)

- Write Subject Name and Code, Registration number, Session and Roll number in the space provided on the Answer Script.

  Example : Such as for Paper III-A (MCQ) and III-B (Descriptive).

  Subject Code : | III | A | & | B |

  Subject Name : | |

- Candidates are required to attempt all questions (MCQ). Below each question, four alternatives are given [i.e. (A), (B), (C), (D)]. Only one of these alternatives is 'CORRECT' answer. The candidate has to write the Correct Alternative [i.e. (A)/(B)/(C)/(D)] against each Question No. in the Answer Script.

  Example — If alternative A of 1 is correct, then write :
  1. — A

- There is no negative marking for wrong answer.

মাল্টিপল চয়েস প্রশ্নের (MCQ) জন্য জরুরী নির্দেশাবলী

- উত্তরপত্রে নির্দেশিত স্থানে বিষয়ের (Subject) নাম এবং কোড, রেজিস্ট্রেশন নম্বর, সেশন এবং রোল নম্বর লিখতে হবে।

  উদাহরণ — যেমন Paper III-A (MCQ) এবং III-B (Descriptive)।

  Subject Code : | III | A | & | B |

  Subject Name : | |

- পরীক্ষার্থীদের সবগুলি প্রশ্নের (MCQ) উত্তর দিতে হবে। প্রতিটি প্রশ্নে চারটি করে সম্ভাব্য উত্তর, যথাক্রমে (A), (B), (C) এবং (D) করে দেওয়া আছে। পরীক্ষার্থীকে তার উত্তরের স্বপক্ষে (A) / (B) / (C) / (D) সঠিক বিকল্পটিকে প্রশ্ন নম্বর উল্লেখসহ উত্তরপত্রে লিখতে হবে।

  উদাহরণ — যদি **1** নম্বর প্রশ্নের সঠিক উত্তর **A** হয় তবে লিখতে হবে :

  1. — A

- ভুল উত্তরের জন্য কোন নেগেটিভ মার্কিং নেই।

Turn Over

Paper Code : VIII - A

Full Marks : 20 Time : Thirty Minutes

Choose the correct answer.

Each question carries 4 marks.

1. What is the atomic radius for face centre cubic lattice? Atomic radius and lattice parameter denotes as 'r' and 'a'
   A. $r = \frac{a}{2}$
   B. $r = \frac{\sqrt{a}}{2}$
   C. $r = \frac{\sqrt{3a}}{2}$
   D. $r = \frac{a}{2\sqrt{2}}$

2. If the sun radiates energy at the rate of 4 x 10^{26} Js^{-1}, what is the rate at which its mass is decreasing?
   A. 5.54×10^9 kgs^{-1}
   B. 4.44×10^9 kgs^{-}
   C. $3.54 \times 10^9 kgs^{-1}$
   D. $2.44 \times 10^9 kgs^{-1}$

3. A specimen of intrinsic Ge at 300K having a concentration of carriers of $2.5 \times 10^{13}/cm^3$ is doped with doner atoms for every million Ge atoms. If the concentration of Ge atoms is $4.4 \times 10^{22}\ /cm^3$, the concentration of minority carriers in this case will be-
   A. $1.42 \times 10^{16}\ /cm^3$
   B. $1.42 \times 10^{10}\ /cm^3$
   C. $1.42 \times 10^{4}\ /cm^3$
   D. $1.42 \times 10^{9}\ /cm^3$

4. In an intrinsic semiconductor the carrier concentration varies as –
   A. T
   B. $\frac{1}{T}$
   C. $T^{\frac{3}{2}}$
   D. T^2

Turn Over

5. If a 500 $Watt$ laser beam is concentrated by a lens in to a cross sectional area of $10^{-10}\ m^2$, the value of Poynting vector will be
   A. $5 \times 10^{12}\ Watt/m^2$
   B. $5 \times 10^{10}\ Watt/m^2$
   C. $5 \times 10^{8}\ Watt/m^2$
   D. $2.5 \times 10^{12} Watt/m^2$

Turn Over

2020

PHYSICS (Honours)

Paper Code : VIII - B

[New Syllabus]

Full Marks : 70 Time : Three Hours Thirty Minutes

The figures in the margin indicate full marks.

Answer any *five* questions. 14×5=70

1. Give Huygen's theory of double refraction. Write a short note on the use of polaroids. 5+9

2. Describe the construction and action of a Nicol prism. Explain how a Nicol prism can be used to produce and analyse plane polarised light. 9+5

3. a) What is optical rotation? Deduce Fresnel's equation of optical rotation. 4+6

   b) Calculate the thickness of a quarter wave plate for light of wavelength 5893 Å, given refractive indices for ordinary ray and extraordinary ray as 1.544 and 1.553, respectively. 4

4. Define numerical aperture of an optical fiber. Find an expression for it in term of refractive indices of the core and cladding. 2+12

5. Derive the equations of Lorentz transformation and deduce the relation for addition of velocities. 7+7

6. a) Using Maxwell's electromagnetic field equations, find the expression for velocity of electromagnetic wave in free space.
   b) Show that in the Rayleigh scattering, scattering cross-section is inversely proportional to the fourth power of wavelength of incident light. 7+7

7. Deduce Langevin's theory of diamagnetism and hence show that the diamagnetic susceptibility of an element is independent of temperature but increases linearly with atomic number 'Z'. 9+5

8. a) Derive the Widemann–Franz law on the basis of Drude model of free electrons.
   b) An insulator has an optical absorption which occurs for all wavelengths shorter than 1800 Å. Find the width of the forbidden gap in eV of the insulator. 9+5

9. How are energy bands formed in solids? Distinguish among a metal, a semiconductor and an insulator on the basis of band theory ofsolids. 7+7

10. a) What is a unit cell? Define a reciprocal lattice. 2+3
    b) Find the reciprocal lattice of body centre cubic (bcc) and face centre cubic (fcc) lattice. 4+5
