January 2022

APPLIED PHYSICS-II

Time Allowed: 1.5 Hours | Full Marks: 60

Answer to Question No.1 is compulsory and Answer any two questions from the rest.

1. Choose the correct answer from the given alternatives (any twenty): 20x2

i) If The length of a conducting wire be made half and the area of cross section be made double ,the resistance becomes- (a) four times (b) two times (c) halved (d) one–fourth

ii) LASER is the acronym for
(a) Light Amplification by Stimulated Absorption of Radiation
(b) Light Amplification by Stimulated Emission of Radiation
(c) Light Amplification by Spontaneous Emission of Radiation
(d) None of these

iii) X–rays are deflected by-
(a) electric field
(b) magnetic field
(c) both magnetic field and electric field
(d) neither electric field nor magnetic field

iv) The specific resistance of a copper conductor depends on- (a) Length (b) area of cross–section
(c) temperature (d) all of these

v) A moving charge produces-
(a) an electric field only
(b) a magnetic field only
(c) Both electric and magnetic field
(d) either electric field or magnetic field

vi) If the forward bias voltage across a p–n junction be increased, the width of the depletion region
(a) decrease (b) increase (c) remains same (d) increases proportionally to the applied voltage

vii) The SI unit of resistivity is- (a) $ohm.m^{-1}$ (b) $volt.m^{-1}$ (c) volt.m (d) ohm.m

viii) In germanium crystal ,the energy band gap is- (a) 0.068 eV (b) 6.8 eV (c) 68 eV (d) 0.68 eV

ix) The output of a full wave rectifier is- (a) an AC voltage (b) a constant DC voltage
(b) zero (d) a pulsating unidirectional voltage

x) The power of two is +5D and –2.5 D. The focal length of the two lenses in contact will be
(a) +40 cm (b) –40 cm (c) +40 m (d) none of these

xi) The SI unit of magnetic flux is- (a) weber (b) gauss (c) oersted (d) none of these

xii) The phase difference between any two points situated on a wave front is
(a) π (b) 2π (c) 0 (d) $\frac{\pi}{2}$

xiii) If the potential difference applied to an X-ray tube be doubled ,the cut off (minimum) wavelength
(a) becomes halved (b) becomes doubled (c) becomes four time(d) remains same

xiv) Two resistances of 6Ω and 8Ω are connected in parallel and the combination is connected across a 24 volt battery. The total power consumed is- (a) 48 watt (b) 84 watt (c) 168 watt (d) 36 watt

xv) For obtaining a p–type semiconductor ,doping is to be done with impurity material which is
(a) tetravalent (b) pentavalent (c)trivalent (d) none of these

xvi) The lasing action is based on
(a) Stimulated emission
(b) Spontaneous emission
(c) absorption
(d) none of these

xvii) The induced emf in a 1 millihenry inductor in which the current changes from 5A to 3A in 10^{-3}s is
(a) $2x10^{-6}$V (b) $8x10^{-6}$ (c) 2V (d) 8V

xviii) The focal length of a convex lens is maximum for the colour of light- (a) blue (b) yellow (c) green (d) red

xix) In the interference fringe, if width of dark band is β_1 and that of the bright band is β_2,then
(a) $2\beta_1=\beta_2$ (b) $2\beta_2=\beta_1$ (c) $\beta_1=\beta_2$ (d) $\beta_1+3\beta_2=1$

xx) If a conductor moves across a magnetic field ,the direction of induced emf is obtained from
(a) Laplace's law (b) Fleming's left and rule (c) Fleming's right hand rule (d) none of these

xxi) If a lens is surrounded by a medium denser than air, the focal length of the lens
(a) decreases (b) increases (c) remains same (d) cannot be determined

xxii) For destructive interference the path difference of the waves emitted from the two sources is equal to- (a) odd multiple of $\frac{\lambda}{2}$ (b) even multiple of $\frac{\lambda}{2}$ (c) any multiple of $\frac{\lambda}{2}$ (d) any other number

xxiii) A source of emf 2 volt sends 0.2 amp current to an external circuit for 5s.The energy used by the source is- (a) 0.2 joule (b) 0.4 joule (c) 4.0 joule (d) 2.0 joule

xxiv) The intensity of X–rays produced by an X–ray tube can be increased by- (a) increasing the tube voltage (b) decreasing the tube voltage (c) decreasing the filament current (d) increasing the filament current

xxv) In He–Ne laser pumping is done b-y
(a) optical method
(b) Thermo–chemical reaction
(c) atom–atom inelastic collision through electrical discharge
(d) none of these

2. a) What do you mean by free and damped oscillations?
b) What are beats? Prove that, the number of beats per second produced by two sources of sound is equal to the difference in the frequencies of the two sources.
c) What are the requirements of good acoustic in a auditorium?
d) Write down the medical applications of ultrasonic waves. 2+(1+3)+2+2

3. a) State the criteria for the phenomenon of total internal reflection of light to take place.
b) How does focal length of a lens change when red light incident on it is replaced by violet light? Give reason for your answer.
c) Draw a ray diagram of a compound microscope. Write the expression for its magnifying power.
d) How will the interference pattern in Young's double slit experiment get affected, when
(i) distance between the slits S_1 and S_2 reduced and
(ii) the entire set up is immersed in water? Justify your answer. 2+2+(3+1)+2

4. a) State Gauss' law in electrostatics. Using this law, derive an expression for the electric field due to a uniformly charged sphere.
b) Why electrostatic potential is constant throughout the volume of the conductor and has the same value as on its surface?

c) Net capacitance of three identical capacitors in series is 1μF. What will be their net capacitance if connected in parallel?

d) Define electric flux. Write its SI unit. (1+2)+2+2+(2+1)

5. a) Define the term electrical resistivity of a material. Write its SI unit.

b) State Kirchhoff's rules for an electric network.

c) Draw a circuit diagram for a Wheatstone bridge. For a Wheatstone bridge, use Kirchhoff's laws to obtain its balance condition.

d) A wire of 15Ω resistance is gradually stretched to double its original length. It is then cut into two equal parts. These parts are then connected in parallel across a 3V battery. Find the current drawn from the battery. 2+2+ (1+2)+3

6. a) State Biot-Savart's law in vector form expressing the magnetic field due to an element carrying current at a distance from the element. A circular coil of radius R carries a current L. Derive the expression for the magnetic field due to this coil at its centre. What is the effect of increasing the number of turns on magnetic field produced to a circular coil?

b) State the Faraday's law of electromagnetic induction.

c) A galvanometer of resistance 50Ω gives full scale deflection when a current of 500 μA passes through it. It is to be converted into a voltmeter reading up to 10V. Explain how this can be done? Circuit diagram is essential. (2+2+1)+2+3

7. a) Distinguish between an intrinsic semiconductor and p-type semiconductor.

b) With the help of circuit diagrams, distinguish between forward biasing and reverse biasing of a p-n junction diode.

c) Draw a labeled diagram of a full wave rectifier circuit. Show the input-output waveforms.

d) Draw the circuit diagram of an illuminated photodiode in reverse bias. How is photodiode used to measure light intensity. 2+2+3+3

8. a) Write any two distinguishing features between conductors, semiconductors and insulators on the basis of energy band diagrams.

b) State two advantages of LED lamps over conventional incandescent lamps.

c) Draw a circuit diagram of n-p-n transistor amplifier in CE configuration.

d) Why GaAs is most commonly used in making of a solar cell? 3+2+3+2

9. a) What is the main difference between ordinary light and LASER?

b) Write a short note on 'population inversion'.

c) How continuous and characteristic X-rays are produced in Coolidge tube? Explain.

d) Explain the mechanism of light propagation through optical fiber. 2+3+3+2