APPLIED PHYSICS-II

Time Allowed: 2.5 Hours *Full Marks: 60*

Answer to Question No. 1 of Group A must be written in the main answer script. In Question No. 1, out of 2 marks for each MCQ, 1 marks is allotted for right answer and 1 marks is allotted for correct explanation of the answer.

Answer any Five (05) Questions from Group-B.

GROUP-A

1. Choose the correct answer from the given alternatives and explain your answer (any ten): $2 \times 10 = 20$

i) The velocity of a particle vibrating in S.H.M.-
(a) is maximum at the mean position, (b) is minimum at the mean position, (c) remains constant at every point, (d) none of these.

ii) The equation of a plane progressive wave is $y = 6 \sin \frac{2\pi}{7}(14t-x)$. The frequency and amplitude of vibration is –
(a) 2, 7 (b) 2, 6 (c) 6, 2 (d) 7, 6.

iii) The wavelength of the ultrasonic sound-
(a) is same as that of audible sound, (b) is less compared to audible sound, (c) is larger compared to audible sound, (d) may be greater or less than audible sound.

iv) Focal length of a convex lens is 20cm. Power of the lens is –
(a) +5D, (b)-5D, (c) 0.05D, (d) -0.05D.

v) For which colour of light the refractive index of a medium is maximum?
(a) Green, (b) Yellow, (c) Red, (d) Violet.

vi) Force of repulsion between two point charges placed at a distance r is N. If the separation between them becomes 2r, the force of repulsion will be (a) 2 N, (b) $\frac{N}{2}$, (c) 4 N, (d) $\frac{N}{4}$.

vii) Two capacitors of capacitance 6 μF and 3 μF are connected in series. The value of their equivalent capacitance is
(a) 9 μF, (b) 2 μF (c) 18 μF (d) 0.5 μF

viii) If the length of a copper wire is doubled by stretching it, its resistivity will
(a) be doubled (b) be halved (c) remain unchanged (d) be increased by 4 times

ix) When current is passed through a junction of two dissimilar metals, heat is evolved or absorbed at the junction. This process is called –
(a) Seebeck effect, (b) Joule effect, (c) Peltier effect, (d) Thomson effect.

x) A galvanometer can be converted into an ammeter by connecting it with a
(a) suitable high resistance in parallel, (b) suitable low resistance in parallel, (c) suitable high resistance in series, (d) suitable low resistance in series.

xi) Magnetic dipole moment of a current carrying loop is independent of
(a) number of turns in the coil, (b) area of the loop of the coil, (c) current in the coil, (d) magnetic field in which it is placed.

xii) A hydrogen atom makes a transition from 1st excited state to ground state. The energy of the photon in eV, emitted in this process is (a) 2.20, (b) 10.20, (c) 12.09, (d) 12.75.

xiii) In X-ray tube, the penetrating power of the X-rays can be increased by
(a) increasing the filament voltage, (b) decreasing the filament voltage, (c) increasing the voltage across the electrodes, (d) decreasing the voltage across the electrodes.

xiv) N-type semiconductor is obtained on doping intrinsic germanium by-
(a) gold, (b) boron, (c) aluminium, (d) phosphorous.

xv) In a transistor the base region is -
(a) highly doped, (b) moderately doped, (c) lightly doped, (d) none of these.

GROUP – B

Answer **Any Five (05)** questions

2. (a) Write down the characteristics of SHM. (b) The equation of a plane progressive wave propagating along positive X direction is given by, $y = 10\ sin\left(100\pi t - \frac{2\pi}{7}x\right) cm$, where x is in meter and t in second. Calculate the amplitude, frequency, wavelength and speed of the wave. (c) Write down two applications of ultrasonic wave. 2+4+2

3. (a) Establish the relation between critical angle and absolute refractive index of the two medium. (b) With necessary ray diagram state the position and nature of image formed by an extended object placed in between principal focus and optical center of a convex lens. (c) The radius of curvature of a plano-convex lens is 20cm. Calculate its focal length if the absolute refractive index of the material of the lens is 1.5. 2+3+3

4. (a) State Gauss' law in electrostatics. Using this law, derive an expression for the electric field intensity at an outside point of a uniformly charged sphere. (b) Calculate how many electrons are present in one coulomb of charge? (c) State the factors on which the capacitance of a conductor depends. (2+2)+ 2+2

5. (a) On which factors does the resistance of a conductor depend and how? Define resistivity. (b) Three resistors 6 Ω, 4 Ω and 8 Ω are connected in sides AB, BC and AC respectively in a triangle ABC. A 12 V dc battery is connected across 6 Ω resistor. With necessary diagram find the equivalent resistance between A and B and the current through 8 Ω resistor. (c) Show that equivalent resistance in parallel combination of resistances is less than the smallest resistance in the combination. (2+1)+3+2

6. (a) State and explain Kirchhoff's current law & Kirchhoff's voltage law. (b) Define neutral temperature & inversion temperature for a thermo couple. (c) Draw the thermo e.m.f. vs. temperature graph for a thermo couple & show the position of neutral temperature and temperature of inversion. 3+3+2

7. (a) State and explain Biot - Savart Law in electromagnetism. (b) A circular wire of radius 10 cm is carrying a current of 2A. Calculate the magnetic field at the centre of the coil. (c) Which rule gives the direction of the force on a current carrying conductor when placed in a magnetic field? State & explain the rule. (d) "Magnetic force on a charge particle does no work" – explain. 2+2+ (1+1) +2

8. (a) State & explain Faraday's law of electromagnetic induction. (b) A galvanometer of resistance 20Ω gives full scale deflection when a current of 0.5mA passes through it. Explain with proper circuit diagram how can this be converted to an ammeter reading up to 5 A. (c) "The Curie point of Iron is 770°C" – Explain. 3+3+2

9. (a) Write down the differences between insulator, semiconductor and conductor. (b) With necessary diagram and drawing input and output waveform explain the working of p-n junction diode as full wave rectifier using two diodes. 3+ 4+1
(c)What is LED?

10. (a) State & explain the postulates of Bohr's atomic model. (b) Explain the working principle of an optical fiber with a proper diagram. (c) Draw the curve showing the variation of intensity with wavelength of X-rays obtained from X-ray tube and mark cut-off wavelength (λ_{min}), continuous & characteristic X-rays. (d) Write two uses of LASER 2+2+2+2