Total No. of printed pages = 5

PH 131202

Roll No. of candidate | | | | | | | | | |

201

B. Tech 2nd Semester End-Term Examination

PHYSICS - II

Full Marks–100 Pass Marks–35 Time–Three hours

The figures in the margin indicate full marks for the questions.

1. Answer the following questions : 3×10=30

(a) What are X-rays ? What is the wavelength range of X-rays ?

(b) State Weber-Fechner law for acoustics.

(c) Define the term, 'coefficient of absorption'.

(d) What do you mean by metastable state in laser ?

(e) What are the characteristics that differentiate ordinary light from laser ?

(f) Explain with diagram the three sections of optical fiber.

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(g) What is group velocity of matter wave ?

(h) What is Meissner effect ?

(i) Define zero bias of a P-N junction diode.

(j) What are Cooper Pairs ?

2. Answer any *five* questions : 4×5=20

(a) Explain how the characteristic X-ray spectra are produced. How are the wavelengths of characteristic X-rays determined ?

(b) What is meant by time of reverberation ? Discuss Sabine's formula.

(c) Discuss any four methods of pumping to achieve population inversion in laser.

(d) State few applications of laser (minimum eight).

(e) Discuss signal loss due to attenuation in optical fiber.

(f) Distinguish between Type-I and Type-II superconductors. Give three examples for each type.

(g) What are α and β of a transistor ? Derive the relation between them.

(h) Show that the wavelength associated with a particle having mass 'm' and kinetic energy 'E' is $\lambda = \frac{h}{\sqrt{2mE}}$.

3. Answer any *four* questions : 5×4=20

(a) An X-ray tube operated at 40 kV emits a continuous X-ray spectrun with a short wavelength limit $\lambda_{min} = 0.31\text{Å}$. Calculate Planck's constant h.

(Velocity of light = 3×10^8 m/sec, Charge of electron = 1.6×10^{-19}C).

(b) Absorption coeffcient of an empty assembly hall of height 10m, breadth 15m and length 20m is 0.106. Find the reverberation time of the hall.

(c) Calculate the minimum length of an iron rod to generate ultrasonic waves of frequency 0.05 MHz.

(Modulus of elasticity of iron = $1.15 \times 10^{11}\,\text{Nm}^{-2}$, Density of iron = 7.25×10^3 kgm^{-3}).

(d) A laser source of wavelength 690 Nm and power of 70 mW and an aperture 4 mm is focused with a lens of local length of 0.1m. Calculate the area and intensity of the image.

(e) An optical fiber has fiber index 1.30 and fractional refractive index change $\Delta = 0.03$. Find the numerical aperture and acceptance angle.

(f) What potential difference must be applied to an electron source so as to produce electrons having wavelength equal to 0.24×10^{-10}m.

(g) The position and momentum of a 1 KeV electron are simultaneously determined. If the position is located with 2Å, what is the percentage of uncertainty in momentum ?

4. Answer any *three* questions : $10 \times 3 = 30$

(a) State Moseley's law. Derive Moseley's law with the help of Bohr's theory.

(b) Describe the construction and working principle of piezo-electric oscillator for production of ultrasonic waves.

(c) Discuss the construction and working principle of Ruby laser with diagram.

(d) Discuss the block diagram of optical fiber communication system and the operation of different parts.

(e) State and explain Heisenberg's uncertainty principle. Apply this principle to conclude that a proton exist inside the atomic nucleus.

(f) Explain Hall effect and show that for a n-type semiconductor, the Hall coefficient $R_H = \frac{1}{Ne}$, where 'N' is the number of electron per cubic meter and 'e' is electronic charge.