B.Tech. (Common for all Branches) (NEP Pattern) Semester - I & II

STBSC102 - Engineering Physics

P. Pages : 3 **GUG/W/24/16153**

Time : Three Hours Max. Marks : 80

Notes : 1. All questions are compulsory.
2. Due credits will be given to neatness and adequate dimensions.
3. Assume suitable data wherever necessary.
4. Illustrate your answers wherever necessary with the help of neat sketches.
5. Diagram & Chemical equations should be given wherever necessary.
6. Use of non programmable Electronic calculator is allowed.

List of Constants:

1. Plank's constant: $h = 6.634 \times 10^{-34} JS$
2. Mass of electron, $m_e = 9.1 \times 10^{-31} Kg$
3. Charge on electron, $e = 1.602 \times 10^{-19} C$
4. Free space permittivity, $\in_0 = 8.85 \times 10^{-12} F/m$
5. Velocity of light, $C = 3 \times 10^8 m/s$

1. a) Explain light of wave-particle dualism of radiation by de-Broglie's concept of matter wave. **6**

b) What are the physical significance of wave function ' ψ '? Explain in brief the mathematical conditions imposed on ' ψ '. **6**

c) What is the energy of photons in the beam? If the wavelength of yellow light is 5890 Aº. Express energy in electron volt. **4**

OR

2. a) Calculate Energy levels of a particle enclosed in one dimensional box of infinite height. **6**

b) Write briefly on Heisenberg's uncertainty principle. What is its significance? **6**

c) If electron is accelerated from rest through a potential difference of 40 volts. Then calculate de-Broglie's wavelength. **4**

3. a) Draw energy band diagram of p-n junction diode under the following conditions. **6**

i) Unbiased ii) Forward Biased

iii) Reverse Biased

b) Explain the effect of high doping concentration and low temperature on the fermi levels. **6**

c) A semiconductor has a conductivity $250\,\Omega/m$ at 20ºC and $1100\,\Omega/m$ at 100ºC. Determine its energy band gap value. **4**

OR

4. a) What is Fermi function? Draw and explain graph showing its variation with energy at different temperature. **6**

b) Draw a graph showing variation of electron energy in silicon crystals as a function of interatomic distance. **6**

c) Calculate the probabilities for an electronic state to be occupied at 20ºC, if the energy of these state lies 0.11 eV above and 0.11 eV below the fermi level. **4**

5. a) Define the terms: **6**

i) Unit Cell ii) Primitive Cell

iii) Non-primitive Cell iv) Crystal lattice

v) Space lattice vi) Lattice parameter

b) Explain how Millier indices of a crystallographic direction are found? **6**

c) The Bragg angle corresponding to the first order reflection from (111) plane in a crystal is 30º. When x-rays of wavelength 1.75 Aº are used. Calculate interatomic spacing. **4**

OR

6. a) Show that FCC structure possesses least percentage void among SC, BCC & FCC cubic structure. **6**

b) Explain and deduce Bragg's law for x-ray diffraction. **6**

c) A beam of x-rays of wavelength ($\lambda = 0.842\,A^o$) is incident on a crystal at a glancing angle of 8.35º, where the first order Bragg's reflection occur? Calculate the glancing angle for second order reflection. **4**

7. a) Describe Newton's Ring experiment to determine the wavelength of incident mono-chromatic light. **6**

b) Explain what happens when **6**

i) Monochromatic light is incident normally on uniform thin film.

ii) White light is incident on the film.

c) A film of thickness 5×10^{-5} cm viewed at an angle 35° to the normal. Find the wavelength of light. ($\mu = 1.33$). **4**

OR

8. a) Explain construction and working of electrostatic lens. **6**

b) Show that velocity acquired by an electron in a uniform electrostatic field varies as the square root of potential difference through which it is accelerated. **6**

c) What is the velocity after travelling a distance of 7.1 cm in the electric field. If An electron travelling with a velocity of 1.8×10^{4} m/s, enters uniform electric field of strength 0.003 N/C. **4**

9. a) With the help of neat labelled diagram, explain the different types of process of interaction of matter with radiation. **6**

b) What is metastable state? How it is used in LASER. Explain 3-level laser system. **6**

c) Calculate coherence time and coherence length for gas laser if the width of line is 1×10^{-5} m. **4**

OR

10. a) What is optical fibre? Explain in brief its working? **6**

b) Explain different modes of propagation in fibre. **6**

c) What is the attenuation in dB/km, if 15% of the power fed at the launching end of a (0.5 km) km fibre is lost during propagation. **4**

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