Total No. of Questions – [5] Total No. of Printed Pages : 4

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Paper Code - VII9.105A (CBE-FS)

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F. Y. B. TECH. (COMMON) (SEMESTER - II)

COURSE NAME: Engineering Physics

Course code: ES10175A

(2017 PATTERN)

Time: [**2 Hours**] [Max. Marks: **50**]

Instructions to candidates:

1) **Answer Q.1 OR Q.2, Q.3 OR Q.4 and Q.5**
2) **Figures to the right indicate full marks.**
3) **Use of scientific calculator is allowed**
4) **Use suitable data wherever required**
5) $h = 6.63 \times 10^{-34} Js, c = 3 \times 10^{8}\, m/s,\ e = 1.6 \times 10^{19} C,$ $k = 1.38 \times 10^{-23}\, J/K$ *or* $k = 8.6 \times 10^{-5} eV/K$

Q1 a) Explain with the help of a neat diagram the concepts of (i) spontaneous emission (ii) stimulated emission and (iii) population inversion. [6]

b) Describe with the help of diagrams use of lasers in any two industrial applications. [6]

c) If the refractive index of the core and the cladding of an optical fibre is n_1 = 1.490 and n_2 = 1.481, respectively, then calculate NA of the fibre. [4]

OR

Q2 a) Describe with the help of neat diagrams construction and working of a CO_2 laser. [6]

b) Derive with the help of a diagram an expression for Numerical Aperture for an optical fibre. [6]

c) If the energy difference between upper and lower levels of a laser is 1.9595eV, then what is the wavelength of the laser? [4]

Q3 a) Draw the wave function ψ and $|\psi|^2$ for first three energy levels for a particle in a rigid box. Discuss the meaning. [6]

b) Explain the pros and cons of nuclear energy. [4]

c) Calculate the energy released when two protons and two neutrons undergo fusion to form the nucleus of Helium, i.e. an alpha particle. Given m_p =1.007276 amu, m_n = 1.008665 amu and m_{alpha} = 3.727379 amu. [4]

OR

Q4 a) Draw a neat diagram of nuclear fission reactor and explain its [6]

working in brief.

b) Draw a labelled diagram for a non-rigid box. Write down the Schrodinger equation for a particle with energy E < Vo (the potential of the walls) when it is inside the box. [4]

c) If a nucleus is assumed to be a rigid box, then what is the energy (in MeV) of an electron confined to a nucleus of Uranium with a diameter of 15×10^{-15} m? [4]
Given mass of an electron $m_e = 9.1\times10^{-31}$ kg.

Q.5 Attempt following multiple choice questions: [1×20=20 marks]

a) Sound in a liquid is [1]
(i) periodic compression and rarefaction (ii) periodic oscillations of molecules about a mean position (iii) longitudinal wave (iv) all of the above

b) Sound waves can undergo [1]
(i) reflection (ii) refraction
(iii) interference (iv) all of the above

c) Pitch of sound related with [1]
(i) frequency (ii) intensity (iii) loudness (iv) both (ii) and (iii)

d) A well designed auditorium will have [1]
(i) minimum noise (ii) minimum reverberation time
(iii) uneven distribution of sound (iv) no reverberation

e) Ultrasound can be used to [1]
(i) detect faults in a solid (ii) detect kidney stones (iii) find thickness of standard gauge (iv) all of the above

f) Anti-reflection coating is usually a [1]
(i) thick uniform film (ii) thin uniform film
(iii) thick wedge shaped film (iv) thin wedge shaped film

g) When light travelling in a rarer medium is reflected from a denser medium, a phase change of_____ occurs according to Stoke's law. [1]
(i) 45° (ii) 90° (iii) 180° (iv) 0°

h) For Fraunhofer diffraction from a grating when $m_{max} = \frac{(a+b)}{\lambda} = 2.99$, the number orders seen on one side of the principal maximum are [1]
(i) 3 (ii) 2.99 (iii) 2 (iv) none of the above

i) Rayleigh's criteria states that when principal maximum of one [1]

image falls on the first minimum of the second and vice-versa then the images are said to be

(i) fully resolved (ii) just resolved

(iii) not resolved (iv) none of the above

j) When a parallel beam of white light is incident on a diffraction grating, then in a given order _____ colour occurs at the smallest angle. [1]

(i) Violet (ii) Blue (iii) Yellow (iv) Red

k) In p-type semiconductor with low doping concentration, Fermi energy is [1]

(i) at the centre of the band gap (ii) near the conduction band

(iii) near the valence band (iv) is not well defined

l) For orbitals of Silicon there is _____ type of hybridization. [1]

(i) sp (ii) sp^2 (iii) sp^3 (iv) sp^4

m) Band gap in a solid is largest for [1]

(i) metals (ii) conductors (iii) semiconductors (iv) insulators

n) Fermi Dirac Distribution function has a value of _____ at $E = E_F$. [1]

(i) 0 (ii) 0.25 (iii) 0.5 (iv) 1.0

o) To obtain p-type semiconductor, an intrinsic semiconductor is doped with _____ impurities [1]

(i) Trivalent (ii) Tetravalent (iii) pentavalent (iv) hexavalent

p) When the load resistance connected across a solar cell is zero, the power generated is [1]

(i) minimum (ii) maximum

(iii) optimum (iv) zero

q) If the absorption coefficient of light for the material of solar cell is α then the intensity of light (I) after it travels a distance x in the materials is [1]

(i) $I = I_0 e^{\alpha x}$ (ii) $I = I_0 e^{-\alpha x}$ (iii) $I = I_0 e^{\alpha/x}$ (iv) $I = I_0 e^{-\alpha/x}$

where I_0 is the initial intensity at the surface of the solar cell.

r) A smaller Fill factor _____ of a solar PV cell [1]

(i) increases the efficiency

(ii) decreases the efficiency

(iii) does not affect the efficiency

(iv) none of the above

s) Solar PV cells are appropriate for generation of electrical energy in [1]

(i) space applications

(ii) remote areas

(iii) decreasing pollution

(iv) all of the above

t) Solar cell is [1]

(i) n-type semiconductor

(ii) p-type semiconductor

(iii) intrinsic semiconductor

(iv) p-n junction diode