

Total No. of Questions - [5]

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Paper Code - U127-105A (RE-F&FF)

JUNE 2018 / RE-EXAM

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

- Q1 a) With the help of appropriate diagrams, explain building blocks of laser (i) active medium (ii) Pumping mechanism (iii) optical resonance cavity. [6]
- b) Explain the following characteristics of a laser: [6]
- i. Directionality
 - ii. Intensity
 - iii. Monochromaticity
- c) Find relative population of two states in a ruby laser that produces light of wavelength 6943\AA at 300K. [4]

OR

- Q2 a) Explain with the help of neat diagrams construction and working of CO_2 laser. [6]
- b) Explain any three applications of lasers in mechanical industry. [6]
- c) A Cladding of optical fibre has a glass core of refractive index 1.55. Cladding is doped to give fractional refractive index of 0.0005. Find cladding refractive index & acceptance angle if surrounding medium is air (refractive index=1) [4]

- Q3 a) Derive an expression for energy eigen value for "Particle in a rigid box". Give expression for energy difference between the lowest two energy states. [6]
- b) Explain : Fission in U^{235} on the basis of binding energy curve. [4]

- c) Calculate the energy of the ground state of a proton trapped in an infinite potential well of width $L = 2 \times 10^{-14}$ m. Given mass of proton = 1.67×10^{-27} kg, $h = 6.63 \times 10^{-34}$ Js. [4]

OR

- Q4 a) Derive Schrodinger's time independent equation. [6]
 b) Explain the Quantum mechanical term "wave function Ψ ". What do you mean by $|\Psi|^2$? Give the conditions for a wave function to be well behaved. [4]
 c) Find binding energy per nucleon of ${}^7_3\text{Li}$. [4]
 Given: Mass of neutron(m_n)=1.008665amu
 Mass of proton(m_p)=1.007276amu
 Atomic mass of ${}^7_3\text{Li}$ =7.04084amu

Q.5 Attempt following multiple choice questions: [1x20=20 marks]

- a) Frequency of following is less than audible range [1]
 (i) Infrasonic (ii) ultrasonic
 (iii) supersonic (iv) None of the above
- b) Intensity of sound from a source at a distance 'r' is proportional to [1]
 (i) r (ii) $1/r^2$
 (iii) $1/r$ (iv) e^{-r}
- c) Echelon effect is produced due to [1]
 (i) regularly arranged staircase (ii) soft curtains
 (iii) Padded chairs (iv) open windows
- d) Intensity of sound is proportional to [1]
 (i) (amplitude)² (ii) (amplitude)⁻¹
 (iii) (amplitude) (iv) none of the above
- e) For a echo to be heard, minimum distance between the source of sound & reflecting surface should be [1]
 (i) 20m (ii) 17m
 (iii) 7cm (iv) None of the above
- f) An Anti reflection coating (ARC) is used for [1]
 (i) reducing intensity of reflected light (ii) enhancing transmission
 (iii) increasing efficiency of solar cell (iv) all of the above

- g) Which of the following materials cannot be used as anti-reflection coating for a glass slab [1]
 i) MgF_2 (ii) Cu (iii) TiO_2 (iv) Al_2O_3
- h) In an interference pattern due to a thin film, the fringe width is given by $\beta =$ [1]
 (i) $\lambda/2\mu\theta$ (ii) $\lambda/2\theta$ (iii) $\lambda^2/\mu\theta$ (iv) none of the above
- i) What is the reflectivity of silicon if light is normally incident from air on silicon? (refractive index of Si=3.45, refractive index for air=1) [1]
 (i) 30.3% (ii) 60% (iii) 6% (iv) none of the above
- j) What should be the thickness of a TiO_2 ($\mu=1.5$) on Si ($\mu=3.45$), so that it does not reflect light of wavelength 5000\AA ? [1]
 (i) 5000\AA (ii) 500\AA
 (iii) 2500\AA (iv) none of the above
- k) According to Fermi Dirac distribution, what is the probability of finding an electron at $T=0K$ having energy $E < E_F$? [1]
 (i) 0.5 (ii) 1 (iii) 1.5 (iv) None of the above
- l) The barrier potential V_{bi} in a p-n junction diode depends on [1]
 (i) Donor concentration (ii) acceptor concentration
 (iii) intrinsic charge concentration (iv) All of the above
- m) In a forward biased diode, the current increases with voltage [1]
 (i) linearly (ii) is constant (iii) exponentially (iv) is polynomial
- n) The charge on a n-type semiconductor sample is [1]
 (i) positive (ii) negative (iii) neutral (iv) none of the above
- o) In reverse biased diode (reverse voltage V_r), the built in potential (V_{bi}) changes as [1]
 (i) $V_{bi}-V_r$ (ii) $V_{bi}+V_r$
 (iii) V_{bi}/V_r (iv) all of the above

- p) At Open circuit voltage in a solar cell, the total current (I_{total}) in the cell becomes [1]
(i) half (ii) zero
(iii) negative (iv) Positive
- q) Efficiency of a solar cell η depends on [1]
(i) Anti reflection coating of cell
(ii) surface texturing of cell
(iii) Thickness of solar cell
(iv) All of the above
- r) What is maximum Power P_{max} if short circuit current $I_{sc}=3.3A$, open circuit voltage $V_{oc}=0.614V$, $FF=0.75$ at $27^{\circ}C$? [1]
(i) 5.1W (ii) 1.52W (iii) 0W (iv) 4.03W
- s) Hot spotting of a solar cell in a module is prevented by using [1]
(i) Blocking diode
(ii) Bypass diode
(iii) resistor in parallel to the hot spot cell
(iv) none of above
- t) If C is the full capacity of a battery & it takes 3hrs for the battery to charge or discharge fully, then the C rating is [1]
i. 0.5C
ii. 0.333C
iii. 1.5C
iv. 0C