Paper Code - U117 - 105A (BE - FS&F)

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

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

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 (i) stimulated emission (ii) population inversion (iii) optical resonance cavity. [6]

b) Explain the principle and working of an optical fibre with the help of a neat diagram. Derive the expression for the numerical aperture. [6]

c) Laser beam from a 10mW diode laser (λ = 8732Å) has a beam width of 1 mm. Calculate the intensity of the beam. [4]

OR

Q2 a) Describe with the help of neat diagrams construction and working of a Single Hetero-junction diode laser. [6]

b) Explain any three applications of lasers in mechanical industry. [6]

c) Refractive indices of the core and the cladding of an optical fibre are 1.5 and 1.55, respectively. Calculate the acceptance angle of the fibre. [4]

Q3 a) Explain construction and working of a thermal fission reactor with the help of a neat diagram. [6]

b) Draw ψ and $|\psi|^2$ for lowest three energy levels of a particle in a rigid box. [4]

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

OR

Q4 a) Derive Schrodinger's time independent equation. [6]

b) What is reactor poisoning? How is the operation of a thermal fission reactor changed due to reactor poisoning? [4]

c) If energy liberated by fission of one U^{235} nucleus is 200MeV, calculate the energy generated when 1 kg of U^{235} undergoes fission. Given Avogadro's number = 6.023×10^{23} atoms/gram-mole. [4]

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

a) Pitch of sound is related with [1]

(i) intensity (ii) intensity level

(iii) frequency (iv) power

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) Non-destructive testing of a solid can be carried out using [1]

(i)ultrasound (ii) sound

(iii)infrasound (iv) hypersound

d) Mechanical frequency of a quartz crystal with thickness 't' is proportional to [1]

(i) 1/t (ii) t

(iii) $1/t^2$ (iv) none of the above

e) Reverberation time of an auditorium increases if [1]

(i) all the windows are closed

(ii) audience leaves the auditorium

(iii) heavy carpets on the floor are removed

(iv) all of the above

f) Coloured interference fringes on a soap bubble are due to [1]

(i) incident white light

(ii) change in angle of incidence from point to point

(iii) change in wall thickness of the bubble from point to point

(iv) all of the above

g) Which of the following materials cannot be used as anti-reflection coating for [1]
a glass slab

(i) MgF_2 (ii) Al_2O_3 (iii) TiO_2 (iv) Al

h) In Fraunhofer diffraction from a single slit of width 'a', the path difference [1]
between the rays coming from the two opposite edges of
the slit is

(i) $a \sin\theta$ (ii) $2a \sin\theta$ (iii) $(a/2) \sin\theta$ (iv) none of the above

i) In Fraunhofer diffraction [1]

(i) source and screen are at infinite distance

(ii) incident and diffracted rays are parallel

(iii) wave fronts of incident and diffracted rays are plane wave front

(iv) all of the above

j) For diffraction of white light from a diffraction grating, the angle of diffraction[1]

in first order spectrum θ(UV) for ultraviolet and θ(IR) for Infrared is such that

(i) $\theta(UV) > \theta(IR)$ (ii) $\theta(UV) = \theta(IR)$

(iii) $\theta(UV) < \theta(IR)$ (iv) none of the above

k) For a forward biased p-n junction diode [1]

(i) current increases exponentially with voltage

(ii) current is independent of voltage

(iii) current increases linearly with voltage

(iv) current increases logarithmically with voltage

l) The barrier potential V_{bi} in a p-n junction diode is due to [1]

(i) electrons on the n-side

(ii) holes on the p-side

(iii) immobile positive charges on the n-side and immobile negative charges on the p side

(iv) immobile negative charges on the n-side and immobile positive charges on the p side

m) In an n-type semiconductor, the value of $E_F - E_c$ decreases with [1]

(i) increase in doping concentration of trivalent impurity

(ii) increase in doping concentration of pentavalent impurity

(iii) increase in temperature

(iv) all of the above

n) The charge on a n-type semiconductor sample is [1]

(i) positive (ii) negative (iii) neutral (iv) none of the above

o) In an intrinsic semiconductor, if n_i, n and p is intrinsic charge carrier density, electron density and hole density, respectively, then [1]

(i) $n_i = n$ (ii) $n = p$

(iii) $n_i = p$ (iv) all of the above

p) A solar PV cell is a [1]

(i) photo diode (ii) photo transistor

(iii) photo cell (iv) light dependent resistor (LDR)

q) Connecting two solar PV cell in series leads to [1]

(i) addition of voltages of the two cells

(ii) addition of current of the two cells

(iii) both (i) and (ii)

(iv) none of the above

r) A solar PV panel is kept at a latitude such that the sun is overhead at 12 noon. Sun beam will go through air mass AM1 at [1]

an angle of

(i) 30° (ii) 33.6° (iii) 0° (iv) 67.2°

s) Texturing of the surface of solar PV cell is done to [1]

(i) decrease temperature of solar cell

(ii) increase light refracted into solar cell

(iii) increase reflectivity of the surface of solar cell

(iv) decrease reflectivity of solar cell

t) If the band gap of the solar cell material is 1.44 then it will not [1]
absorb light of wavelength

(i) 4000Å (ii) 6000Å (iii) 8000Å (iv) 9000Å