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

Total No. of Questions – [5] Total No. of Printed Pages 6

JUNE **2018 / RE-EXAM**

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

COURSE NAME: Engineering Physics

Marking scheme

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**

				Marking scheme	Cognitive	Difficulty	CO
Q1	a)	With the help of appropriate diagrams, explain building blocks of laser (i)active medium (ii)Pumping mechanism (iii)optical resonance cavity.	[6]	2M each	U	M	5
	b)	Explain the following characteristics of a laser: i. Directionality ii. Intensity iii. Monochromaticity	[6]	2M each	U	M	5
	c)	Find relative population of two states in a ruby	[4]	$\frac{N_2}{N_1} = e^{\frac{-(E_2-E_1)}{KT}}$	A	M	5

		laser that produces light of wavelength 6943A° at 300K.		$E_2 - E_1 = h\upsilon = \frac{hc}{\lambda} = \frac{12400}{\lambda} eV$ $= \frac{12400}{6943} = 1.79eV$ $\frac{N_2}{N_1}\Big\|_{300K} = e^{\frac{-1.79}{8.61x10^{-5}\frac{eV}{K}x300K}} =$ $e^{-69.3} = 8x10^{-31}$			
					OR		
Q2	a)	Explain with the help of neat diagrams construction and working of CO_2 laser.	[6]	Diagrams – 2 Construction and working – 4M	U	M	5
	b)	Explain any three applications of lasers in mechanical industry.	[6]	2M each	U	M	5
	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 index & acceptance angle if surrounding medium is air(refractive index=1)	[4]	Fractional refractive index $\Delta=(n_1-n_2)/n_1$ $0.0005=(1.55-n_2)/1.55$ $n_2=1.5492$ acceptance angle $\theta_A=\sin^{-1}[(n_1^2-n_2^2)^{1/2}]/n_0$ $=2.85°$	A	H	5
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]	Derivation-4M Lowest energy states difference-2M	U	M	6
	b)	Explain : Fission in U^{235} on the basis of binding energy curve.	[4]	Graph-2M Explanation-2M	U	M	6
	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]	$E = n^2h^2/8mL^2$ $=(6.63\times10^{-34})^2/8\times1.67\times10^{-27}\times 4\times10^{-28}$ $=1.6\times10\text{-}13$ J = 0.5MeV	A	M	6
					O		

		= 6.63 × 10^{-34}Js.					
					O R		
Q4	a)	Derive Schrodinger's time independent equation.	[6]	6M	U	M	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]	explainΨ- 1M explain $\|\Psi\|^2$ -1M conditions-2M	U	H	6
	c)	Find binding energy per nucleon of $_3Li^7$. Given: Mass of neutron(m_n)=1.008665amu Mass of proton(m_p)=1.007276amu Atomic mass=7.04084amu	[4]	Here Li has 3 proton and 4-Neutron Given Data: m_p= 1.007276 a.m.u. m_n= 1.008665 a.m.u. and M_N=7.040484 a.m.u. Therefore the mass defect is, $\Delta m = (4.\ m_p + 3.\ m_n) - M_N$ = (3 × 1.007276 + 4 × 1.008665) - 7.016004) =0.040484 a.m.u. • The binding energy of Lithium nucleus is $E_b = \Delta m$ x 931.5 MeV = 0.040484 x 931.5 MeV = 37.710846 MeV. • The binding energy per nucleon = E_b/A. = 37.710846 /7 = 5.39 MeV.	A	L	6

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

			Ans	Cog	Dif	CO
a)	Frequency of following is less than audible range (i)Infrasonic (ii) ultrasonic (iii)supersonic (iv) None of the above	[1]	(i)	K	L	1

b)	Intensity of sound from a source at a distance 'r' proportional to (i) r (ii) $1/r^2$ (iii) $1/r$ (iv) e^{-r}	[1]	(ii)	K	M	1
c)	Echelon effect is produced due to (i)regularly arranged staircase (ii) soft curtains (iii)Padded chairs (iv)open windows	[1]	(i)	K	M	1
d)	Intensity of sound is proportional to (i) $(\text{amplitude})^2$ (ii) $(\text{amplitude})^{-1}$ (iii) (amplitude) (iv) none of the above	[1]	(i)	K	M	1
e)	For a echo to be heard,minimum distance betwee the source of sound & reflecting surface should b (i) 20m (ii) 17m (iii) 7cm (iv)None of the above	[1]	(ii)	K	M	1
f)	An anti reflection coating (ARC) is used for (i) reducing intensity of reflected light (ii) enhancing transmission (iii) increasing efficiency of solar cell (iv) all of the above	[1]	(iv)	K	M	2
g)	Which of the following materials cannot be used a anti-reflection coating for a glass slab (i) MgF_2 (ii) Cu (iii) TiO_2 (iv) Al_2O_3	[1]	(ii)	K	M	2
h)	In a interference pattern due to a thin film,the fringe width is given by by $\beta=$ (i) $\lambda/2\mu\theta$ (ii) $\lambda/2\theta$ (iii) $\lambda^2/\mu\theta$ (iv) none of the above	[1]	(i)	K	M	2
i)	What is reflectivity of silicon if light is normally incident from air on silicon? (refractive index of	[1]	(i)	K	M	2

	Si=3.45, refractive index for air=1) (i) 30.3% (ii) 60% (iii) 6% (iv) none of the above					
j)	What should be the thickness of a TiO_2 (μ=1.5) or Si(μ=3.45),so that it does not reflect light of wavelength 5000A° (i) 5000A° (ii) 500A° (iii) 2500A° (iv) none of the above	[1]	(ii)	U	H	2
k)	According to Fermi Dirac distribution, what is the probability of finding an electron at T=0K having energy $E<E_f$? (i) 0.5 (ii) 1 (iii) 1.5 (iv) None of the above	[1]	(ii)	K	M	3
l)	The barrier potential V_{bi} in a p-n junction diode depends on (i) donor concentration (ii) acceptor concentration (iii) intrinsic charge concentration (iv) All of the above	[1]	(iv)	K	H	3
m)	In a forward biased diode, the current increases with voltage , (i) linearly (ii) is constant (iii) exponentialy (iv) polynomial	[1]	(iii)	U	M	3
n)	The charge on a n-type semiconductor sample is (i) positive (ii) negative (iii) neutral (iv) none of	[1]	(iii)	A	H	3

	the above					
o)	In reverse biased semiconductor(reverse voltage V_r), the built in potential (V_{bi}) changes as (i) $V_{bi}-V_r$ (ii) $V_{bi}+V_r$ (iii) V_{bi}/V_r (iv) all of the above	[1]	(ii)	K	L	3
p)	At Open circuit voltage in a solar cell,the total current (I_{total}) in the cell becomes (i) half (ii) zero (iii) negative (iv) Positive	[1]	(ii)	K	L	4
q)	Efficiency of a solar cell η depends on (i) Anti reflection coating of cell (ii) surface texturing of cell (iii) Thickness of solar cell (iv) all (i),(ii)&(iii)	[1]	(iv)	K	M	4
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°C? (i)5.1W (ii) 1.52W (iii) 0W (iv) 4.03W	[1]	(ii)	A	M	4
s)	Shot spotting of a solar cell in a module is prevented by using , (i) Blocking diode (ii) Bypass diode (iii) resistor in parallel to the hot spot cell (iv) none of above	[1]	(ii)	K	M	4
t)	If C is the full capacity of a battery & it takes 3hrs for the battery to charge or discharge fully the C rating is i. 0.5C ii. 0.333C iii. 1.5C v. 0C	[1]	(ii)	A	H	4