COLLEGE OF ENGINEERING, PUNE

(An Autonomous Institute of Government of Maharashtra.)

END Semester Examination

Programme: F.Y.B.Tech **Semester:** I

Course Code: PH19001 **Course Name:** OPTICS AND MODERN PHYSICS (O.M.P.)

Branch: F.Y.B.Tech ALL **Academic Year:**2019-20

Duration:3 Hrs. **Max Marks:** 60

Student PRN No.

1	1	1	9	0	5	0	1	5

Instructions:

1. Figures to the right indicate the full marks.
2. Mobile phones and programmable calculators are strictly prohibited.
3. Writing anything on question paper is not allowed.
4. Exchange/Sharing of stationery, calculator etc. not allowed.
5. Write your PRN Number on Question Paper.

			Marks	CO	PO
Q 1	A	What are assumptions of Fresnel theory of optical rotation? Derive the expression for angle of rotation using Fresnel's theory.	5M	I	
	B	A slit of width 'a' is illuminated by white light. At what value of slit width 'a' , the first maxima of red light(λ=6500Å) is observed at 30^0 with respect to rays travelling straight ?	3M	I	
Q 2	A	Explain how the refractive index of material and wavelength of light can be determined using Newton's Rings Experiment.	5M	II	
	B	Determine the state of polarization for a wave represented by $\vec{E} = \hat{j}E_0 Sin(kx-wt) - \hat{k}E_0 \cos(kx-wt-\frac{\pi}{2})$	3M	II	
Q 3	A	Explain the construction and working of Nd-YAG LASER with suitable diagrams	4M	III	
	B	With the neat diagrams explain the phenomenon absorption, spontaneous emission and stimulated emission.	3M	III	
	C	Calculate the ratio of number of atoms in excited state to that of lower energy state in LASER that produces wavelength of 6328A.U. at temperature 27^0C. (Given Planck's constant = 6.63×10^{-54}JSec, Speed of light = 3×10^8 m/s , Boltzmann Constant = 1.38×10^{-23} J/K)	3M	III	

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Q4	A	Calculate the energy difference in electron volts between ground state and the first excited state for an electron in one dimensional infinite well of length 10^{-8}cm. Given that mass of electron = 9.1×10^{-31}Kg and Planck's constant h = 6.63×10^{-34} JSec.	5M	IV	
	B	What is the physical significance of wave function of a particle? Explain what are conditions on acceptable wave function. **OR** Establish Schrodinger's time dependent wave equation from plane wave equation associated with particle.	5M	IV	
	C	The duration of a radar pulse is 10^{-6} sec. Calculate the uncertainty in it's energy in electron volts. Given that Planck's constant h = 6.63×10^{-34} JSec.	3M	IV	
Q5	A	Determine the expression for momentum operator, kinetic energy operator and total energy operator from the expression for wave function. Determine the eigenvalue of momentum operator for the eigenfunction $\Psi(x) = e^{ikx}$	5M	IV	
	B	Write Schrödinger's wave equation and expression for the energy eigen value for one dimensional harmonic oscillator. What is the ground state energy and sketch the energy level diagram. **OR** Explain what is expectation value of an operator. Normalise the wave function given by $\psi(x) = Ae^{\frac{-ax^2}{2}}$ (Given : $\int_{-\infty}^{\infty} e^{-\beta x^2} dx = \sqrt{\frac{\pi}{\beta}}$)	5M	IV	
	C	Determine the kinetic energy of neutron in electron volts if de-Broglie wavelength of neutron is 1 Å. (Given : The mass of neutron = 1.67×10^{-27}Kg and Planck's constant = 6.63×10^{-34}JSec)	3M	IV	
Q6	A	What is Piezo electric effect? Explain the working of Piezo electric generator	5M	V	
	B	Explain the working of ultrasonic blood flow meter	3M	V	