Reg. No. \_\_\_\_\_\_\_\_\_\_\_\_\_



**End Semester Examination – Nov / Dec – 2019**

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| **Code :** | **17PH1001** | **Duration :** | **3hrs** |
| **Sub. Name :** | **APPLIED PHYSICS** | **Max. Marks :** | **100** |

**ANSWER ALL QUESTIONS (5 x 20 = 100 Marks)**

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| **Q. No.** | **Sub Div.** | **Questions** | **Course**  **Outcome** | **Marks** |
| 1. | a. | Apply Schrodinger’s wave equation for the problem of particle trapped inside an infinite, one dimensional potential well and find out the eigen values and eigen function. The well lies between x=L/2 and x=3L/4. | CO1 | 12 |
| b. | Evaluate the wavelength associated with an electron having kinetic energy equal to 1 MeV and that of a proton having the same kinetic energy. Compare and writw which particle has longer wavelength. [Hint: mass of proton = 1836 times the mass of electron] | CO1 | 5 |
| c. | A proton is confined to a nucleus of size10-14m. Calculate the minimum uncertainty in its momentum. | CO1 | 3 |
| **(OR)** | | | | |
| 2. | a. | Make use of de Broglie’s matter wave equation for total energy and develop Schrodinger’s time independent wave equation. | CO1 | 12 |
| b. | An electron initially at rest is accelerated through a potential difference of 100 V. Compute   1. The velocity of electron 2. Phase velocity of the electron wave | CO1 | 5 |
| c. | A particle is having a mass of 0.65 MeV/c2 and has a kinetic energy of 20 eV. Find its de Broglie wavelength. | CO1 | 3 |
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| 3. | a. | Prove the existence of stimulated emission of radiation using Einstein’s quantum theory of radiation. | CO2 | 12 |
| b. | Compare the number of photons/second emitted by He-Ne laser (632.8 nm) and CO2 laser (10,600 nm) when operating in continuous mode for the same output power of 5 mW. Point out which laser will emit more number of photons per second. | CO2 | 5 |
| c. | List the four fundamental properties of laser. | CO2 | 3 |
| **(OR)** | | | | |
| 4. | a. | Elaborate on the principle, construction and working of a Nd-YAG laser with necessary energy level diagrams. | CO2 | 12 |
| b. | Find the ratio of population of two energy levels at 330 K when the wavelength of the light emitted is 632 nm. Deduce what will happen to (N2/N1) if T is raised to 660 K. Write down your inference from the results. | CO2 | 5 |
| c. | Show that the ratio of stimulated emission to spontaneous emission is as follows:- | CO2 | 3 |
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| 5. | a. | Defend the following statement with suitable numerical values substituted in the following equation.  Step index multimode optical fiber cables carry twice the number of signals carried by graded index multimode optical fiber cables. | CO3 | 12 |
| b. | Estimate the cladding refractive index and critical angle when the core refractive index is 1.48 and the relative refractive index is 2% i.e. 0.02. | CO3 | 5 |
| c. | Distinguish between different types of optical fiber cables based on the modes of transmission of light. | CO3 | 3 |
| **(OR)** | | | | |
| 6. | a. | Prove that the numerical aperture can be written in relation with the refractive indices of the core and cladding of an optical fiber cable. Hence, show that | CO3 | 12 |
| b. | Evaluate the refractive indices of core and cladding materials of an optical fiber if its numerical aperture is 0.22 and relative refractive index is 0.012. | CO3 | 5 |
| c. | Conclude which fiber among the following is most suitable for applications in a commercial aeroplane and state the reason for the same.  Step index single mode, step index multimode and graded index multimode. | CO3 | 3 |
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| 7. | a. | Assume that the sound energy is spread uniformly throughout in a conference hall of volume V. Arrive at an expression for reverberation time using Sabine’s technique. | CO4 | 12 |
| b. | Elohim Auditorium has a volume of 1500 m3. Its total absorption is equivalent to 100 m2 of open window.  (a)Find the reverberation time. (b) What will be the effect on the reverberation time, if the audience fills the hall and thereby increases the absorption by 100 m2 of open window or sabines. | CO4 | 5 |
| c. | Justify that there will be no sound if the reverberation time becomes zero second. | CO4 | 3 |
| **(OR)** | | | | |
| 8. | a. | Determine the quality of materials using Pulse Echo Testing using ultrasonic waves. | CO4 | 12 |
| b. | Longitudinal standing waves are set up in a quartz plate with antinodes at opposite faces. The fundamental frequency of vibration is given by the relation f = 2.87 x 103/t, where f is in Hz and t is the thickness of the plate in meter. Compute the young’s modulus of the quartz plate. Deduce the thickness of the plate required for a frequency of 1200 kHz. The density of the quartz is 2660 kg m-3. | CO4 | 5 |
| c. | Justify the following statement. Ultrasonic waves do not travel through vacuum. | CO4 | 3 |
|  | | **Compulsory**: |  |  |
| 9. | a. | Superconductors are diamagnetic in nature. Explain the above statement with necessary equations. | CO5 | 12 |
| b. | Calculate the Bohr magneton value of an electron. | CO5 | 5 |
| c. | Charged particles have magnetic moments. This would mean both protons and electrons are having magnetic moments. But, the atomic magnetic moment is calculated based only on electron magnetic moments. Write the reason for the same. | CO5 | 3 |