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



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

|  |  |  |  |
| --- | --- | --- | --- |
|  |  |  |  |
| **Code :** | **18PH1009** | **Duration :** | **3hrs** |
| **Sub. Name :** | **APPLIED PHYSICS AND PROPERTIES OF MATTER** | **Max. Marks :** | **100** |

|  |  |  |  |
| --- | --- | --- | --- |
| **Q. No.** | **Questions** | **Course Outcome** | **Marks** |
| **PART – A (10 X 1 = 10 MARKS)** | | | |
| 1. | The pumping method used for operation of Nd-YAG laser is   1. In-elastic atom-atom collision. 2. Chemical reaction. 3. Direct electron excitation 4. Optical pumping. | CO1 | 1 |
| 2. | Laser Heat Treatment is used to \_\_\_\_\_\_\_\_ in general.   1. decrease the strength of the materials. 2. increase the shining of the materials. 3. increase the strength of the materials. 4. decrease the shining of the materials. | CO1 | 1 |
| 3. | Calculate the acceptance angle if the numerical aperture of an optical fiber cable is 0.3. | CO2 | 1 |
| 4. | Dispersion is minimum in the following type of optical fiber cable.  (a) Graded Index Multi Mode   1. Step Index Single Mode 2. Step Index Multi Mode 3. None of the above. | CO2 | 1 |
| 5. | According to de Broglie’s experiment, the wavelength of the matter waves increases when the mass of the particles \_\_\_\_\_\_\_\_\_\_\_.   1. increases 2. becomes infinity 3. becomes zero 4. decreases | CO4 | 1 |
| 6. | Heisenberg’s Uncertainty Principle holds good because there is no experiment designed to measure position and momentum simultaneously with great accuracy. State true or false. | C04 | 1 |
| 7. | Ordered sound generally consists of a fundamental frequency, along with a series of overtones whose frequencies are integral multiples of the fundamental frequency. These are known as   1. Plasmonics 2. Harmonics 3. Hydroponics 4. Pneumonics | C05 | 1 |
| 8. | An acoustically sound hall has a volume of 1000 m3 and total absorption of 163 Open Window Units. Deduce the reverberation time of the hall. | C05 | 1 |
| 9. | Obtain the first overtone of ultrasound waves produced by a quartz crystal of length 1.5 mm vibrating at resonant frequency. The fundamental frequency is given by 1.82 MHz. The density of the material is 2650 kg/m3. Its Young’s Modulus value is 7.9 x 1010 N/m2. | C06 | 1 |
| 10. | SONAR is the acronym for \_\_\_\_\_\_\_\_\_\_\_. | C06 | 1 |

|  |  |  |  |
| --- | --- | --- | --- |
| **PART – B (6 X 3 = 18 MARKS)** | | | |
| 11. | Define the term ‘Population Inversion’. | CO1 | 3 |
| 12. | A step index fibre has a core of refractive index 1.5. If the numerical aperture of the fibre is 0.26, calculate the refractive index of the cladding material. | CO2 | 3 |
| 13. | Explain Hooke’s law for elastic materials. | CO3 | 3 |
| 14. | Using the concept of photoelectric effect, find the wavelength corresponding to a photon of energy 3.5 eV capable of breaking a chemical bond in the molecules of human skin, causing sunburn. | CO4 | 3 |
| 15. | Differentiate between musical sound and noise. | CO5 | 3 |
| 16. | An ultrasonic source generating waves of frequency 800 kHz is used to find the depth of the sea. The velocity ‘u’ of sound in sea water is 1440 m/s. The time taken by the sound to reach the source after reflection from the sea bed is 0.95 s. Estimate the depth of the sea. | CO6 | 3 |

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **PART – C (6 X 12 = 72 MARKS)**  **(Answer any five Questions from Q.no 17 to 23. Q.No 24 is a Compulsory Question)** | | | | |
| 17. | a. | Discuss the importance of stimulated emission for laser action by using Einstein’s quantum theory of radiation. | CO1 | 10 |
| b. | Deduce the energy of a single photon emitted by a laser emitting a wavelength of 600 nm. | CO1 | 2 |
| 18. | a. | Prove that acceptance angle = sin-1 (Numerical Aperture)  i.e. . | CO2 | 10 |
| b. | Find the numerical aperture of a step index fibre that has a core and cladding refractive indices of 1.42 and 1.40 respectively. | CO2 | 2 |
| 19. | a. | Construct an experiment for finding Young’s modulus of a rectangular wooden beam by uniform bending method and arrive at an equation for the same. | CO3 | 10 |
| b. | Summarize the qualities of a good biomaterial. | CO3 | 2 |
| 20. | a. | Demonstrate the existence of matter waves using Davisson Germer experiment with necessary diagrams. | CO4 | 10 |
| b. | Evaluate the lowest energy in joules that a neutron posseses while it is confined inside a nucleus of 10-14 m diameter. Given that the mass of a neutron is 1.67 x 10-27 kg. | CO4 | 2 |
| 21. | a. | Criticize on any four factors affecting the acoustics of an auditorium and suggest the remedial measures for the same. | CO5 | 10 |
| b. | A movie theatre has a total volume of 8000 m3. The acoustics of the theatre needs to be designed to give a reverberation time of 2s. Determine the magnitude of total absorption within the theatre. | CO5 | 2 |
| 22. | a. | Elaborate on the construction, principle and working of Helium-Neon laser with suitable diagrams. | CO1 | 10 |
| b. | Explain the process of stimulated emission. | CO1 | 2 |
| 23. | a. | Compare and contrast optical fibers based on refractive index profiles with representative figures. | CO2 | 10 |
| b. | Distinguish single mode from multi mode optical fiber cables. | CO2 | 2 |
|  |  | **Compulsory:** | | |
| 24. | a. | Explain the procedure of producing ultrasonic waves by inverse piezoelectric method. | CO6 | 10 |
| b. | Discover the depth of a submerged submarine if the ultrasound pulse reflected from the submarine reaches the source after 0.83s and the velocity of sound in sea water is 1400 m/s. | CO6 | 2 |