SASTRA DEEMED UNIVERSITY

(A University under section 3 of the UGC Act, 1956)

End Semester Examinations

March 2021

Course Code: **PHY137**

Course: **FUNDAMENTALS OF PHYSICS**

Question Paper No. : **U043**

Duration: **3 hours**

Max. Marks:**100**

PART - A

Answer all the questions

10 x 2 = 20 Marks

1. A block whose mass m is 680 g is fastened to a spring with k= 65 N/m. The block is pulled to a distance x=11 cm from its equilibrium position at x = 0 on a frictionless surface and released at t = 0. Calculate its angular frequency and time period of the resulting motion.

2. State the principle of superposition.

3. Define Ampere's law of electromagnetism.

4. What are the types of double refraction? Give example.

5. Calculate the λ associated with thermal neutron of energy 0.045eV. (m_n= 1.675×10^{-27} kg)

6. Based on band theory in solids, compare the behavior of resistivity and impurity for a conductor and semiconductor.

7. Is laser action is possible at optical frequency? Give reason.

8. A laser of wavelength 6328Å emits an output power of 5mW. Find the number of photons emitted by laser in one second.

1

9. An optical fibre has a numerical aperture of 0.15 and cladding index of 1.55, find the acceptance angle.

10. In an isothermal reversible process, find the change of entropy of 1 kg of ice that is melted reversibly at and converted to water at The heat of fusion of water is $Q_f = 3.34 \times 10^5$ J/kg.

PART – B

Answer any four questions   **4 x 15 = 60 Marks**

11. (a) Explain why the intensity is not uniform in the Fraunhofer's single slit diffraction method.   (12)
    (b) A parallel beam of sodium light is normally incident on a plane transmission grating having 4250 lines per cm and a second order spectral line is observed at an angle of 30°.Calculate the wavelength of light?   (3)

12. (a) State and prove Gauss law.   (5)
    (b) Calculate the magnetic field intensity at point inside and outside the circular loop carrying current using Biot Savert's law.   (10)

13. (a) Derive the expression for the Schrodinger's time independent and time dependent equation.   (12)
    (b) A particle is moving in a 1D potential of width 10Å. Calculate the probability of finding the particle within an interval of 1Å at the center of the box at its lowest energy.   (3)

14. Explain the theory of Hall Effect. Deduce the expression to find the concentration, mobility, and conductivity using experimental.

15. Derive Einstein's quantum theory of radiation for the laser action.

16. Explain the different operations involved in Carnot cycle. Hence deduce the efficiency of Carnot engine.

2

PART – C

17. (a) Derive the expression for the effective mass of the spring system if the mass of the spring is not negligible. Also find the spring constant, when two springs A & B are connected in series and parallel. (6)

(b) Stat the four Maxwell's equation in a vacuum medium. (4)

(c) Explain the construction and working of Nd-YAG laser. (10)

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