Jharkhand University of Technology, Ranchi

B.Tech. 1st Semester Examination, 2018

Subject : Physics-I (Oscillations Waves and Option) **Subject Code : 18104**

Time Allowed : 3 Hours **Full Marks : 70**

Candidates are required to give their answers in their own words as far as practicable.

The figures in the margin indicate full marks.

Answer any five *questions.*

1. Choose the correct answer: 2×7=14

(i) Two sources of light are said to be coherent if the waves produced by them have the same

(a) wavelength

(b) amplitude

(c) wavelength and a constant phase difference

(d) amplitude and same wavelength

(ii) The wavefront originating from a point source is called

(a) cylindrical wavefront

(b) spherical wavefront

(c) circular wavefront

(d) None of the above

(iii) The wavelength of He-Ne laser is

(a) 6943Å

(b) 6328Å

(c) 6534Å

(d) 6845Å

(iv) Laser beam is not

(a) monochromatic

(b) unidirectional

(c) coherent

(d) non-coherent

(v) In Fraunhofer diffraction the incident wavefront is often

(a) spherical

(b) cylindrical

(c) plane

(d) None of the above

(vi) In simple harmonic motion, the acceleration is

(a) directly proportional to the displacement from mean position.

(b) constant.

(c) inversely proportional to displacement from mean position.

(d) inversely proportional to the square of displacement from mean position.

(vii) Total internal reflection would take place if light passes

(a) from air to water.

(b) from water to glass.

(c) from glass to diamond.

(d) from glass to water.

Or,

State and explain Fermat's principle of stationary time and deduce the laws of reflection and refraction from it. 14

2. What are damped oscillations? Derive and solve the differential equation of a damped harmonic oscillator. Find the conditions for weakly damped, critically damped and over damped motions. 14

3. Establish a relationship between Einstein's A and B coefficients. Describe the construction and working of a three level Ruby laser with necessary diagrams. 14

4. What is interference of light? Describe the Young's double slit experiment and explain it. Derive expressions for intensity at a point on the screen and the fringe width. 14

5. Describe and explain the formation of Newton's rings in reflected monochromatic light. Prove that in reflected light

(i) diameters of bright rings are proportional to the square roots of the odd natural numbers and

(ii) diameters of dark rings are proportional to the square roots of the natural numbers. How Newton's rings can be used to determine the wavelength of monochromatic light. 14

10

6. Describe Fraunhofer diffraction due to a single slit and deduce the positions of maxima and minima. Show that the relative intensities of successive maxima are $1:\frac{1}{22}:\frac{1}{62}:\frac{1}{120}$ 14

7. Set up the differential equation for transverse vibration of a string under tension T and length l. Starting from one dimensional differential wave equation show that a string of infinite length can sustain any arbitrary frequency of vibration, but when the string is of finite length and rigidity fixed at both ends can sustain only certain discrete frequencies. Find the frequency of Vibration in the n-th mode and fundamental mode. 14

64
30
94