Jharkhand University of Technology, Ranchi

B.Tech. 2nd Semester Examination, 2019

(Held in May, 19)

Subject : Physics-II (Optics & Fibre Optics) **Subject Code : BSC-105**

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. Multiple choice questions: 2×7=14

(i) Which of the following is conserved when light waves interfere?

(a) Intensity (b) Energy

(c) Amplitude (d) Momentum

(ii) When a drop of oil is spread on the surface of water, it displays beautiful colours in day light because of

(a) dispersion of light. (b) reflection of light.

(c) polarisation of light. (d) interference of light

(iii) The penetration of light into the geometrical shadow is called

(a) Polarisation (b) Interference

(c) Diffraction (d) Reflection

(iv) A calcite crystal is placed over a dot on a piece of paper and rotated. On seeing through the calcite, one will see

(a) two rotating dots. (b) two stationary dots.

(c) one dot only. (d) one dot rotating about the other.

(v) When a light ray is incident on a thick glass plate $(\mu = \sqrt{3})$, the reflected light is plane polarised. The angle of incidence is

(a) 45° (b) 57°

(c) 60° (d) 68°

(vi) Laser beam is not

(a) Mono Chromatic (b) Unidirectional

(c) Coherent (d) Non – coherent

(vii) An optical fibre is based on the principle of

(a) refraction of light.

(b) dispersion of light.

(c) total internal reflection.

(d) None of these

Or,

What is an optical fibre? Describe the working principle of an optical fibre. What is meant by acceptance angle and numerical aperture of a fibre? What do you mean by a graded-index fibre? Discuss its advantages over a step-index fibre. 14

2. Derive an expression for the resultant intensity at a point due to superposition of two light waves. Find the conditions of maximum intensity and minimum intensity. Draw and explain intensity distribution curve. Discuss the effect of introducing a thin mica sheet in the path of one of the interfering beams in a biprism experiment. Deduce an expression for the displacement of fringes. How this method is used for finding the thickness of a thin glass plate? 14

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

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

(b) diameters of dark rings are proportional to the square roots of natural numbers. 14

4. Describe Fraunhofer diffraction due to a single slit and deduce the positions of the maxima and minima. Show that the relative intensities of successive maxima are nearly $1:\frac{1}{22}:\frac{1}{61}:\frac{1}{121}$. 14

5. Find the resultant intensity of the diffracted beams when parallel rays fall normally on a plane diffraction grating. Hence work out the conditions for principal maxima and secondary maxima. Obtain the condition of absent spectra in a plane diffraction grating. 14

6. What is polarisation of light? Distinguish between plane polarised and unpolarised light. Define plane of polarisation and plane of vibration. State Brewster's law. Show that when a ray is incident at the polarising angle the reflected ray is perpendicular to the refracted ray. State and explain Malus law.

A ray of light is incident on the surface of glass plate of refractive index 1·732 at the polarising angle. Calculate the angle of refraction of the ray. 14

7. Obtain a relation between transition probabilities of spontaneous and stimulated emissions. Explain the construction and working of He-Ne laser. 14