

BIT Sindri
2nd Mid-term examination – 2018
Semester 1 (First year)
Branch – Electrical Engineering,
Paper – Physics 1
(Oscillation, waves and optics)

Time – $1\frac{1}{2}$ hours

Full Marks : 20

Answer five questions from group A and group B. Group A is compulsory.
Group A (Multiple choice questions)

1X4 = 4

Answer any four questions

Q.1

- (i) In Newton's rings arrangement, if the distance between the lens and the plate is increased, the order of the ring at a given point
(a) decreases (b) increases (c) remains unchanged (d) none of these
- (ii) In Michelson interferometer the shape of fringes depend upon
(a) distance of source from compensating plate (b) distance of semi-silvered plate from compensating plate
(c) the inclination between two mirrors (d) distance of semi-silvered plate from telescope
- (iii) In Michelson interferometer, if a uniform sheet of thickness t and refractive index μ is introduced in one of the paths, then the additional one way path introduced in the beam is
(a) $2(\mu - 1)t$ (b) $(\mu - 1)t$ (c) $\frac{D}{2d}(\mu - 1)t$ (d) μt
- (iv) In Fraunhofer diffraction the incident wave front is often
(a) spherical (b) cylindrical (c) plane (d) none of these
- (v) In the diffraction pattern due to a single slit, the width of the central maximum will be
(a) greater for narrow slit (b) less for narrow slit
(c) greater for wide slit (d) less for wide slit
- (vi) According to Rayleigh's criterion of resolution, the two spectral lines of equal intensity are just resolved when the central maximum of the diffraction pattern due to one falls
(a) on the central maximum of the diffraction pattern of the other (b) on the secondary maximum of the diffraction pattern of the other (c) on the first minimum of the diffraction pattern of the other (d) none of these

Group B (Long answer questions)

Answer any four questions

4X4 = 16

Q.2 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 odd natural numbers and (ii) the diameters of dark rings are proportional to the square roots of natural numbers.

Q.3 Describe the construction of a Michelson interferometer and explain its working. Describe how the interferometer may be used to obtain (i) circular fringes, (ii) straight fringes, (iii) white-light fringes.

Q.4 Describe Fraunhofer diffraction due to a single slit and deduce the positions of the maxima and minima.

Q.5 What is meant by the resolving power of an optical instrument? Explain Rayleigh's criterion for limit of resolution. Derive an expression for the resolving power of a diffraction grating.

Q.6 Starting from one dimensional differential wave equation so that a string of infinite length can sustain any arbitrary frequency of vibration, but when the string is of finite length and rigidly fixed at both ends can sustain only certain discrete frequencies.

Q.7 Derive an expression for the velocity of a plane longitudinal wave in a fluid medium. Clearly mention the assumptions you make.