Ref. No. Ex/BS/PH/T104/2019

# Bachelor of Engineering (Information Technology) Examination 2019

## (First Year and First Semester)

## PHYSICS

Time: 3 hours Full Marks: 100

Answer any *five* questions

1.a) What do you mean by interference of light? Coherent sources are essential for observing sustained interference pattern- explain.

b) Find the conditions of maxima and minima( in terms of path difference) for an interference pattern.

c) Describe and explain the formation of Newton's rings in reflected monochromatic light. Show that the diameters of the dark rings are proportional to the square root of natural numbers.

d) In an Newton's ring experimental setup, the diameter of the $m^{th}$ dark ring is 8mm and that of $(m + 5)^{th}$ dark ring is 12mm. If the radius of curvature of the lower surface of the lens is 10m, find the wavelength of the light used. 5+3+8+4

2.a) Distinguish between Fresnel and Fraunhofer class of diffraction.

b) Find an expression for the intensity distribution of a Fraunhofer diffraction pattern due to a single slit illuminated by a monochromatic light. Hence find the positions of the maximas and the minimas.

c) A monochromatic light of wavelength 5000Å is diffracted by a grating having 1000 lines per cm. Calculate the maximum order that can be observed. 3+(8+5)+4

3.a) What do you mean by polarization of light? Do sound waves show this phenomenon?

b) What is angle of polarization? Show that when a light ray is incident at the angle of polarization, the reflected ray is perpendicular to the refracted ray.

c) Explain the terms: Double refraction, O-ray, E-ray and Optic axis.

d) A thin mica sheet(refractive index=1.6) of 7 microns thickness is introduced in the path of one of the interfering beams in a young's double slit experiment. The central fringe shifts to a position normally occupied by the $7^{th}$ bright fringe. Find the wavelength of the light used.

3+6+6+5

4.a) Write down the equation of motion for a particle executing damped simple harmonic motion. Solve it for the case of small damping. Show the solution graphically.

b) Why is damping usually taken to be proportional to instantaneous velocity?

c) A mass of 10 kg is acted upon by restoring force of 0.01 N/m and a resisting force of 0.002 N.s/m. Find out whether the motion is oscillatory or non-oscillatory. Also find the value of resisting force for the motion to be critically damped. (3+6+3)+2+6

5. a) What is the time of reverberation?

b) Derive Sabine's formula. Explain growth and decay of energy density with time and draw necessary diagrams.

c) Discuss some important parameters which are generally used for judging the acoustics of an auditorium 2+13+5

6. a) Define (i) Young's modulus and (ii) shear modulus.

b) Establish a relation between Young's modulus and bulk modulus with the help of the necessary diagrams showing the nature of stress and strains.

c) What is the general equation for the depression (y) in case of a cantilever? Explain it's maximum value with a diagram. 5+10+5

7.a) What is Compton effect? Show that in Compton effect change in wavelength depends only on the angle of scattering. Do you expect Compton effect for visible light?

b) Compare the de Broglie wavelengths of (i) an electron moving with the velocity $10^7$ m/s and (ii) a golf ball of mass 45 gm and velocity 50 m/s. (2+10+2)+6

8.a) Write down the time independent Schrodinger equation for a particle trapped in a one dimensional box of length L. Show that the energy values of the particle are quantized. Also find the normalized eigen functions of the particle.

b) State Heisenberg's uncertainty principle. Using uncertainty relation show that an electron can't exist within the nucleus of an atom. (2+5+7)+6