Registration No : | | | | | | | | | | |

Total Number of Pages : 02 **M.Sc.I**

19MIMS103

1st Semester Regular Examination 2019-20

PHYSICS

BRANCH : M.SC.I.(MSE)

Max Marks : 100

Time : 3 Hours

Q.CODE : HR723

Answer Question No.1 (Part-1) which is compulsory, any EIGHT from Part-II and any TWO from Part-III.

The figures in the right hand margin indicate marks.

Part-I

Q1 **Only Short Answer Type Questions (Answer All-10)** **(2 x 10)**

a) What is the difference between standing wave and progressive wave ?

b) Find the speed of a longitudinal wave propagating in a medium of density 1000 kg/m^3 and bulk modulus 2.5 x 10^9 N/m^2.

c) State Huygen's principle of light.

d) What is the difference between Fraunhoffer and Fresnel diffraction?

e) Calculate the gradient of the scalar field $\varphi = x^2y + x^2yz + yz^2$.

f) If $\nabla^2\phi = 0$ then prove that grad ϕ is solenoidal.

g) What will be the ratio of the maximum intensity to the minimum intensity in a fringe system of two coherent sources whose intensity ratio is 16 : 9 ?

h) Define Q-value of oscillator. For a weak damping case, write the relationship between the Q-factor and the natural frequency of the oscillator

i) Draw the diagrams of the in-phase and out-of-phase modes of a coupled oscillator in the mean position and two extreme ends.

j) In a Newton's rings experiment, the radius of the 2nd dark ring is found to be 0.005cm. What will be the radius of the 6th dark ring?

Part-II

Q2 **Only Focused-Short Answer Type Questions- (Answer Any Eight out of Twelve)** **(6 x 8)**

a) Find a,b,c so that $\vec{V}$ = (5x + 3y + az)$\hat{\imath}$ + (bx — 6y—2z) $\hat{\jmath}$ + (3x+cy + 6z) $\hat{k}$ is irrotational

b) Prove that $\nabla \times (\nabla\phi) = 0$ (i.e. curl grad ϕ =0).

c) Prove that $\nabla \cdot (\nabla \times \vec{A}) = 0$ (i.e. div curl $\vec{A}$=0)

d) What are the conditions for a sustained interference pattern? What is the difference between interference and diffraction?

e) Derive the expression for fringe width in interference pattern due to Young's double slit experiment.

f) Find an expression for the diameter of Newton's ring if a liquid of refractive index μ_{liquid} is introduced between the lens and the glass plate.

g) What do you mean by phase velocity and group velocity? Find a relation between them?

h) State Gauss Law in electrostatics and derive Maxwell's 1st equation from it in differential form

i) Newton's Rings are formed using a lens of radius of curvature 100 cm. Calculate the diameter of 20th dark ring with a light of wavelength 5900 Å.

j) What do you mean by normal modes of oscillation for a system of two pendulums coupled by a spring? Find the expression for normal mode frequencies

k) A plane diffraction grating of width 2.5 cm has 12,500 rulings on it. What is maximum order of maxima in the grating spectrum that can be observed for incident light of wave length 5500 Å ?

l) Write the Maxwell equations in differential form as well as integral form

Part-III

Only Long Answer Type Questions (Answer Any Two out of Four)

Q3 **a)** A damped oscillator is subjected to a damping force proportional to its velocity. Set up the differential equation of the oscillator. Discuss the under-damped, over damped and critically damped oscillation with necessary diagram. **(8)**

b) The amplitude of an under-damped oscillator falls to 1/10 of its initial value after 500 oscillations. If the period of oscillation is 0.1sec find (i) the damping coefficient (ii) logarithmic decrement (iii) Time during which energy falls to 1/10 of its original value **(8)**

Q4 **a)** In Fraunhofer diffraction due to single slit, obtain the conditions for principal maximum, secondary maxima and minima. Show the distribution of intensity graphically in this diffraction pattern **(8)**

b) Show that the intensity of secondary maxima decreases with increase in order **(8)**

Q5 **a)** With suitable diagram describe the formation of Newton's rings and the conditions for bright and dark rings in reflected light. Explain why the central fringe is dark? How can it be made white? **(8)**

b) In a Newton's ring arrangement, the diameter of a bright ring is 0.5 cm. What would be the diameter of the same bright ring if radius of curvature of Plano convex lens becomes twice the initial value? **(8)**

Q6 **a)** Establish the differential equation for forced vibration and find the steady state solution. **(8)**

b) Starting from the solution of the equation for forced vibration explain the phenomenon of amplitude and velocity resonance. **(8)**