Registration no:

1st Semester Back Examination 2016-17
PHYSICS - I
BRANCH(S): ALL
Time: 3 Hours
Max Marks: 70
Q.CODE: Y765
Answer Question No.1 which is compulsory and any five from the rest.
The figures in the right hand margin indicate marks.

Q1   **Answer the following questions:**   **(2 x 10)**

a) Graphically show how the phase difference between the forced oscillator and the driving force varies with frequency for low damping force.

b) In a Newton's rings experiment, the radius of the 2th dark ring is found to be 0.005cm. What will be the radius of the 8th dark ring?

c) Distinguish between Fresnel and Fraunhoffer type diffraction.

d) Calculate the thickness of double refractive plate capable of producing a path difference of $\frac{\lambda}{4}$ between ordinary and extra ordinary ray. Given: $\mu_o = 1.540, \ \mu_o = 1.525$ and $\lambda = 6000 \, A^0$.

e) Graphically show the amplitude variation of an under damped harmonic oscillator with respect to time.

f) State Gauss' divergence theorem.

g) Write SI unit of the electric displacement.

h) Calculate the gradient of the scalar field $\phi = x^3 y + yz + x^2 yz^2$.

i) Write the Schrodinger time independent equation for a body of mass moving freely in the ZX plane.

j) Calculate the probability of leaking of a wave function through a barrier of infinite width.

Q2 **a)** Set up the differential equation of motion for forced oscillation and derive the condition of resonance.   **(5)**

    b) Set up the differential equations of motion for a coupled oscillator having two equal masses connected by a spring and decouple the equations using normal coordinates.   **(5)**

Q3 **a)** Derive the expression of resultant intensity for diffraction due to single slit and obtain the angular positions for Principal maximum, minima and Secondary maxima.   **(7)**

    b) A plane diffraction grating has 8000 rulings/cm. What is the highest order of spectrum observable for the wavelength of light 6000 A^0 ?   **(3)**

Q4 **a)** State Brewster's law. Establish a relation between refractive index and the polarizing angle. **(4)**

b) Describe the construction and working of Nicol Prism. **(6)**

Q5 **a)** Obtain the electromagnetic wave equations from Maxwell equations for free space in the absence of any charge and current sources. Show that electromagnetic wave travels with the speed of light in free space. **(7)**

b) Distinguish between real current and displacement current. **(3)**

Q6 **a)** State and explain Heisenberg's uncertainty principle. Using the uncertainty relation, show that electron does not exist inside nucleus. **(6)**

b) Write the characteristics of a wave function in quantum mechanics. **(4)**

Q7 Derive the expressions for energy eigen values and eigen functions for a particle trapped inside a potential well of infinite depth. Graphically show the energy eigen functions upto n=3. **(10)**

Q8 **Write short answer on any TWO:** **(5 x 2)**
a) Zone plate
b) Poynting theorem
c) Compton effect
d) Quantum mechanical tunneling