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

Total Number of Pages: 02 **B.Tech.**
PAP1A102

1st Semester Regular/Back Examination 2017-18
APPLIED PHYSICS
Branches: AEIE, AUTO, CHEM, CIVIL, CSE, ECE, EEE, EIE, ELECTRICAL, ETC, IEE, IT, MANUTECH, MECH, METTA, MINERAL, MINING, MME, PE, PLASTIC, PT, TEXTILE
Time: 3 Hours
Max Marks: 100
Q.CODE : B817
Answer Question No.1 and 2 which are compulsory and any four from the rest.
The figures in the right hand margin indicate marks.

Q.1 **Answer the following questions:** **[2 x 10]**

a) State the principle of virtual work. Give one example. How is D' Alemberts' principle related to this principle?
b) What are parameters that completely define a wave? A stationary wave has wavelength 5m. What is the distance between an antinode and its nearest node of the wave?
c) How many times of the potential energy and the kinetic energy attain maximum of an oscillating body in one oscillation. Substantiate your anwer with example.
d) Differentiate between Fresnel type and Fraunhofer type of diffraction.
e) What are semiconductor and insulators? Explain their differences in terms band theory.
f) What do you mean by population inversion? Explain briefly how production of LASER depends on this phenomena.
g) What are bosons, fermions and Maxwellian Particles? How these differ from each other. How the number of particles are distributed in terms of their individual energy at temperature T ^{o}K?
h) State Gauss divergence theorem. What is its importance in Electrostatics? Give example.
i) State Faraday's law of electromagnetic induction in differential as well as integral form. Does it satisfy one of the conservation laws in physics.
j) State Ampere's circuital law in integral and in differential form. Can one find electric or magnetic field due to current flow? How?

Q.2 **Answer all the questions :** **[2 x 10]**

a) Define Lagrangian L and hence action S for a dynamical system between two extreme points under consideration. Clearly specify the variable(s) for N-particle system.
b) Obtain equation of motion for given Lagrangian
$L = m\,v^2/2 - k\,x^2/2$, where $v=dx / dt$ is the velocity of the particle.
c) If two waves have path difference Δ, then what is the phase difference between them?
d) What are the similarities and disimilarites between a zone plate and convergent lens?
e) Mention the characteristic properties of LASER.
f) Distinguish between primitive cell and unit cell.
g) Explain briefly the advantages of optical fibre communication over conventional system.
h) What are scalar and vector potntials? Express the Electric field E and magnetic field B in terms of these potentials.
i) State de Broglie's hypothesis. Find the wave length of a material particle of mass m and moving with velocity v.
j) State Heisenberg's uncertainty relation.

Q.3 The Lagrangian of a system is given by **[15]**
$L=(1/2)\, m\, (d\eta_1/dt)^2 + (1/2)\, m\, (d\eta_2/dt)^2 - (1/2)\, k\, \eta_1^2 - (1/2)\, k\, \eta_2^2$,
where η_1 and η_2 are displacements, m is the mass and k is the force constant. Find the equation of motion and hence general solutions.

Q.4 **a)** Write down the equation of motion for a damped harmonic oscillator of mass m and obtain its solution in different conditions. **[10]**

b) A damped oscillator looses 0.6 % of its mechanical energy per cycle. How many period it will take to reduce its amplitude by 1/e. **[5]**

Q.5 **a)** Describe the Michelson interferometer with a neat diagram and explain the formation of fringes in it. **[10]**

b) In a Michelson interferometer,100 fringes pass in the field of view when the mirror is moved from 12.7347mm to 12.7051mm. Calculate the wavelength of light used. **[5]**

Q.6 **a)** What is reciprocal lattice? Show that FCC lattice is reciprocal of BCC lattice. **[12]**

b) The two dimensional lattice has the following basis vectors a = 3 i + j and b = i+ 4 j, where i and j are unit vectors along respective axis. Find the reciprocal lattice vectors. **[3]**

Q.7 **a)** Describe the working principle of He–Ne gas Laser. What are the advantages of this Laser over Ruby Laser? **[12]**

b) If the wavelength of Laser is 6328Å. Find the Intensity of the Laser if the power delivered is 10^3 watt. **[3]**

Q.8 **a)** Explain what is displacement Current.Obtain an expression for displacement current inside a plate capacitor of area A filled with dielectric material of permitivity ε_o. **[10]**

b) The electric field inside the plate capacitor of area 2 cm^2 changes at the rate of 1.2 x10^8 V/m.s.
Calculate the displacement current. **[5]**

Q.9 **a)** The wave function of a system is given by **[5]**
$Y(x)=(1/\sqrt{2})\, \varphi_1(x) + (1/\sqrt{3})\, \varphi_2(x) + (1/\sqrt{6})\, \varphi_3(x)$. What is the probability that the system is to be found in state $\varphi_3(x)$.

b) Radiation of wavelength 2500Å in incident on a metal surface whose work function is 3.1eV. Calculate the stopping potential. **[5]**

c) The wave function of a particle is $Y(x)= C \exp(-a x^2)$ defined in the interval $-\infty < x < \infty$. Find the value of C . **[5]**