Registration No : | 2 | 2 | 0 | 1 | 2 | 1 | 4 | 0 | 6 | 5 |

Total Number of Pages : 02

B. Tech /
Integrated Dual Degree (B. Tech & M.Tech)
RPH1A001

1st Semester Regular/Back Examination: 2022-23

Physics

BRANCH(S): AE, AEIE, AG, BIOTECH, CIVIL, CSE, CSEAI, CSEAIME, CSEDS, CSIT, CST, ECE, EEE, EIE, ELECTRICAL, ELECTRICAL & C.E, ELECTRONICS & C.E, ETC, IT, MANUTECH, MECH, METTA, MINING, MME, PLASTIC, PT

CE, CSE, EE

Time : 3 Hour

Max Marks : 100

Q.Code : L657

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

a) The maximum amplitude of a forced damped oscillator is 1.5 cm. What will be the maximum amplitude if damping constant and magnitude of driving force are doubled?

b) The total energy of a simple harmonic oscillator is 1.2 ergs. Find its kinetic energy at the mid-point of the mean position and one extreme end.

c) State the conditions for sustained interference.

d) Write two uses of Newton's rings experiment.

e) Distinguish between spontaneous emission and stimulated emission.

f) Calculate the inter-planer spacing for a (321) plane in a simple cubic lattice whose lattice constant is 0.42 nm.

g) Distinguish between conduction current and displacement current.

h) State Gauss divergence theorem in vector field.

i) In Compton effect, a photon recoils back after striking an electron at rest. What is the change in wavelength of the photon?

j) The energy required to remove an electron from sodium is 3.1 eV. Does sodium show a photoelectric effect for orange light with λ= 680 nm? Justify.

Part-II

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

a) A damped oscillator is subjected to a damping force proportional to its velocity. Write the differential equation of motion of the oscillator and discuss the under-damped, over-damped and critically damped motions with suitable diagram.

b) Define coupled oscillation. In a coupled oscillation of two identical pendulums of mass **100 gm** and length **100 cm** each connected by a spring of spring constant **300 dyne/cm**. Calculate the frequency in the out-of-phase mode.

c) With a suitable ray diagram explain the formation of Newton's rings. Why the fringes in Newton's rings interference pattern are circular?

d) What is a zone plate? Compare a zone plate with a convergent lens

e) Draw the structure of an optical fiber. Distinguish between a single mode and a

multimode optical fiber.

f) Write Bragg's law of X-ray diffraction. State its significance. A beam of X-rays of wavelength **0.073 nm** is diffracted by **(110)** plane of rock salt with lattice constant of **0.3 nm**. Find the glancing angle for the second-order diffraction.

g) State Ampere's circuital law. Obtain its differential form.

h) State and explain Poynting theorem. Write the direction and S.I unit of the Poynting vector.

i) The electromagnetic wave is propagating in free space with electric vector $E(z,t)=50\cos(4\times10^{7}t-Kz)\hat{i}$ volt/meter. Obtain an expression for magnetic vector. State the direction of propagation of the electromagnetic wave.

j) What is pair production? Does it violate conservation of momentum? Find the threshold energy of the photon required to produce pair production

k) Define probability density. Calculate the probability of finding a particle in the region **$2 \leq x \leq 4$**, if the wave function for the particle is given by $\psi(x) = 0.25\, e^{2ix}$.

l) What are matter waves? If the ratio of the velocities of proton and α-particle is **8:1**, then find the ratio of their de - Broglie wavelengths.

Part-III

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

Q3 (a) Define diffraction. Derive an expression for the intensity incase of Fraunhofer's diffraction due to single slit with a neat diagram. Discuss the conditions for principal maximum, minima and secondary maxima. Draw its intensity distribution curve. (12)

(b) In Fresnel's biprism experiment, the width of 10 fringes is **2 cm** which are formed at a distance of **2 meter** from the slit. If the wavelength of light is **540 nm**, then find the distance between two coherent sources. (4)

Q4 (a) Write the four Maxwell's equations in differential form in vacuum. Discuss the significance of each Maxwell's equation. (8)

(b) Derive the electromagnetic wave equation in terms of electric vector when the wave is propagating in a charge free non-conducting medium. Obtain an expression for its velocity. Find the impendence of vacuum. (3)

Q5 (a) With a suitable diagram explain the construction and working of ruby laser. Draw the energy level diagram showing the operation of the ruby laser. Write the limitations of ruby laser. (12)

(b) A Ruby laser emits light of **693.95** nm wavelength. If **1 mole** of Cr^{+3} ions are involved in the lasing process, calculate the pulse energy in eV. (4)

Q6 (a) Starting from the Schrodinger's equation for a particle confined in a one dimensional box of infinite height, develop an expression for the normalized wave function. Show that its energy is discrete and quantized. (10)

(b) An electron is trapped in a one-dimensional box of length 2 Å. How much energy is required to excite the electron from the first excited state to the third excited state? Find the de-Broglie's wavelength of the electron in the 3rd excited state. (6)

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. **[5]**
Calculate the displacement current.

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]**

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Total Number of Pages : 02

B.Tech
PAP1A102

1st Semester Back Examination 2019-20
APPLIED PHYSICS
BRANCH : AEIE, AERO, AUTO, BIOMED, BIOTECH, CHEM, CIVIL, CSE, ECE, EEE, EIE, ELECTRICAL, ENV, ETC, FAT, IEE, IT, MANUFAC, MANUTECH, MECH, METTA, MINERAL, MINING, MME, PE, PLASTIC, PT, TEXTILE
Max Marks : 100
Time : 3 Hours
Q.CODE : HB632

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) State D. Alembert's principle.
b) Graphically show the displacement-time curves for under-damped, over-damped and critically damped motion.
c) What do you mean by diffraction? Write down the type of diffraction.
d) Distinguish between conduction current and displacement current.
e) Write down Maxwell's electromagnetic equations in integral form.
f) What do you mean by population inversion?
g) On which principle does fibre optics work?
h) Write down SI unit of Poynting vector.
i) What is pair production? Write down one example.
j) At θ = __ , the Compton shift in maximum.

Part-II

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

a) What are generalized co-ordinates? Obtain equation of motion for given Lagrangian $L = \frac{mv^2}{2} - \frac{kx^2}{2}$, where v=dx/dt is the velocity of the particle.
b) Two pendulums of mass 50g each are suspended by massless rigid rods of length 0.98m. The two masses are coupled by a massless spring of force constant k=150 dyne/cm. Determine the normal mode frequencies of the coupled oscillator.
c) Write down the similarities and differences between a zone plane and convex lens.
d) Write about Michelson interferometer and calculate the wave length of monochromatic light using it.
e) Prove that the curl of gradient of a scalar field is zero and divergence of curl of a vector field is zero.
f) Write down the difference between Basons and Fermions.
g) Prove thatFCC lattice is the reciprocal of BCC lattice and vice-versa.
h) Write down the difference between spontaneous emission and stimulated emission of radiation.
i) Derive steady state equation for electric and magnetic field.
j) Write down the advantages of fibre optics cables over conventional cables. Define numerical aperture.
k) The wave function of a system is given by $Y(x) = \frac{1}{\sqrt{2}}\Phi_1(x) + \frac{1}{\sqrt{3}}\Phi_2(x) + \frac{1}{\sqrt{6}}\Phi_3(x)$. What is the probability that the system is to be found in the state Φ_3 (x).
l) Calculates the expectation value of x-component of momentum of a free particle in a box of length l, $\psi = \sqrt{\frac{2}{l}}[\sin\left(\frac{n\pi x}{l}\right)]$

Part-III

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

Q3	**a)**	Set up the differential equation of motion for forced oscillation and derive the condition of resonance.	**(6)**
	b)	Prove with necessary diagram that the diameters of the dark rings, in Newton's ring experiment, as obtained by reflected light are proportional to square root of natural numbers.	**(6)**
	c)	In a Newton's ring system, the diameters of the 5^{th} and 10^{th} dark rings are 0.122cm and 0.150cm respectively. What is the diameter of the 15^{th} ring?	**(4)**
Q4	**a)**	What do you mean by miller indices? Write down the procedure to find out the miller indices of the plane (5, 7,9).	**(6)**
	b)	Write down the difference between step index fibre and graded index fibre	**(4)**
	c)	On the basis of band theory, distinguish between conductors, semiconductors and insulators.	**(6)**
Q5	**a)**	Write in detail construction, principle and working of He-Ne laser. What are the advantages of He-Ne laser over ruby laser	**(12)**
	b)	State Gauss divergence theorem. Using the theorem prove that the volume of the sphere is $4/3\ \pi r^3$.	**(4)**
Q6	**a)**	What is Photoelectric effect? Explain Einstein's explanation about it.	**(4)**
	b)	Using Heisenberg's uncertainty principle prove that the energy of the one dimensional harmonic oscillator cannot be zero.	**(6)**
	c)	Derive time independent and time dependent Schrodinger equation	**(6)**

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Total Number of Pages: 02 **B.Tech**
BS1102

1ST SEMESTER BACK EXAMINATION 2017-18
PHYSICS-I
BRANCH: AEIE, AERO, AUTO, BIOTECH, CHEM, CIVIL, CSE, ECE, EEE, EIE, ELECTRICAL, ETC, FASHION, IEE, IT, MECH, METTA, MME, PE, TEXTILE
Max Marks: 70
Time: 3 Hours
QCODE: B934

Answer Question No.1 which is compulsory and any five from the rest.
The figures in the right hand margin indicate marks.

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

a) What are free and forced oscillations?

b) What is the principle of superposition?

c) What is the Interference? Write the types of Interference.

d) Define grating element of a diffraction grating.

e) What is a quarter wave plate?

f) State Maxwell's equations in a medium having no charge and no current.

g) What is Lorentz gauge condition?

h) What is pair production?

i) State Wien's displacement law.

j) What is meant by Quantum mechanical tunneling?

Q.2 **a)** Set up the differential equation of a forced oscillator subjected to an external force. **[5]**

b) Mention the similarities and difference between a converging lens and a zone plate. **[5]**

Q.3 **a)** What are Fresnel's half period zones? **[3]**

b) Explain the factors on which the intensity at a point due to Fresnel's half period zones depend? **[7]**

Q.4 **a)** What in meant by polarization of light. How polarization is produced by reflection. **[5]**

b) State Brewster's law. **[5]**

Q.5 **a)** Prove that the curl of gradient of a scalar field is zero and divergence of curl of a vector field is zero. **[5]**

b) Show that the electromagnetic waves are transvers in nature. **[5]**

Q.6 **a)** Derive the time independent Schrodinger's equation for one dimensional system. **[6]**

b) Hence find out the energy of a free particle? **[4]**

Q.7 **a)** What is a one-dimensional potential step? **[2]**

b) Derive the Schrödinger equation for a particle in a potential box of infinite depth. **[8]**

Q.8 **Write short answer on any two:** **[5 x 2]**

a) Coupled oscillation.

b) Zone plate.

c) Poynting theorem.

d) Compton shift.

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

Total Number of Pages : 02 **B.Tech**
BS1102

1st Semester Back Examination 2019-20
PHYSICS - I
BRANCH : AEIE, AERO, AUTO, BIOMED, BIOTECH, CHEM, CIVIL, CSE, ECE, EEE, EIE, ELECTRICAL, ENV, ETC, FASHION, FAT, IEE, IT, ITE, MANUFAC, MANUTECH, MARINE, MECH, METTA, METTAMIN, MINERAL, MINING, MME, PE, PLASTIC, TEXTILE
Time : 3 Hours
Max Marks : 70
Q.CODE : HB856
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) In a damped oscillator, the damping force is proportional to the velocity. Mention the position at which damping force vanishes?
b) What do you mean by sharpness of resonance and sharp resonance in forced harmonic oscillation?
c) 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?
d) Define absent spectra?
e) If $\nabla^2\phi = 0$ then prove that grad ϕ is solenoidal.
f) Write gradient, divergence and curl in integral from.
g) A single turn coil loop of radius 5cm is placed on a plane paper and magnetic flux directed perpendicularly out of the paper varies according to $\phi = 11t^2 + 7t + 15$. What is the magnitude of induced emf in the coil at time t=1.5s.
h) What do you understand by pair production?
i) What is black body radiation?
j) What is tunneling?

Q2 **a)** Derive the equation of motion for simple harmonic oscillation and prove that the total energy of the oscillator is constant with respect to time. **(5)**
b) Starting from the differential equation of a damped oscillator, write the solution for under damped oscillatory motion . Graphically show the variation of amplitude with time. Mention the condition for critical damping. **(5)**

Q3 **a)** Explain Brewster's law. A light is incident on a partially transparent medium at polarizing angle. Show that the reflected and transmitted rays are mutually perpendicular to each other. **(5)**
b) Explain how the wavelength of monochromatic light is determined using Newton's ring arrangement. **(5)**

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. **(5)**
b) 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 A^0? **(5)**

Q5 **a)** Prove that Poynting theorem is a statement of conservation of energy in electromagnetic field. **(5)**

b) What is uncertainty principle?Using uncertainty principle, show the non-existence of electron inside the nucleus. . **(5)**

Q6 Derive electromagnetic wave equation for **E** and **B**in a charge free conducting medium. Write the dissipative terms and find out the wave equation for non-conducting medium. **(10)**

Q7 Find out the wave function of a particle of mass **m** inside an infinite deep potential well using Schrodinger equation. Discuss about quantized energy levels and normalized eigen function for the particle. **(10)**

Q8 **Write short Notes on any TWO :** **(5 x 2)**

a) Transverse nature of EM waves.

b) Quarter-wave plate.

c) Compton Scattering.

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

Total Number of Pages: 03 **B.Tech.**

15BS1102

1st Semester Back Examination: 2017-18

Physics

BRANCH (s): , AEIE, BIOTECH, CHEM, CIVIL, CSE, ECE, EEE, EIE, ELECTRICAL, ETC, IEE, IT, MANUTECH, MECH, MINERAL, MINING, MME, PE, TEXTILE

Time: 3 Hours

Max Marks: 100

Q.CODE: B843

Answer Part-A which is compulsory and any four from Part-B.

The figures in the right hand margin indicate marks.

Part-A (Answer all questions)

Q1 **Select the correct answer of the followings:** **(2 x 10)**

a) In simple harmonic motion kinetic energy is maximum at
(i)equilibrium position (ii) extreme position (iii) any position between extreme and minimum position (iv) none of the above

b) The maximum velocity of a particle executing SHM represented by $x=A\sin\omega t$ at time t occurs at (i) x=0; (ii) x=A; (iii) x=-A; (iv) x=A/2

c) What should be the path difference between two coherent waves of wavelength such that there will be constructive interference?
(i)$N\lambda$ (ii) $(2N+1)\lambda$ (iii) $(2N-1)\lambda$ (iv) none of the above

d) What is the phase difference between two waves originating from two consecutive Fresnel's half period zones?
(i)0 (ii) $\pi/2$ (iii) π (iv) 2π

e) What type of wavefront is incident in the case of Fresnel's diffraction?
(i)Plane (ii) Spherical (iii) cylindrical (iv) elliptical

f) The refractive index of certain glass is 1.5. What is the polarizing angle for this glass surface?
(i)55^o (ii) 56^o (iii) 57^o (iv) 58^o

g) The divergence of a position vector in XYZ plane is
(i)3 (ii) 9 (iii) 12 (iv) 15

h) Velocity of light in free space is given by c
(i)$c=\sqrt{\mu_o\varepsilon_o}$ (ii) $c=\sqrt{\mu_o}/\sqrt{\varepsilon_o}$ (iii) $c=\sqrt{\varepsilon_o}/\sqrt{\mu_o}$ (iv) $c=1/\sqrt{\mu_o\varepsilon_o}$

i) Through what potential difference should an electron be accelerated so that its de-broglie wavelength becomes 5500 A^o.
(i)4.98×10^{-6} V (ii) 4.98×10^{-5} V (iii) 4.98×10^{-4} V (iv) 4.98×10^{-3} V

j) Name a phenomenon where energy is converted into matter.
(i)Compton effect (ii) photoelectric effect (iii) pair production
(iv) Radioactive decay

Q2 **Answer the following questions:** **(2 x 10)**

a) What do you mean by critically damped harmonic oscillation? Write its applications.

b) Show graphically under damped, over damped and critically damped harmonic oscillations.

c) What are the conditions for sustained interference?
d) Write few differences between interference and diffraction.
e) Define optical rotation and write its unit.
f) State Gauss law in electrostatic field. Write its integral and differential form.
g) State Stoke's theorem.
h) Show that vector $\mathbf{A}=(x+3y)\mathbf{i} + (y+ az)\mathbf{j} +(x+az)\mathbf{k}$ is solenoidal.
i) What is the need of Quantum mechanics?
j) What is quantum mechanical tunneling?

Part-B (Answer any four questions)

Q3 **a)** A damped oscillator is subjected to a damping force proportional to its velocity. Set up the differential equation of the oscillator. Discuss under damped oscillation. Explain logarithmic decrement. **(5)**

b) The time period of simple harmonic oscillator is 4s. It is subjected to a damping force proportional to its speed with damping co-efficient 0.1/s. Find the time period and logarithmic decrement when subjected to damping forces. **(5)**

c) Differentiate between progressive and stationary wave. **(5)**

Q4 **a)** Give the theory of Newton's rings and how to determine the refractive index of transparent liquid using it. **(5)**

b) A source of light emitting two wavelengths λ_1=6000 A^o and λ_2=4500 A^o is used for Newton's rings. It is found that the n^{th} dark ring due to λ_1 coincides with $(n+1)^{th}$ dark ring for λ_2. If the radius of curvature of the convex surface is 100 cm, find the diameter of nth dark ring for λ_2. **(5)**

c) A slit illuminated by a monochromatic light is placed at a distance of 10 cm from a biprism of refractive index 1.5 and base angle 2^o. If the distance between two dark fringes is 0.18 mm, as observed on a screen placed at a distance of 1 m from the biprism. Find the wavelength of light. **(5)**

Q5 **a)** Write some similarities and dissimilarities between zone plate and convex lens. **(5)**

b) A plane diffraction grating of width 2.5 cm has 1500 rulings. Monochromatic light of wavelength 5893 A^o is incident normally on it. Find the angle at which second order principal maximum occurs. **(5)**

c) In Fraunhofer diffraction due to single slit, obtain the conditions for principal maxima, secondary maxima and minima. Show the intensity distribution curve graphically in this diffraction pattern. **(5)**

Q6 **a)** Explain the construction and working of Nichol prism with suitable diagram. **(5)**

b) Distinguish between e-ray and o-ray. **(5)**

c) The refractive indices of a double refracting material for o-ray and e-rays for wavelength, 5500 A^o are 1.588 and 1.594 respectively. Calculate the required thickness of the material for, (i) half wave plate (ii) quarter wave plate. **(5)**

Q7 **a)** With the help of Gauss divergence theorem, show that the volume of a sphere is $\pi d^3/6$, where d is the diameter of the sphere. **(5)**

b) Derive electromagnetic wave equations in conducting medium and write the dissipative terms. **(5)**

c) Distinguish conduction current and displacement current. **(5)**

Q8 **a)** Define Poynting vector. Deduce Poynting theorem for the flow of energy in an electromagnetic field. **(5)**

b) State Heisenberg's uncertainty principle and using it show that electrons cannot reside inside a nucleus. **(5)**

c) Define group velocity and find a relation between group velocity and phase velocity. **(5)**

Q9 **a)** The probability that a system can be in the states represented by eigen functions ψ_1, ψ_2, ψ_3 are ½, 1/3, ¼ respectively. Write the wave function for the system. If the energy eigen values for the given states are 2 eV, 3 eV and 4 eV respectively, find the energy expectation value. **(5)**

b) Write the Schrodinger's equation for an infinitely deep one dimensional potential well and find expression for the wave function and energy of the particle. **(5)**

c) Calculate the expectation value of x-component of momentum of a free particle in a box of length l,
$\Psi=\sqrt{(2/l)}\ [\sin(n\pi x/l)]$

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

Total Number of Pages : 02

B.Tech
RPH1A001

1st Semester Regular/Back Examination 2019-20
PHYSICS
BRANCH : AEIE, AERO, AG, AUTO, BIOMED, BIOTECH, CHEM, CIVIL, CSE, CST, ECE, EEE, EIE, ELECTRICAL, ELECTRICAL & C.E, ELECTRONICS & C.E, ENV, ETC, FASHION, FAT, IEE, IT, ITE, MANUFAC, MANUTECH, MARINE, MECH, METTA, METTAMIN, MINERAL, MINING, MME, PE, PLASTIC, PT, TEXTILE
Max Marks : 100
Time : 3 Hours
Q.CODE : HRB634

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) Two simple pendulum of mass 'm' and length 'l' each, are coupled by a spring of force constant 'k'. Write the expression for frequency of normal modes of vibration of the coupled system.

b) A harmonic wave is represented by the wave function $\psi(x, t) = (3cm) \sin (0.6x - 2.2t + \pi)$. Determine the amplitude, frequency, wave length and phase velocity of the wave.

c) What is the condition for Resonance?

d) Write the Difference between interference and diffraction fringes.

e) A silica glass optical fibre has a core refractive index of 1.500 and the cladding refractive index of 1.450. Calculate critical angle for core-cladding interface and numerical aperture (NA) of the fibre.

f) What is population inversion?

g) What is the difference between Crystalline and Amorphous Solid?

h) State Ampere'scircuital law in integral and in differential form.

i) Compute de Broglie wave length of a bike having mass 100kg and moving with speed 100 km/hour.

j) Write down time independent Schrodinger's equation for a free particle of mass 'm' moving in Y-axis.

Part-II

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

a) Developed the equation for forced oscillation and discuss about frequency, phase, amplitude, velocity of the forced oscillation.

b) Show that the radii of Fresnel half period zones are proportional to the square root of nature numbers.

c) Write down the differences between spontaneous emission and stimulated emission of radiation.

d) Give differences between standing wave and progressive wave. Calculate the fringe width of interference a pattern produced in Young's double slit experiment with two slits 10^{-3}m apart on a screen 1 m away. Wave length of light is 5893×10^{-8} cm.

e) State the difference between mono mode and multi-modefibres. What is acceptance angle?

f) State Maxwell's equations in differential and integral forms both in the presence and absence of free charges and currents.

g) Define divergence of a vector field. Write its physical significances. Find out the divergence and curl of the given vector field $\vec{v} = (xyz)\,\hat{\imath} + (3x^2y)\,\hat{\jmath} + (xz^2 - y^2z)\hat{k}$ at (2,-1, 1).

h) Write the difference between Poynting vector and Poynting theorem.

i) What do you mean by miller indices? Write down the procedure to find out the miller indices. A certain orthorhombic crystal has axial units a: b: c of 0.424:1: 0.367. Find the miller indices of the crystal whose intercepts are 0.424:∞:0.123.

j) What do you mean by Fermi energy? Write down the differences between Fermions and Bosons.

k) What is Bragg's law? The minimum order of Bragg's reflection occurs at angle of 20^0 in the plane [212]. Find the wave length of X- rays if lattice constant is $3.615A^0$.

l) What do you mean by Compton shift? In Compton effect, the incident photon has wavelength 2×10^{-10}m and angle of scattering $\theta=90^0$. Calculate the wave length of the scattered photon.

Part-III

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

Q3 a) What is a Bi-prism? How can the wavelength of monochromatic light be measured with the help of a Fresnel's Bi-prism, explain it in details. **(6)**

b) Differentiate between Fresnel and Fraunhoffer diffraction. **(4)**

c) Write down the differences and similarities between Zone plate and similarities of convex lens. **(6)**

Q4 a) Describe in detail, the components, principle of operation and working of ruby laser. State the limitation of ruby laser. **(10)**

b) Write about the basic characteristics of optical fiber and its application in communication system. **(6)**

Q5 a) Derive wave equation for damped vibration and calculate the logarithmic decrement. **(6)**

b) What are the difference between conduction current and displacement current? The electric field inside the plate capacitor of area $2cm^2$ changes at the rate of 1.2×10^8V/m.s, Calculate the displacement current. **(6)**

c) State Gauss divergence theorem. Evaluate the surface integral for the vector function $\vec{f}= \hat{\imath}4xz-\hat{\jmath}y^2+\hat{k}yz$ over the surface S, where S is the surface of the unit cube bounded by x=0, x=1, y=0, y=1, z=0, z=1 planes, using Gauss divergence theorem. **(4)**

Q6 a) What do you mean by photoelectric effect? Find out Planck's constant from Einstein's photoelectric equation. **(6)**

b) Define Heisenberg's uncertainty principle. Prove that the ground state energy of the simple harmonic oscillator is non-zero **(6)**

c) A particle is confined to move along a line of length "L" cm. Find the expectation value of the particles position <x>, If the normalized wave function is $\psi = \sqrt{\frac{2}{l}}[\sin\left(\frac{n\pi x}{l}\right)]$. **(4)**

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

Total Number of Pages : 02

B.Tech
PAP2A101

2nd Semester Back Examination 2018-19
APPLIED PHYSICS
BRANCH : AEIE, AERO, AUTO, BIOTECH, CIVIL, CSE, ECE, EEE, EIE, ELECTRICAL, ETC, IT, MECH, MINERAL
Max Marks : 100
Time : 3 Hours
Q.CODE : F523

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) Define time period, frequency and amplitude of an oscillator.
b) What difference between interference fringes and diffraction fringes?
c) What are different types of diffraction?
d) State and explain D' Alembert's principle.
e) What are Brillouins Zones? How are these constructed?
f) If a scalar field f satisfies the relation $\nabla^2 f = 0$, show that $\vec{\nabla} f$ is both solenoidal and irrotational.
g) Write the Maxwell's electromagnetic equation in differential form, which follows from the concept of displacement current.
h) State Heisenberg's Uncertainty Principle?
i) What is photoelectric work function?
j) X-Rays of wave length 1Å undergoes Compton scattering through 90^0. Find the Compton Shift.

Part- II

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

a) What are generalised co-ordinates? Explain how the principle of virtual work and D'Alembert's principle help us in treating constrained motion.
b) The Lagrangian of a particle of mass m, exhibiting oscillation is given by $L = \frac{1}{2}m\dot{q}^2 - \frac{1}{2}kq^2$, with initial conditions that at $t = 0$, $q = q_0$ and $p = p_0$. Obtain equation of motion and its solution.
c) Derive the total energy of the driven oscillator subjected to an external periodic force.
d) Define coupled Oscillation. Formulate the differential equation for the coupled Oscillation and establish the normal mode equations.
e) What is a zone plate? Show that it has multiple focal length.
f) Discuss the Fraunhofer diffraction due to a single slit. Find condition of Principal maximum and minimum.
g) Prove that the FCC lattice is the reciprocal of the BCC lattice and vice versa.
h) Describe how the band theory of solids explains conductors, insulators and semiconductors with diagram.
i) Explain the working mechanism of a He – Ne laser. What are the advantages and limitations of a He-Ne laser?
j) State and explain Gauss divergence theorem. Explain its significance in electrostatics.
k) What is the meaning of wave function in quantum Mechanics? Mention its characteristics.
l) Show that an electron cannot be the constituent of an atomic nucleus using Heisenberg's uncertainty principle.

Part-III

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

Q3 Set up the differential equation for a damped harmonic oscillator subjected to damping force proportional to velocity. Discuss the solution, Logarithmic Decrement and Quality factorfor under damping condition. **(16)**

Q4 What are Fresnel's half period zones? Explain all factors on which the intensity at a point due to Fresnel's half period zones depend? **(16)**

Q5 State the Maxwell's electromagnetic equations in a medium in presence of charges and currents. Obtain the differential form. Write down the physical significance of Maxwell's equation. **(16)**

Q6 What is black body radiation? Mention its general characteristics. State Planck's formula for black body radiation. Show that the Rayleigh-jeans formula and Wien's formula are limiting cases of this formula. **(16)**

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

Total Number of Pages : 02 **B.Tech.**
BS1102

2nd Semester Back Examination 2017-18
PHYSICS - I
BRANCH : AEIE, AERO, AUTO,
BIOMED, BIOTECH, CHEM, CIVIL, CSE, ECE, EEE, EIE, ELECTRICAL, ENV, ETC, FASHION, FAT, IEE, IT, ITE, MANUFAC, MANUTECH, MARINE, MECH, METTA, METTAMIN, MINERAL, MINING, MME, PE, PLASTIC, TEXTILE
Time : 3 Hours
Max Marks : 70
Q.CODE : C922
Answer Question No.1 which is compulsory and any five from the rest.
The figures in the right hand margin indicate marks.
Answer all parts of a question at a place.

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

a) In a two slit interference with monochromatic light, fringes are obtained on a screen placed at same distance from the slits. If the screen is moved by 5×10^{-2} m towards the slits, the change in fringe width is 3×10^{-5} m. If the distance between the slit is 10^{-3} m, calculate the wavelength of light used.

b) When two displacements represented by $y_1 = asin\omega t$ and $y_2 = bcos\omega t$ are superimposed the motion is
(i) Not a simple harmonic
(ii) Simple harmonic with amplitude $\frac{a}{b}$
(iii) Simple harmonic with amplitude $\frac{b}{a}$
(iv) Simple harmonic with amplitude $\sqrt{a^2+b^2}$

c) The equation of motion of a point particle of mass 0.1 kg executing SHM is given by$y = 0.1sin\left(4t+\frac{\pi}{4}\right)$; where 'y' is in meter and 't' is in second. Find the kinetic energy of the particle when it passes through the mean position.

d) If on rotating the analyzer the emergent light does not change in intensity ,then it is:
(i) either plane polarized or partially polarized;
(ii) either unpolarised or circularly polarized;
(iii) either partially polarized or elliptically polarized;
(iv) only circularly polarized.

e) The de-Broglie wavelength associated with a neutron is 1.4×10^{-10} m whose mass is 1.675×10^{-27} kg. Estimate the kinetic energy.

f) Calculate the minimum uncertainty in the velocity of an electron confined to a box of 10^{-8} m length. ($m_e = 9.1\times10^{-31}\ kg, \hbar = 1.05\times10^{-34}\ Js$)

g) Differentiate between interference and diffraction.

h) A particle is limited to the x-axis has the wave function $\phi(x) = bx^2$ between x = 0 and x = 2; the wave function $\phi(x) = 0$ elsewhere, Find the probability that the particle can be found between x = 1.0 and x = 1.5.

i) What is the physical significance of $\nabla . B = 0$; where B is the magnetic field.

j) State Gauss divergence theorem and write the mathematical form.

Q2 **a)** Write down the equation of motion for a damped harmonic oscillator of mass 'm' and obtain its solution in different condition. **(7)**

b) In a forced oscillation, if ω_0 is the natural frequency and ω is the forced frequency of oscillation, draw Amplitude-Frequency response graph for zero damping, low damping and high damping in a single plot. **(3)**

Q3 **a)** What is double refraction? Distinguish between ordinary ray and extraordinary ray. **(5)**

b) What is Fresnel's Biprism. With proper schematic diagram suggest a method to determine the wavelength of monochromatic light source. **(5)**

Q4 **a)** Write down the Maxwell's equations both in differential and integral form. **(5)**

b) Find the magnetic field B of the electromagnetic wave in free space if the components of the electric fields are $E_x = E_y = 0$and $E_z = E_0 cos kx sin \omega t$. **(5)**

Q5 **a)** What is plane diffraction grating? With necessary theory, explain how to determine the wavelength of a monochromatic light using plane diffraction grating. **(7)**

b) Find the directional derivative of $\phi = x^2yz + 2xz^2$ at (1, -1, -1). **(3)**

Q6 **a)** Explain the uncertainty principle. Taking typical size of the nucleus to be 2×10^{-14} m, show that electron cannot exist inside the nucleus. ($m_e = 9.1 \times 10^{-31}\ kg, \hbar = 1.05 \times 10^{-34}\ Js$) **(6)**

b) Show that the expectation value of linear momentum for the wave function given by $\psi_n(x) = \begin{cases} A \sin\left(\frac{n\pi x}{a}\right) & 0 < x < a \\ 0 & otherwise \end{cases}$ is zero **(4)**

Q7 **a)** What is Nicol Prism? Discuss its principle and its use as a polarizer and analyzer. **(3)**

b) Derive pointing theorem and write its physical significance. **(5)**

c) A particle is in one-dimensional infinitely deep potential well of width L. Graphically show the probability density of the particle in the ground and first excited state. **(2)**

Q8 **Write short answer on any TWO :** **(5 x 2)**

a) Zone plate

b) Black body radiation spectrum

c) Displacement Current

d) Coupled Oscillation

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

Total Number of Pages : 03 **B.Tech.**
PAP2A101

2nd Semester Regular / Back Examination 2017-18
APPLIED PHYSICS
BRANCH: AEIE, AERO, AUTO, BIOMED, BIOTECH, CHEM, CIVIL, CSE, ECE, EEE, EIE, ELECTRICAL, ENV, ETC, FAT, IEE, IT, MANUFAC, MANUTECH, MECH, METTA, MINERAL, MINING, MME, PE, PLASTIC, PT, TEXTILE
Time : 3 Hours
Max Marks : 100
Q.CODE : C803
Answer Part-A which is compulsory and any four from Part-B.
The figures in the right hand margin indicate marks.
Answer all parts of a question at a place

Part – A (Answer all the questions)

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

a) The photoelectric effect signifies the ……..
(i) Wave nature of light
(ii) particle nature of light
(iii) both(i)&(ii)
(iv) none of these

b) Condition for obtaining minima in Fraunhofer diffraction patterns due to a single slit is ……
(i) $d\cos\theta = \frac{1}{\lambda}$
(ii) $d\sin\theta = \frac{1}{\lambda}$
(iii) $d\sin\theta = \pm m\lambda$
(iv) $d\sin\theta = \frac{1}{\pm m\lambda}$

c) In a Bi prism experiment, 5mm wide fringes are obtained on a screen placed 1.0m away from coherent sources using a light of wavelength 5000A0. The separation between the two coherent resources is
(i) 1.0mm (ii) 0.1mm (iii) 0.01mm (iv) 0.05mm

d) The de Broglie wave length of a particle of mass m and kinetic energy $E_k$is given by……
(i) λ=hc/$\sqrt{[E_k(E_k+2mc^2)]}$ (ii) λ=hc/$\sqrt{[2E_k(E_k+2mc^2]}$
(iii) λ=hc/$\sqrt{[E_k(E_k+mc^2)]}$ (iv) λ=hc/$\sqrt{[2E_k(E_k+2mc^2)]}$

e) For a simple cubic structure, packing fraction is ……
(i) 0.52 (ii) 0.74 (iii) 0.68 (iv) 0.51

f) The equation of continuity for charges explains
(i) Non-conservative nature of charge
(ii) conservation of charge for a static electric field
(iii) conservation of charge for a non-static electric field
(iv) non-destructive nature of charge

g) The wavelength of a HE-Ne LASER generating 3.147mW power is632.8 nm. When it is in operation, the number of photons emitted per minute is ……..
(i) 4.79×10^{14} (ii) 3.14×10^{-19} (iii) 0.5×10^{9} (iv) 6×10^{17}

h) A mathematical function can be considered as a quantum mechanical wave function if the probability density is
(i) positive and finite
(ii) negative and finite
(iii) positive and infinite
(iv) finite and either positive or negative

i) In a Compton scattering process, the wavelength of the incident beam changes from .5 nm to …… when scattered at an angle 45^0.
(i) 1.49nm (ii) 0.78nm (iii) 0.5nm (iv) none of these

j) For a high damping factor, the resonance ……..
(i) is very high
(ii) is unaffected
(iii) is flatter
(iv) varies linearly

Q2 **Answer the following questions:** **(2 x 10)**

a) Graphically show the variation of phase difference between the oscillator and driving force with frequency for two representative damping forces.

b) State de Alembert's principle.

c) The photoelectric threshold of tungsten is $2300A^0$.Determine the energy of the electron ejected from the surface by ultraviolet light of wavelength $1800A^0$.

d) Write two applications of LASER.

e) The refractive indices of for core and cladding for a step index fibre are 1.52 and 1.41 respectively. Calculate the numerical aperture of the fibre.

f) Write in SI unit system, the integral and differential forms of Gauss' law in electrostatics in a dielectric medium.

g) The wave function of a system is a linear combination of the eigen function $\varphi_1, \varphi_2, \varphi_3, \varphi_4 \; and \; \varphi_5$

$$= \frac{1}{\sqrt{3}}\varphi_1 + \frac{1}{\sqrt{3}}\varphi_2 + \frac{1}{\sqrt{6}}\varphi_3 + \frac{1}{\sqrt{24}}\varphi_4 + \frac{1}{\sqrt{8}}\varphi_5$$

h) A parallel plate capacitor having circular plates of radius 5.5 cm is being charged. Calculate the displacement current if the rate of change of electric field between the plates is $1.5x10^{10}$ V/m.s.

i) Mass of proton is approximately 1840 times of the mass of an electron. Calculate the ratio of the de Broglie wavelengths of electron and proton if both the particles move with same velocity.

j) State and explain Heisenberg's uncertainty principle.

Part – B (Answer any four questions)

Q3 **a)** What are normal coordinates? Set up the differential equations of motion of two pendulums of equal masses coupled together by a spring and hence find out the normal mode frequencies. Discuss the in phase mode and out of phase mode of oscillations. **(10)**

b) Apply Lagrange's equation of motion to obtain the differential equation for a one dimensional harmonic oscillator. **(5)**

Q4 **a)** Derive an expression for fringe spacing in a two source interference pattern. **(5)**

b) With neat diagrams, explain in detail, the determination of wavelength of light using Fresnel's Biprism. **(7)**

c) The diameter of the central zone of a zone plate is 2.3mm. If a point source of light of wavelength $\lambda = 5893\, A^0$ is placed at a distance of 6.0m from the zone plate, calculate the position of the first image. **(3)**

Q5 **a)** What is band theory of solids?Discuss the classification of materials on the basis of band theory of solids. **(8)**

b) State and explain Bragg's law. **(3)**

c) X-ray of wavelength $1.4\, A^0$ is found to be Bragg reflected from (111) plane of an fcc crystal structure. If the lattice parameter of the crystal is $5A^0$, find the angle at which the X-ray is incident on the (111) plane of the crystal. **(4)**

Q6 **a)** What does LASER stand for? Describe in detail, the components, principle of operation and working of a Ruby LASER. **(10)**

b) Write five differences between step-index and graded-index optical fibers. **(5)**

Q7 **a)** Define curl of a vector field. Write its physical significance. **(7)**

Find the curl of the vector field is given by $\vec{A} = -\frac{2z^2y}{x^3}\hat{\imath} + \frac{z^2}{x^2}\hat{\jmath} + \frac{2yz}{x^2}\hat{k}$.

b) State Ampere's circuital law. Write the integral and differential forms of Ampere's law in free space in SI unit. **(4)**

c) Distinguish between real current and displacement current. **(4)**

Q8 **a)** Derive the condition for obtaining minima and maxima for the diffraction pattern due to a single slit. **(6)**

b) Calculate the probability of finding a particle in the region $2 \leq x \leq 4$, if the wavefunction for the particle is given by $\psi = 0.25e^{2ix}$. **(4)**

c) Using the uncertainty principle derive the ground state energy of harmonic oscillator. **(5)**

Q9 **a)** With a neat labeled diagram, describe the construction of Michelson interferometer. **(5)**

b) What are Miller indices? Explain the steps to find out these indices of a crystal plane from the intercepts made by this plane along the three axes. **(4)**

c) What is expectation value of an observable? A particle is observed to have five quantum mechanical states $\psi_1, \psi_2, \psi_3, \psi_4$ and $\psi_5$with relative probabilities 0.2, 0.1, 0.3, 0.2 and 0.2 respectively. If the corresponding energy eigen values for these states are 2 eV, 3eV, 3 eV, 1eV, 1 eV then calculate the energy expectation value. **(3)**

d) Write some of the advantages of optical fibers over conventional wires. **(3)**

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Total Number of Pages : 01 **B.Tech**
BS1102

2nd Semester Back Examination 2018-19
PHYSICS-I
BRANCH : AEIE, CIVIL, CSE, ECE, EEE, ELECTRICAL, ETC, IT, MECH
Time : 3 Hours
Max Marks : 70
Q.CODE : F082

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) Define time period, frequency and amplitude of an oscillator.
b) What is the principle of superposition?
c) State the relation between path difference and phase difference.
d) Write down difference between Fresnel and Fraunhoffer diffraction.
e) What is a quarter wave plate?
f) Evaluate curl of a position vector.
g) State Maxwell's equations in a medium having no charge and no current.
h) State Heisenberg's Uncertainty Principle?
i) What is Photoelectric effect?
j) X-Rays of wave length 1Å undergoes Compton scattering through 90^0. Find the Compton Shift.

Q2 a) Establish the differential equation of a damped harmonic oscillator subject to damping force proportional to velocity. **(5)**
b) Define coupled Oscillation. Formulate the differential equation for the coupled Oscillation and establish the normal mode equations. **(5)**

Q3 a) Derive the expression for fringe width in Bi-prism arrangement. **(5)**
b) Mention the similarities and difference between a converging lens and a zone plate. **(5)**

Q4 a) What are Fresnel's half period zones? Explain the factors on which the intensity at a point due to Fresnel's half period zones depend? **(5)**
b) Discuss the Fraunhofer diffraction due to a single slit. Find condition of Principal maximum and minimum. **(5)**

Q5 a) What in meant by polarization of light. How polarization is produced by reflection. State Brewster's law. **(5)**
b) With neat diagram, explain the construction and working of a Nicol Prism. **(5)**

Q6 Write the integral form of the Ampere's circuital law.Obtain the differential form of the Ampere's circuital law. Write down the distinction between current and current density. **(10)**

Q7 Derive the time independent and time dependent Schrodinger's equation for 3-dimensional system and hence find out the energy of a free particle? **(10)**

Q8 **Write short answer on any TWO :** **(5 x 2)**

a) Newton's Ring
b) Zone plate
c) Poynting theorem

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

Total Number of Pages : 02

B.Tceh
15BS1102

2nd Semester Back Examination 2018-19
PHYSICS
BRANCH : AUTO, CHEM, CIVIL, CSE, ECE, EEE, ELECTRICAL, ETC, FAT, IEE, IT, MECH, MME, PE
Max Marks : 100
Time: 3 Hours
Q.CODE : F529

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 oscillatory motion? Mention the characteristics of this type of motion.
b) What is interference? Can longitudinal waves exhibits interference?
c) What is the condition for the destructive interference in terms of phase difference between the two interfering waves?
d) Distinguish between a zone plate and a convex lens.
e) What is polarization of light?
f) What is double refraction? Name two crystals which exhibit double refraction.
g) Define gradient of a scalar field. Is it a vector or a scalar?
h) Evaluate curl A, where A = ixy + jyz + kxz.
i) What is Compton effect? Write expression for Compton shift.
j) State de-Broglie hypothesis for matter wave.

Part- II

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

a) Setup the differential equation for a one-dimensional simple harmonic oscillator. Write the general solution. Show that the total energy of the oscillator is constant in time.
b) What is wave motion? Distinguish between wave velocity and group velocity.
c) Show analytically that circular fringes are produced in Young's two source arrangement if the screen is placed longitudinally with respect to the two sources.
d) Describe the construction of a biprism. Describe the experimental arrangement for determination of wavelength of monochromatic light using biprism.
e) Show that the Fresnel's half period zones have the same area.
f) What is zone plate? Show that is has multiple focii.
g) What is half wave plate? Why is it so named? Can it be used as half plate for all colors of light?Explain.
h) Give the construction of Nicol prism. Explain how it produces polarized light.
i) Distinguish between conduction current and displacement current.
j) A vector field is given by A = i2xy + j x^2y + kxyz. Find the divergence and curl of the vector at the point (1, 1, -1).
k) What is the expectation value? A particle moving along x-axis has the wave function,

$$\psi(x) = bx \text{ between } x=0 \text{ and } x=1$$
$$= 0 \text{ elsewhere}$$

Find the expectation value $\langle x \rangle$ of the particles position.

l) The wave function for certain particle is given as $\psi = Cos^2 x$ for $-\frac{\pi}{2} < x < \frac{\pi}{2}$.

Normalise the wave function in the given range.

Part-III

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

Q3 Setup the differential equation for a one-dimensional oscillator, subjected to a damping force proportional to velocity and an external periodic force. Derive the condition of resonance. How does the maximum amplitude at resonance depend on the damping constant? **(16)**

Q4 What is diffraction? Differentiate between Fresnel and Fraunhofer type of diffraction. Find the condition for the principal maximum and secondary maximum in the single slit diffraction pattern. **(16)**

Q5 Derive the Maxwell's electromagnetic equations in differential form in a medium in the presence of charge and currents. Identify and state the laws of electromagnetism with which these equations are associated. **(16)**

Q6 Derive the time independent and time dependent Schrodinger's equation for one dimensional system and hence find out the energy of a free particle? **(16)**

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Total Number of Pages : 02 B.Tech

RPH2A001

2nd Semester Regular Examination 2018-19

PHYSICS

BRANCH : AG, AUTO, BIOTECH, CHEM, CIVIL, CSE, ECE, EEE, ELECTRICAL, ENV, ETC, IT, MECH, MME, PE

Max Marks : 100

Time : 3 Hours

Q.CODE : F530

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 sharpness of resonance? What is the phase difference between the velocity and the driving force of a driven oscillator at resonance?
b) Define Q – factor of an oscillator. How does it depend on damping?
c) What difference between interference fringes and diffraction fringes?
d) How do the focal lengths of a zone plate depend on wavelength?
e) Explain the meaning of metastable state.
f) Mention the similarities and differences between unit cell and primitive cell.
g) State Maxwell's equations in a medium having no charge and no current.
h) If $\phi = 3x^2y - y^3x^2$, Calculate grad ϕ at the point (1, -2, -1).
i) What is the difference between Compton effect and Photoelectric effect?
j) Calculate the de-Broglie wave length associated with an electron at rest mass 9.1×10^{-31}kg accelerated on a potential of 100V.

Part- II

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

a) Distinguish between the progressive and stationary waves.
b) Setup the differential equation for a one-dimensional simple harmonic oscillator. Show that the total energy of the oscillator is constant in time.
c) Define coupled Oscillation. Formulate the differential equation for the coupled Oscillation and establish the normal mode equations.
d) Find an expression for the diameter of the nth ring in Newton's ring experiment?
e) Discuss the Fraunhofer diffraction due to a single slit. Find condition of Principal maximum and minimum.
f) Explain the difference between spontaneous emission and stimulated emission.
g) Show diagrammatically and differentiate the valence and conduction bands for insulators, conductors and semiconductors.
h) Prove that the curl of gradient of a scalar field is zero and divergence of curl of a vector field is zero.
i) Show that $\vec{\nabla} A(r) = \hat{r}\frac{\partial A}{\partial r}$, where $\hat{r}$ is an unit vector along the position vector $\vec{r}$.
j) State Heisenberg's uncertainty principle. Show that an electron cannot be the constituent of an atomic nucleus.

k) The normalised wave function of certain particle is $\psi(x)=\sqrt{\frac{3}{\pi}}Cosx$ where $-\frac{\pi}{2}<x<\frac{\pi}{2}$. Derive an expression for the expectation value of particle's momentum.

l) The wave function for certain particle is given as $\psi = Cos^2 x$ for $-\frac{\pi}{2}<x<\frac{\pi}{2}$. Obtain the normalised the wave function in the given range.

Part-III

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

Q3 A damped oscillator is subjected to a damping force proportional to its velocity. Setup the differential equation of the oscillator. Discuss the under-damped, over-damped and critically damped motion of the oscillator. **(16)**

Q4 Explain the working mechanism of a He – Ne laser. What is the meaning of resonance transfer in He – Ne laser? What are the advantages and limitations of a He – Ne laser? **(16)**

Q5 Write Maxwell's electromagnetic equations in integral and differential form. From Maxwell's electromagnetic equation in a medium, obtain the electromagnetic wave equations for electric field and magnetic field. **(16)**

Q6 A beam of monoenergetic particles is incident on a one-dimensional potential barrier. Show that the spacing between consecutive energy levels increases for higher energy values. How does the actual behavior of the particles differ from the predictions of classical physics? **(16)**