SLR-IP – 443

Seat No.	

M.Sc. (Part – I) (Semester – I) Examination, 2015
PHYSICS (Appl. Elect.) (New)
(Paper – I)
Mathematical Techniques

Day and Date : Wednesday, 15-4-2015 Max. Marks : 70
Time : 11.00 a.m. to 2.00 p.m.

Instructions : *1) Q. No.* ***1*** *and Q. No.* ***2*** *are* ***compulsory****.*
2) Answer ***any three*** *questions from Q. No.* ***3*** *to Q. No.* ***7****.*
3) Use of Non programable calculator is ***allowed****.*
4) ***All*** *questions carry* ***equal*** *marks.*

1. a) Choose the correct alternative : **6**

i) The value of the $\int_c \frac{dz}{z+2} c : |z| = 1$ is

A) $2\pi i$ B) $-2\pi i$ C) $4\pi i$ D) 0

ii) Both real and imaginary parts of an analytic functions are

A) Harmonic B) Non-Harmonic
C) Homomorphic D) Continuous

iii) The eigen values of the matrix $\begin{pmatrix} 4 & 0 & 0 \\ 0 & 3 & 0 \\ 0 & 0 & 1 \end{pmatrix}^{-1}$ are

A) 4, 3,1 B) – 4, – 3, –1 C) 1/4, 1/3, 1 D) 4, 3, 0

iv) The laplace inverse of $\frac{1}{s^2+4}$ is

A) cos 2t B) $\frac{1}{2}$ cos 2t C) sin 2t D) $\frac{1}{2}$ sin 2t

v) The Fourier Transform of $e^{-x^2/2}$ is

A) $e^{s^2/2}$ B) $e^{-s/2}$ C) $e^{s/2}$ D) $e^{-s^2/2}$

vi) The Fourier series of x^2 in $(-\pi, \pi)$ will involve _____ terms.

A) only cosine terms
B) constants
C) both sine and cosine terms
D) only sine terms

b) State **true** of **false**.

i) The value of $f'(z)$ for an analytic function f (z) = u + iv is $u_x + iv_x$. **8**

ii) If f (z) is analytic function and on the closed curve C, if a is any point within C, the $\frac{1}{2\pi i}\int_C \frac{f(z)dz}{z-a} = f(a)$.

iii) Eigen vectors of the matrix are linearly dependent.

iv) The Laplace transform is possible only for t > 0.

v) The Fourier Integral of f (x) is possible only if it satisfy Dirichlet's conditions in each finite interval $(-l, l)$ and it is integrable in $(-\infty, \infty)$.

vi) If a, b, c, are the eigen values corresponding to the matrix A, then the eigen values corresponding to A^n will be a, b, c.

vii) A transformation is said to be linear if it satisfy T (c.x + d.y) = c.T (x) + d. T(y), where c, d are constants.

viii) Fourier series of the function f(x) is defined only if it satisfy Dirichlet's conditions.

2. Write short notes on :

a) Write a note on Vector Spaces. **5**

b) Define Cosine Integral and Sine Integral of the function f (x). **4**

c) Find Laplace Transform of $\frac{e^{-t}\sin at}{t}$. **5**

3. a) Use Cauchy Integral formula to evaluate $\int_C \frac{3z^2 + z}{z^2 - 1} dz$ where C is the circle $|z-1| = 1$. **8**

   b) Find the eigen values and eigen vectors corresponding to smallest eigen value $\begin{pmatrix} 1 & 0 & -1 \\ 1 & 2 & 1 \\ 2 & 2 & 3 \end{pmatrix}$. **6**

4. a) Solve $(D^2 - 5D + 6)\, y = \sin 3x$. **8**

   b) Find half range Cosine series of $f(x) = x$ in $[0, 2]$. **6**

5. a) Find the Laplace transform of $\int_0^t ue^{-4u} \sin 5u\, du$. **8**

   b) Show that real and imaginary parts of function $w = \log z$ satisfy the Cauchy Riemann equations when z is not zero. **6**

6. a) $(x^2 D^3 - 3xD + 5)\, y = \sin(\log x)$. **8**

   b) Examine vectors for Linear dependence

   $[1, -1, 0], [2, -1, -2], [1, -1, -2]$. **6**

7. a) Find Fourier series of $f(x) = a^2 - x^2$ in $[-a, a]$. **8**

   b) Find Inverse Laplace transform of $\frac{2s^2 - 4}{(s+1)(s-2)(s-3)}$. **6**

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Seat No.	

M.Sc. (Part – I) (Semester – I) Examination, 2015
APPLIED ELECTRONIC (PHYSICS)
(Paper – II) (New)
Condensed Matter Physics

Day and Date : Friday, 17-4-2015 Total Marks : 70
Time : 11.00 a.m. to 2.00 p.m.

Instructions : *1) Attempt **five** questions.*
*2) Q. **(1)** and Q. **(2)** are **compulsory**.*
*3) Attempt **any three** from Q.**3** to Q.**7**.*
*4) Figures to the **right** indicate **full** marks.*
*5) **Use** of non scientific calculator is **allowed**.*

1. A) Select correct alternative. **8**

1) Number of atoms present in unit area of (0 1 0) plane of simple cubic crystal are

a) $1/2r^2$ b) $1/6r$ c) $1/4r^2$ d) $1/8r$

2) Diffraction of crystal is possible only when

a) $n\lambda > 2d$ b) $n\lambda < 2d$

c) $n\lambda \leq 2d$ d) $n\lambda \geq 2d$

3) Width of energy gap of superconductor at 0 K is

a) 0 b) $3.5\ K_B Tc$

c) $K_B Tc$ d) 3.5

4) Specific heat of superconductor shows abrupt change at the temperature T =

a) 0 b) $<T_c$ c) $>T_c$ d) $= Tc$

5) Critical current (I) decreases linearly with increase of applied magnetic field is _____ rule.

a) Weiss's b) Silsbee's

c) Lorentz d) Hunt's

P.T.O.

6) Penetration depth (λ) is the value of 'x' for which flux density reduces to _____ of its original value.

a) 1/e b) infinite c) o d) e

7) If the ratio of average dipole energy to average thermal energy is _____ then polarization is said to be effective

a) 1 b) <1 c) >1 d) –1

8) Fermi level in case of n-type semiconductor lies at

a) $E_F = \frac{E_C + E_D}{2}$ b) $E_F = \frac{E_C - E_D}{2}$

c) $= \frac{E_V - E_D}{2}$ d) $E_F = \frac{E_V + E_D}{2}$

B) State **true** or **false**. **6**

1) Semiconductor have positive temperature coefficient of resistance.

2) At Curie temperature materials shows normal to superconducting state.

3) Simple cubic unit cell having atomic radius r = a/2.

4) FCC structure contains the contribution of six atoms.

5) Extrinsic semiconductor contains equal number of holes and electrons.

6) The reverse saturation current in silicon diode is nearly 1 nA.

2. Attempt following. **14**

1) Orientational polarization **5**

2) Absence of fivefold symmetry **5**

3) Cooper pair **4**

3. a) What is superconductor ? Discuss London theory in detail. **10**

b) Explain Meissner's effect. **4**

4. a) What is dielectric polarization ? Give the expression for electronic polarizability. **10**

   b) Calculate the electronic polarizability of an isolated Se atom.

   The atomic radius of Se atom is 0.12 nm. **4**

5. a) Derive rectifier equation. **10**

   b) Write the relation for Fermi level in n-type semiconductor. **4**

6. a) Write in detail about calculation of energy gap in intrinsic semiconductor. **10**

   b) Calculate critical current (I_c) flowing through long superconducting wire of diameter 10^{-3} m in the absence of applied field. Given Hc = 7.9×10^3 A/m. **4**

7. a) Explain the behaviour of free electron in periodic potential. **8**

   b) Write about the formation of number of possible states in a band. **6**

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Seat No.	

M.Sc. (Part – I) (Semester – I) Examination, 2015
PHYSICS (Applied Electronics) (New)
Analog and Digital Electronics (Paper – III)

Day and Date : Monday, 20-4-2015 Total Marks : 70
Time : 11.00 a.m. to 2.00 p.m.

Instructions *: 1) Q.* ***1*** *and* ***2*** *are* ***compulsory****.*
2) Answer ***any three*** *questions from Q.* ***3*** *to Q.* ***7****.*
3) ***All*** *questions carry* ***equal*** *marks.*

1. Objective questions : **14**

a) Select correct alternatives : **6**

1) An ideal op-amp has

a) Infinite output impedance b) Infinite band width

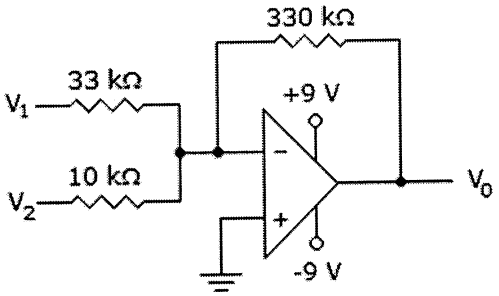
c) Zero input impedance d) All of the above

2) Another name of the unity gain amplifier is

a) Differential amplifier b) Non-inverting amplifier

c) Comparator d) Voltage follower

3) Calculate the output voltage of the following circuit if $V_1 = -0.2$ V and $V_2 = 0$V.



a) 0 V b) – 6.6 V

c) – 4 V d) 2 V

P.T.O.

4) How many Flip-Flops are required for mod – 16 counter ?

a) 5 b) 6

c) 3 d) 4

5) The device which changes from serial data to parallel data is

a) Counter b) Multiplexer

c) Demultiplexer d) Flip-flop

6) Addressing in which the instructions contains the address of the data to the operated on is known as

a) Immediate addressing b) Implied addressing

c) Register addressing d) Direct addressing

b) State **true** or **false**/Justify/**one** line answer : **8**

1) The gain of the non-inverting amplifier is _____

2) An astable multivibrator is also known as a _____

3) What is the resonant frequency equation of Wien bridge oscillator ?

4) The circuit for a DEMUX is basically the same as for a decoder, provided the decoder has an enable input.

5) The memory used in synchronous sequential circuits are flip-flops.

6) Design NOT gate using 1×2 demux ?

7) Program counter is a _____ bit register.

8) Trap is a maskable interrupt.

2. Write short notes on : **14**

a) Instrumentation Amplifier. **5**

b) Wein bridge oscillator. **5**

c) Multiplication program for two 8-bit numbers in 8085 μp. **4**

3. a) Using inverting configuration of an op-amp, explain i) summing amplifier ii) scaling amplifier and iii) averaging amplifier. **10**

b) Write down the circuit diagram for constant current bias. **4**

4. a) Explain in detail about voltage regulators with neat sketches. **8**

   b) Write a brief note on Astable Multivibrator. **6**

5. a) State Demorgan Theorems with examples. **8**

   b) Explain about the Working of RS flip-flop. **6**

6. a) What do you mean by flip-flops ? Describe the edge triggered flip-flops. Convert SR flip-flops into JK flip-flops. **8**

   b) Draw and explain the working of 4-bit up and down synchronous counter. Also describe the working of shift register. **6**

7. a) Explain in detail about the Architectural features of 8085 microprocessor with the help of neat diagrams. **8**

   b) What is an addressing mode ? Write about the addressing modes of 8085 microprocessor with examples. **6**

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Seat No.	

M.Sc. (Part – I) (Semester – I) Examination, 2015
PHYSICS (Applied Electronics)
Paper No. – IV : Classical Mechanics (New)

Day and Date : Wednesday, 22-4-2015 Total Marks : 70
Time : 11.00 a.m. to 2.00 p.m.

Instructions : *1) Q. (**1**) and (**2**) are **compulsory**.*
*2) Answer **any three** questions from Q. **3** to Q. **7**.*
*3) **All** questions carry **equal** marks.*

1. Objective questions : **14**

a) Choose correct alternative : **8**

1) A bead is constrained to slide on a frictionless rod that is fixed at an angle θ with a vertical axis and is rotating with angular frequency ω about the axis. Taking the distance s along the rod as a variable, the Lagrangian for the bead is equal to

a) $\frac{1}{2}m\dot{s}^2 - mgs\cos\theta$

b) $\frac{1}{2}m\dot{s}^2 + \frac{1}{2}m\,(\omega s\cos\theta)^2 + mgs\cos\theta$

c) $\frac{1}{2}m\dot{s}^2 + mgs\cos\theta$

d) $\frac{1}{2}m\dot{s}^2 + \frac{1}{2}m\,(\omega s\sin\theta)^2 - mgs\cos\theta$

2) A particle of mass m moves in a 1 – D potential $V(x) = -ax^2 + bx^4$, where a and b are positive constants. The angular frequency of small oscillations about the minima of the potential is equal to

a) $\pi\,(a/m)^{1/2}$ b) $(a/mb)^{1/2}$

c) $2\,(a/m)^{1/2}$ d) $(a/2m)^{1/2}$

P.T.O.

3) The curvature of Mars is such that its surface drops a vertical distance of 2.0 m for every 3600 m tangent to the surface. In addition, the gravitational acceleration near its surface is 0.4 times that near the surface of earth. What is the speed of the golf ball would need to orbit Mars near the surface, ignoring the effects of air resistance ? (Radius of Mars ~ 8×10^6 m).

a) 0.9 km/s
b) 1.8 km/s
c) 3.6 km/s
d) 4.5 km/s

4) A sphere of mass m is released from rest in a stationary viscous medium. In addition to the gravitational force of magnitude mg, the sphere experiences a retarding force of magnitude bv, where v is the speed of the sphere and b is a constant. Assume that the buoyant force is negligible. Which of the following statements about the sphere is true ?

a) Its KE decreases due to retarding force
b) Its KE increases to maximum and decreases to zero due to retarding force
c) Its speed increases monotonically, approaching a terminal speed that depends on b but not on m
d) Its speed increases monotonically, approaching a terminal speed that depends on both b and m

5) A man of mass m on an initially stationary boat gets off the boat by leaping to the left in an exactly horizontal direction. Immediately after the leap, the boat of mass M, is observed to be moving to the right at speed v. How much work did the man do during the leap (both on his body and on the boat) ?

a) $\frac{1}{2}Mv^2$
b) $\frac{1}{2}mv^2$
c) $\frac{1}{2}(m+M)v^2$
d) $\frac{1}{2}\left(M+\frac{M^2}{m}\right)v^2$

6) A particle of unit mass undergoes 1-D motion such that its velocity varies according to $v(x) = \beta x^{-n}$, where β and n are constant and x is the position of the particle. What is the acceleration of the particle as a function of x ?

a) $-n\beta^2 x^{-2n-1}$
b) $-n\beta^2 x^{-n-1}$
c) $-n\beta^2 x^{-n}$
d) zero

7) A ball is dropped from a height h. As it bounces off the floor, its speed is 80 % of what it was just before it hit the floor. The ball will then rise to a height of most nearly

a) 0.94 h b) 0.80 h

c) 0.75 h d) 0.64 h

8) The term monogenic indicates all forces are

a) generated from a single function (potential) and potential is an explit function of position coordinates only

b) generated from a single function (potential) and potential is an explit function of position and time coordinates

c) generated from a multiple function (potential) and potential is an explit function of position coordinates only

d) none of the above

b) **True** / **false** : **6**

1) Stationary value for a line integral mean that the integral along the given path has the same value to within 1^{st} order infinitesimals as that along all neighborings paths.

2) Number of Generalized coordinates are greater than number of degrees of freedom.

3) Poisson Bracket are invariant under canonical transformations.

4) Holonomic constraints cannot be expressed as an algebraic equation.

5) In any virtual displacement, the total work done by the forces of constraint vanish, unless of course the constraint is associated with frictional forces.

6) If the system is invariant under translation along a given direction then corresponding linear momentum is conserved.

2. Write short answer : **14**

a) Show that the Newton's laws are invariant under Galilean transformation. **5**

b) Explain the motion of Gyroscope. **5**

c) Show that the total linear momentum of the system as measured from centre of mass coordinate system is zero. **4**

3. a) Derive Lagrange's equation of motion for a partly conservative system. **10**

   b) What is Hamiltonian (H) ? Discuss. **4**

4. a) Obtain Euler – Lagrange differential equation. **8**

   b) Write a note on variational principle. **6**

5. a) What is Canonical transformations ? Explain in detail what conditions a transformation can satisfied to be called canonical transformation. **8**

   b) Show that $P = \frac{1}{2}\left(p^2 + q^2\right)$ and $Q = \tan^{-1} q/p$ is a canonical. **6**

6. a) State and explain Kepler's laws of planetary motion. Derive 2^{nd} Kepler's law. **8**

   b) Discuss principle of least action. **6**

7. a) Show that Poisson bracket are invariant under canonical transformations. **8**

   b) What are constraints ? State and explain all types of constraints with one example of each case. **6**

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Seat No.	

M.Sc. (Part – I) (Semester – I) Examination, 2015
PHYSICS (Applied Electronics)
Paper No. – I : Mathematical Techniques (Old)

Day and Date : Wednesday, 15-4-2015 Total Marks : 70

Time : 11.00 a.m. to 2.00 p.m.

Instructions *: 1) Question No.* ***1*** *and* ***2*** *are* ***compulsory****.*
2) Answer ***any three*** *questions from Question No.* ***3*** *to* ***7****.*
3) ***All*** *questions carry* ***equal*** *marks.*

1. A) Choose the most correct alternative : **6**

1) $xy'' - (2x-1)y' + (x-1)y = 0$ for this differential equation consider the statements (i) it is linear (ii) of second degree, then

a) only (i) is true

b) only (ii) is true

c) both (i) and (ii) are true

d) both (i) and (ii) are false

2) The trace of the matrix $A = \begin{bmatrix} 2 & 4 \\ 3 & 7 \end{bmatrix}$ is

a) -7 b) 9 c) 2 d) 14

3) The function $f(z) = \dfrac{z^2 - 3z + 4}{z - 3}$ has a simple pole at $Z =$ _____

a) ∞ b) 3 c) 1 d) 2

4) For a square matrix, conjugate transpose of which coincide with the matrix itself is called

a) Unitary b) Hermitian

c) Orthogonal d) Skew Hermitian

P.T.O.

5) For a function to have Fourier series expansion necessary conditions are
   a) f(x) and its integrals are finite
   b) f(x) and its integrals are single valued
   c) f(x) has discontinuities finite in nature and number
   d) all the above

6) Laplace Transform of the function f(t) = sinh2t is = _____

a) $\frac{s}{s^2+2}$ b) $\frac{2}{s^2+4}$ c) $\frac{2}{s^2-4}$ d) $\frac{s}{s^2-4}$

B) State **True** or **False** : **8**

1) The Laplace's transform of f(t) = t is $1/S^2$.
2) The Eigen values of Hermitian matrix are real.
3) Inverse Laplace Transform of $\frac{3}{(s-2)^2}$ is $\frac{1}{3}e^{-2t}t$.
4) $\begin{bmatrix} 3 & 9 \\ -2 & 6 \end{bmatrix}$ is a singular matrix.
5) $f(z) = \frac{\sin z}{z^4}$ has a pole of order 4 at z = 0.
6) $AA^T = I$ then A is said to be orthogonal.
7) The differential equation $(x^2 - 4xy - 2y^2)\,dx + (y^2 - 4xy - 2x^2)\,dy = 0$ is not an exact differential equation.
8) Term by term integration of a convergent Fourier series is not valid.

2. Attempt the following :

a) Show that $A = \begin{bmatrix} -3 & 2 \\ -2 & 1 \end{bmatrix}$ is not diagonalizable.

b) Define a pole. Find the pole and its order for $f(z) = \frac{\sin z}{z^4}$.

c) Define Laplace transform. Derive Laplace Transform of the functions (i) f(t) = e^{at} (ii) f(t) = sin at. **(5+5+4)**

3. a) Using Residue Theorem evaluate $\int_0^{2\pi} \frac{d\theta}{5+4\cos\theta}$.

   b) Find Eigen values and corresponding Eigen vectors for the matrix.

$$A = \begin{bmatrix} 3 & 4 & -6 \\ 4 & 3 & -6 \\ -6 & -6 & -14 \end{bmatrix}$$

(6+8)

4. a) Find a matrix S that diagonalizes $A = \begin{bmatrix} 3 & -2 & 0 \\ -2 & 3 & 0 \\ 0 & 0 & 5 \end{bmatrix}$.

   b) Solve :

   i) $\frac{d^2y}{dx^2} + 9y = x \sin x$

   ii) Find the solution of $\frac{d^2y}{dx^2} + y = 0$, satisfying y(0) = 1 and $y\left(\frac{\pi}{2}\right) = 2$. **(8+6)**

5. a) Expand the function f(x) = sin x for $0 \le x \le \pi$.

   f(x) = – sin x for $-\pi \le x \le 0$ in Fourier series and draw the waveform.

   b) Find the Fourier transform F(K) of the Gaussian distribution function

   $f(t) = N e^{-at^2}$ where N and 'a' are constants. **(8+6)**

6. a) Obtain Laplace Transform of $\frac{d^2y}{dt^2} + 3\frac{dy}{dt} + 4y + 2\int_0^t y(t)\,dt$.

   b) Using Partial fractions find Inverse Laplace Transform of

   i) $\frac{21s - 33}{(s+1)(s-2)^3}$

   ii) Find Inverse Laplace transform of $\frac{2s+1}{s(s+1)}$. **(6+8)**

7. a) Express general form of first order ODE and solution y(t). What do you mean by boundary conditions ? Thus explain Euler's method to numerically solve the ODE.

   b) Classify the singularities and calculate residue for $f(z) = \frac{1}{z^2 - 1}$. **(10+4)**

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Seat No.	

M.Sc. (Part – I) (Semester – I) Examination, 2015
PHYSICS (Applied Electronics) (Old) (Paper – II)
Condensed Matter Physics

Day and Date : Friday, 17-4-2015 Total Marks : 70
Time : 11.00 a.m. to 2.00 p.m.

Instructions *: 1) Questions* ***1*** *and* ***2*** *are* ***compulsory****.*
2) Answer ***any three*** *questions from Q.* ***3*** *to Q.* ***7****.*
3) ***All*** *questions carry* ***equal*** *marks.*

1. a) Choose the correct alternative. **8**

1) The distribution of electrons in the conduction band is given by
   i) (density of quantum states) × (energy of a state)
   ii) (density of quantum states) × (probability a state is occupied)
   iii) (energy of quantum states) × (probability a state is occupied)
   iv) (energy of quantum states) × (chemical potential of a state)

2) A plane intercepts at (a, b/2, 3c) in a simple cubic unit cell. The Miller indices of the plane are
   i) [1 3 2] ii) [2 6 1]
   iii) [3 6 1] iv) [1 2 3]

3) A beam of X-ray of wavelength 0.25 nm is incident on a crystal of interplanar separation 0.30 nm. The glancing angle for first order diffraction is
   i) 24.6° ii) 36.0°
   iii) 56.4° iv) 54.8°

4) The nearest neighbour distance in the case of bcc structure is
   i) $\frac{a\sqrt{3}}{2}$ ii) $\frac{a}{\sqrt{2}}$
   iii) $\frac{2a}{\sqrt{3}}$ iv) $\sqrt{2}a$

P.T.O.

5) The order of magnitude of the energy gap of a typical superconductor is

i) 1 MeV ii) 1 KeV

iii) 1 eV iv) 1 meV

6) The equation of motion of each electron in the Fermi surface under the influence of a static electric field E is

i) $\hbar\frac{dK}{dt} = Ee$ ii) $\hbar\frac{dK}{dt} = \frac{E}{e}$

iii) $\hbar\frac{dK}{dt} = Ee^2$ iv) $\hbar\frac{dK}{dt} = \frac{e}{E}$

7) Meissner effect implies that in superconducting state, a material has a magnetic susceptibility equal to

i) $\chi = 0$ ii) $\chi = -1$

iii) $\chi = 1$ iv) $\chi = \infty$

8) A lattice is characterized by following primitive vectors $\vec{a} = 2(\hat{i} + \hat{j}), \vec{b} = 2(\vec{j} + \hat{k}), \vec{c} = 2(\hat{k} + \hat{i})$. The reciprocal lattice corresponding to this lattice is

i) bcc with cube edge π

ii) bcc with cube edge 2π

iii) fcc with cube edge π

iv) fcc with cube edge 2π

b) Fill in the gaps with appropriate word. **6**

i) For a given dielectric, the electronic polarizability (α_e) is _____ by temperature change.

ii) The depletion region in an open circuited p-n junction contains _____

iii) The width of the energy gap of a superconductor at 0 K is about _____

iv) The number of ions in the unit cell of CsCl crystal is _____

v) The Miller indices of the plane parallel to y and z axes are _____

vi) Relative permeability of a medium is the permeability relative to that of _____

2. a) Attempt **any two** of the followings : **8**
   i) Explain direct and indirect band gaps in semiconductors.
   ii) Show that the polarizability (α) of a conducting metallic sphere of radius 'a' is $\alpha = a^3$.
   iii) What is the dipole theory of Ferro electricity ?

   b) Attempt **any one** of the followings : **6**
   i) What is Meissner effect ? Obtain an expression for the London penetration depth of magnetic field for a superconductor.
   ii) A magnetic material has a magnetization of 3300 A/m and flux density of 0.0044 Wb/m^2. Calculate the magnetizing force and the relative permeability of a material.

3. a) Write short notes on the followings : **8**
   i) Reciprocal lattice
   ii) Metal-semiconductor contacts.

   b) What are intrinsic and extrinsic semiconductors ? Discuss the location of Fermi levels under suitable limiting conditions and give the necessary theory. **6**

4. a) Explain electronic polarization in atoms and obtain an expression for electronic polarizability in terms of the radius of atom. **8**

   b) Explain qualitatively how p-n junction functions as a rectifier. **6**

5. a) Derive the susceptibility expression for ferromagnetic material. **8**

   b) Write a note on ionic polarizability. **6**

6. a) What is effective mass ? Give the expression for the effective mass of an electron. **8**

   b) In an n-type semiconductor, the Fermi level lies 0.3 eV below the conduction band at 300 K. If the temperature is increased to 330 K, find the new position of the Fermi level. **6**

7. a) Explain Type I and Type II superconductors. **6**

   b) Briefly explain the BCS theory of superconductivity and describe one experimental evidence for the existence of energy gap. **8**

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Seat No.	

M.Sc. (Part – I) (Semester – I) Examination, 2015
PHYSICS (Applied Electronics) (Paper – III)
Analog and Digital Electronics (Old)

Day and Date : Monday, 20-4-2015 Total Marks : 70

Time : 11.00 a.m. to 2.00 p.m.

Instructions *: 1) Q.* ***(1)*** *and* ***(2)*** *are* ***compulsory****.*
2) Attempt ***any three*** *from Q.* ***3*** *to Q.* ***7****.*
3) Figures to the ***right*** *indicate* ***full*** *marks.*

1. a) Select correct alternatives : **(14)**

1) A differentiator has _____ in the input terminal, for an opamp based circuit. **8**

a) Capacitor b) Inductor
c) Resistance d) None of these

2) Multiplexer means _____

a) Many I/P's into one O/P b) One I/P into many O/P's
c) Both a and b d) None of these

3) IC 74150 is _____

a) 16:1 MUX b) 8:1 MUX
c) 1:16 DMUX d) 1:8 DMUX

4) _____ logic gate represents $Y = \overline{A + B}$ operation.

a) OR b) NOR c) AND d) NAND

5) The 4-bit adder circuit can be designed using one half adder and _____ full adder circuits.

a) 3 b) 4 c) 5 d) 7

6) _____ Oscillator circuit uses Inductive feedback.

a) Phase shift b) Wien bridge
c) Hartley d) Colpit

7) An Integrator has _____ in the input terminal, for an Opamp based circuit.
   a) Resistance b) Inductor
   c) Capacitor d) None of these

8) Output impedance of IC 741 is typically _____ Ω .
   a) 100 b) 1000 c) 10 d) 1

b) Fill in the blanks/State **true** or **False :** **6**

i) The number of flip flops required to design MOD 10 counter is _____

ii) In 8085, Opcode fetch cycle is _____ stated.

iii) SR flip flop does not accept the input entry when _____

iv) Colpit oscillator circuit uses tapped inductive feedback.

v) Output impedance of IC 741 is typically 10 Ω .

vi) In 8085, ALE signal is used to demultiplex address/data bus.

2. Attempt following : **(14)**

1) Addressing modes of 8085 microprocessor. **5**

2) Fixed voltage regulators. **5**

3) Opamp as an Integrator. **4**

3. a) Explain inverting configuration with 3-inputs can be used as a summing scaling or averaging amplifier. **8**

b) IC 741 Opamp configured in inverting mode with R_1 = 1k and R_F = 10K.

Find 1) Exact closed loop gain

2) Ideal closed loop gain. **6**

4. a) Draw and explain phase shift oscillator, obtain an expression for frequency of oscillation. **8**

b) Design a phase shift oscillator for f_0 = 1 KHz, using IC741.
(Supply voltage = $\pm$ 12V). **6**

5. a) Describe architecture of Intel 8085 microprocessor. **8**

   b) Explain demultiplexing of AD7-AD0 signals. **6**

6. a) What is shift register ? Draw and explain logic diagram of PISO shift register. **8**

   b) Draw and explain 8:1 multiplexer using AND gate. **6**

7. a) Write an ALP for addition of two 8 bit numbers using immediate addressing mode. **8**

   b) Reduce the following logical expressions using Boolean laws :

   $\left(A\overline{B} + AB\right)(\overline{A}BC + ABC)$. **6**

SLR-IP – 450

Seat No.	

M.Sc. (Part – I) (Semester – I) Examination, 2015
PHYSICS (Applied Electronics) (Paper – IV) (Old)
Classical Mechanics

Day and Date : Wednesday, 22-4-2015 Total Marks : 70
Time : 11.00 a.m. to 2.00 p.m.

Instructions *: 1) Q.* ***1*** *and Q.* ***2*** *are* ***compulsory****.*
2) Answer ***any three*** *questions from Q.* ***3*** *to Q.* ***7****.*
3) ***All*** *questions carry* ***equal*** *marks.*

1. A) Select correct alternative : **8**

1) Reduced mass is
   a) Smaller than sum of two masses
   b) Same as sum of two masses
   c) Greater than sum of two masses
   d) Square of sum of two masses

2) The force which is always directed away or towards a fixed center and magnitude of which is a function only of distance from the fixed center, known as
   a) Coriolis force b) Centripetal force
   c) Centrifugal force d) Central force

3) A particle moving in a central force located at r = 0 describes the spiral $r = e^{-\theta}$, the magnitude of force is inversely proportional to
   a) r b) r^2
   c) r^3 d) r^4

4) One a.u. is the average distance between the Sun and the Earth. Venus takes 225 (earth) days to go round the sun. Its average distance from the Sun is
   a) 1 a.u. b) 0.72 a.u.
   c) 0.27 a.u. d) 1.52 a.u.

P.T.O.

5) The cyclic co-ordinate in the following Lagrangian

$L = \frac{1}{2}m\left(\dot{r}^2 + r^3\dot{\theta}^2 + r^2\dot{\phi}^2 \sin^2\theta\right) - V(r)$ is _____

a) ϕ b) θ c) r d) $\dot{\theta}$

6) Central-force potential is

a) Cylindrically symmetric b) Spherically symmetric

c) Orthogonally symmetric d) Plane symmetric

7) A particle of mass m moves in a central force field defined by $\bar{F} = -k\bar{r}/r^4$, if E is the total energy supplied to the particle, then its speed is given by

a) $\sqrt{\frac{k}{mr^2} - \frac{2E}{m}}$ b) $\sqrt{\frac{k}{mr^2} + \frac{2E}{m}}$ c) $\sqrt[3]{\frac{k}{mr^2} + \frac{2E}{m}}$ d) $\sqrt[3]{\frac{k}{mr^2} - \frac{2E}{m}}$

8) The number of α-particles scattered must be proportional to

a) E b) E^2 c) E^{-1} d) E^{-2}

B) Fill in the blanks : **3**

1) If the certain coordinate is _____, it does not appear in Lagrangian and Hamiltonian.

2) The height of geostationary orbit of an artificial satellite from the surface of earth is _____ km.

3) Hamiltonian is a constant of motion if Lagrangian is not an explicit function of _____

C) State **true** or **false** : **3**

1) $\frac{\partial}{\partial t}[u, v] = \left[\frac{\partial u}{\partial t}, v\right]$

2) In Δ variation, $\frac{\partial t}{\partial \alpha} = 0$.

3) In a central force field motion for circular orbit $E < 0$ and $\in = 0$.

2. Attempt the following : **14**

a) Show that Hamiltonian $H = \sum_j p_j\dot{q}_j - L\left(q_j, \dot{q}_j, t\right)$.

b) Deduce an equation of motion for linear harmonic oscillator in one dimension.

c) Differentiate δ and Δ variations and derive expression for the relation between δ and Δ operations.

3. a) Develop the theory of scattering in central force field and hence discuss scattering of charged particle in Coloumb field. **10**

b) Derive the expression for transformation equations of Fourth form of generating function F ; $F_4(p_j, P_j, t)$. Also state the relation between old and new Hamiltonian in this case. **4**

4. a) State and prove principle of least action. **10**

b) Prove the following relations : **4**

i) $\dfrac{\partial q_j}{\partial Q_k} = \dfrac{\partial P_k}{\partial p_j}$

ii) $\dfrac{\partial q_j}{\partial P_k} = -\dfrac{\partial Q_k}{\partial p_j}$.

5. a) State and prove the illustrations of canonical transformations. **10**

b) Show that the generating function for the transformation $p = 1/Q$, $q = PQ^2$ is $F = q/Q$. **4**

6. a) Explain properties of Poisson brackets and write down Hamilton's canonical equations of motion in terms of Poisson brackets. **10**

b) Solve the Harmonic Oscillator problem by H-J Method. **4**

7. a) Explain constraints and generalized coordinates. What is D'Alembert's principle ? Obtain Lagrange's equations of motion from D'Alembert's principle. **10**

b) The transformation equations between two sets of coordinates are

$Q = \left(e^{-2q} - p^2\right)^{1/2}$

$P = \cos^{-1}(pe^q)$

Show that these transformations are canonical by Poisson Brackets method. **4**

SLR-IP – 452

Seat No.	

M.Sc. (Part – I) (Semester – II) Examination, 2015
PHYSICS (Applied Electronics)
Paper – VI : Quantum Mechanics (New)

Day and Date : Saturday, 18-4-2015 Max. Marks : 70
Time : 11.00 a.m. to 2.00 p.m.

Instructions *: 1) Q.* ***(1)*** *and Q* ***(2)*** *are* ***compulsory****.*
2) Attempt ***any three*** *questions from Q.* ***(3)*** *to Q.* ***(7)****.*
3) ***All*** *questions carry* ***equal*** *marks.*
4) Figures to the ***right*** *indicate marks.*

1. A) Choose the correct alternative : **14**

i) According to Schrödinger a particle is equivalent to a **6**

a) single wave b) light wave

c) wave packet d) sound wave

ii) The wave function of a particle in a box of length L is

$$\psi(x) = \sqrt{\frac{2}{L}} \sin\left(\frac{\pi x}{L}\right) \qquad 0 < x < L$$

$\psi(x) = 0$ for $x < 0$ and $x > L$.

The probability of finding it in the region $0 < x < \frac{L}{2}$ is

a) 0. 4% b) 0.3 % c) 0.2 % d) 0.5 %

iii) In case of a wave function $\psi = \frac{e^{ikr}}{r}$, the probability current density is

a) $\frac{v}{r^2}$ b) $\frac{v}{r}$ c) $\frac{v}{r^3}$ d) v

P.T.O.

iv) If proton and electron have same De-Broglie wavelength 2A° then
   a) both have same kinetic energy
   b) both have same velocity
   c) both have same momentum
   d) Kinetic energy of proton is more than K.E. of an electron

v) The degeneracy of hydrogen atom in state n = 3 is
   a) 3 b) 5 c) 6 d) 9

vi) A system is known to be in a state described by the wave function $\psi(\theta,\phi)=\frac{1}{\sqrt{30}}\left[5Y_4^0+Y_6^0+2Y_6^3\right]$ where, Y_l^m are the spherical Harmonics, the probability of finding the system in a state with m = 0 is

   a) 0 b) $\frac{2}{15}$ c) $\frac{1}{4}$ d) $\frac{13}{15}$

B) Write **true** or **false** : **4**

vii) The experimental proof of wave particle duality was given by Thompson.

viii) Hermitian operator has imaginary eigen values.

ix) The graph of a wave function against r for hydrogen for l = 0 state shows one maxima.

x) The experimental ground state energy of the Helium atom is (– 79.00 ev).

C) Fill in the blanks : **4**

xi) The M shell can accommodate _____ electrons.

xii) The selection rule for Harmonic oscillator is _____

xiii) The Bohr magneton is _____

xiv) ± 1 eigenvalues belong to an _____ operator.

2. Answer **any 3** in brief : **14**

a) Using proper operators derive ore dimensional Schrödinger equation.

b) If there exists a set of orthogonal functions ψ_i which are eigen functions of the operators A and B then prove that they commute.

c) Write the formula for Normalized wave function of Hydrogen for radial part and explain it.

d) Write a note on Hiesenberg's uncertainty principle.

3. a) Distinguish between Hermitian and unitary operators. **3**

   b) Discuss the problem of one dimensional box of width a comment on the graphs showing energy levels and corresponding eigen functions. **7**

   c) What are the factors which influence the wavelengths of different transitions in an energy spectrum of a box ? **4**

4. a) Discuss the Harmonic oscillator problem. Calculate the energy eigen value and normalized energy eigen functions. **10**

   b) Calculate first few Hermite polynomials upto H_3 and prove $H_3 = 2$ and $H_2 - 4 H_1$. **4**

5. a) Solve the radial wave equation for hydrogen like atom. **10**

   b) Obtain an expression for the probability density of 1s orbital. **4**

6. a) In many electron atoms how the electrons of larger 'l' values reduce the effective charge on the nucleus ? State Slater's rules and hence calculate the effective charge on Nitrogen nuclei. **10**

   b) Explain what is Plater determinant. **4**

7. a) Discuss the Hydrogen molecule ion problem using a proper Hamiltonian Normalized molecular orbitals. Calculate the H_{aa} and H_{ab} type integrals and calculate energies. **10**

   b) What are normalized wave functions ? Evaluate the ground state energy. **4**

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SLR-IP – 453

Seat No.	

M.Sc. – I (Semester – II) Examination, 2015
PHYSICS (Applied Electronics)
Paper – VII : Electrodynamics (New)

Day and Date : Tuesday, 21-4-2015 Total Marks : 70
Time : 11.00 a.m. to 2.00 p.m.

Instructions** : 1) Q. **(1)** and **(2)** are **compulsory.
*2) Answer **any three** questions from Q. **3** to Q. **7**.*
*3) **All** questions carry **equal** marks.*

1. Objectives. **14**

A) Choose correct alternative : **8**

1) Stationary charges produce only _____ field.
   a) Electrostatic b) Magnetostatic
   c) Both d) None of these

2) Incident and transmitted waves are always _____
   a) In phase b) Out of phase
   c) Out of path d) Depends on value of $\frac{n1}{n2}$

3) When wave gets reflected from the surface of denser medium there is a phase change of _____
   a) 0° b) 90° c) 180° d) 270°

4) Total outward flux of magnetic induction 'B' through any close surface 'S' is equal to _____
   a) One b) Infinite c) Φ d) Zero

5) The total power radiated is _____ of radius of sphere, which is according to law of conservation of_____
   a) Dependent , energy b) Independent, energy
   c) Dependent, momentum d) None of these

P.T.O.

6) Steady current produce_____ fields that are_____ in time.

a) Magnetic, constant
b) Magnetic, variable
c) Electric, constant
d) None of these

7) Potential function $2x^2 + 2y^2 + 2z$ satisfy_____

a) $\nabla^2\phi=0$
b) $\nabla^2\phi \neq 0$
c) $\nabla^2\phi=\rho/\varepsilon_0$
d) All of these

8) The total power radiated by an oscillating dipole is _____to the _____ power of frequency.

a) Proportional, fourth
b) Inversely proportional, fourth
c) Inversely proportional, third
d) proportional, third

B) **True / False :** **6**

1) In case of oblique incidence transmitted wave is always in phase with incident wave.
2) Magnetic vector potential due to magnetic dipole is proportional to r^{-3}.
3) Half wave antenna is a simply straight conductor.
4) Radiation resistance for half wave antenna is 73.2 ohms.
5) The speed which is significant proportion of the speed of light is called relativistic.
6) A plane wave scattered by an electron shows polarization and scattering.

2. Write the short notes **(any three)** : **14**

1) Wave equation in terms of electromagnetic potential.
2) Skin depth.
3) Terminology of sin wave
4) Polarization of EM wave.

3. a) Give the interaction between two current loops. **8**

   b) Give the expression for energy stored in electric and magnetic fields. **6**

4. a) Explain reflection and refraction of electromagnetic wave across the interface for the case of oblique incidence. **8**

   b) Give electromagnetic wave equation for the wave travelling through free space. **6**

5. a) Write the equations of linear quadrupole potential and field. **8**

   b) Write integral forms of Maxwell's equations. **6**

6. a) Write in detail Lienard-Wiechert potential. **8**

   b) Explain radiation damping. **6**

7. a) Explain radiation form an oscillating electric dipole. **8**

   b) Explain radiation form half wave antenna. **6**

SLR-IP – 454

Seat No.	

M.Sc. (Part – I) (Semester – II) Examination, 2015
PHYSICS (Applied Electronics) (New)
Paper – VIII : Microprocessor and Microcontrollers

Day and Date : Thursday, 23-4-2015 Max. Marks : 70
Time : 11.00 a.m. to 2.00 p.m.

Instructions *: 1) Attempt in* ***all five*** *questions.*
2) Q. ***1*** *and Q.* ***2*** *are* ***compulsory****.*
3) Attempt ***any three*** *questions from Q.* ***3*** *to Q.* ***7****.*
4) Figures to the ***right*** *indicate* ***full*** *marks.*

1. A) Choose correct alternative : **8**

i) The maximum addressable memory with 8086 microprocessor is
a) 1MB b) 5MB c) 10MB d) 500KB

ii) Bit size of program status word in 8051 microcontroller is
a) 8-bit b) 16-bit c) 1-bit d) 2-bit

iii) The total number of SFRs available in 8051 microcontroller is
a) 16 b) 20 c) 10 d) 15

iv) The accumulator size in 8086 microprocessor is
a) 8-bit b) 16-bit c) 20-bit d) 7-bit

v) If the memory chip size is 2048 × 8 bits, how many chips are required to make up 16K bytes memory ?
a) 8 b) 4 c) 10 d) 12

vi) The function of $\overline{WR}$ signal on the memory chip is
a) to write b) to read
c) read and write d) all of these

vii) What decides the bit size of a microprocessor ?
a) Data bus b) Address bus c) ALU d) Control bus

viii) Number of times INC AL instruction executed in the following loop is

```
    MOV AL, 00H
X : INC AL
    JNZ  X
```

a) 0 b) 1 c) 255 d) 256

P.T.O.

B) Fill in the blanks : **6**

i) READY pin of microprocessor is used _____

ii) Number of address lines required to address a memory of 32K is _____

iii) NMI is _____

iv) 8284 is _____

v) Microprocessor is defined as _____

vi) BP is used as pointer for _____

2. Attempt **any three** : **14**

a) Explain the role of DT/$\overline{R}$ and $\overline{DEN}$ pins of 8086 microprocessor.

b) Differentiate the minimum and maximum modes of 8086 microprocessor.

c) Explain the interrupt system of 8051 microcontroller.

d) Write a note on parallel ports of 8051 microcontroller.

3. A) With a neat diagram explain the architecture of 8086 microprocessor. **10**

B) Explain the logical instructions of 8086 microprocessor with examples. **4**

4. A) Why the memory in 8086 is organized into two banks ? With a neat diagram explain concept of the memory banks. **10**

B) Interface two 4KB of RAM to 8086 microprocessor in even and odd addresses. **4**

5. A) Describe the operation of on-chip timers of 8051 microcontroller in different modes. **10**

B) Write an ALP to initialize Timer-1 generate clock for serial port for 2400 baud rate. **4**

6. A) Describe the working of on-chip serial port of 8051 microcontroller in different modes. **10**

B) Write an ALP to transmit/receive the data from external system through on-chip serial port of 8051. **4**

7. A) Explain addressing modes of 8086 microprocessor with examples. **10**

B) Write an 8051 ALP to add two 16-bit numbers. **4**

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SLR-IP – 455

Seat No.	

M.Sc. (Part – I) (Semester – II) Examination, 2015
PHYSICS (Applied Electronics)
Paper – V : Statistical Mechanics (Old)

Day and Date : Thursday, 16-4-2015 Total Marks : 70
Time : 11.00 a.m. to 2.00 p.m.

Instructions *: 1) Attempt **five** questions.*
*2) Q. **1** and Q. **2** are **compulsory**.*
*3) Attempt **any three** from Q. **3** to Q. **7**.*
*4) Figure to **right** indicates **full** marks.*

1. A) Choose correct alternative : **8**

1) Boltzmann's limit of Bosons and Fermions is

a) $e^{\beta\mu} << 1$ b) $e^{\beta\mu} >> 1$ c) $e^{+\beta\mu} >> 1$ d) $e^{-\beta\mu} >> 1$

2) The total energy of the particle which is a constant of motion is given by

a) $E = P^2/m$ b) $E = P/2m$
c) $E = P^2/2 + 1/2\ Kq^2$ d) $P^2/2m + 1/2\ Kq^2$

3) 'μ' space for single particle is

a) Two dimensional b) Three dimensional
c) Six dimensional d) Dimension less

4) Louville's equation gives the rate of change in

a) Pressure b) Temperature c) Density d) Volume

5) Temperature at critical point is

a) 3b b) 8/27R c) 3b/27Rb d) 8a/27Rb

6) 'α' is related with chemical potential (μ) by the relation

a) kT/μ b) $-\mu/kT$ c) μ/β d) $\mu T/k$

7) Gibbs potential is given by the relation

a) $G = E - PV + TS$ b) $G = E + PV + TS$
c) $G = E - PV - TS$ d) $G = E + PV - TS$

8) At a critical point dp/dv =

a) 1 b) 0 c) ∞ d) –1

P.T.O.

B) State **true/false** : **6**

1) Clasius-Clapeyron equation gives rate of change of pressure along equilibrium curve.
2) Diffusion process is irreversible.
3) The point at which the vapour pressure curve abruptly terminates is called transition point.
4) The equation of reduced state requires the values of constants a and b.
5) Gibbs paradox is related to entropy change.
6) In micro canonical ensemble both energy and mass is conserved.

2. Attempt following : **14**
   a) Energy fluxuations in canonical ensemble
   b) Microstates and macrostates
   c) Law of corresponding states.

3. a) What is Gibbs paradox ? How it is resolved ? **10**
   b) Explain phase transition using PT diagram. **4**

4. a) Give the condition for ideal Bose gas. **10**
   b) Explain grand canonical ensemble. **4**

5. a) By using Vander walls equation of reduced state, calculate the values of critical constants. **10**
   b) What is phase space and quantum state ? **4**

6. a) What is Brownian motion ? Write Langivin's theory of Brownian motion. **8**
   b) Explain fluctuation dissipation theorem. **6**

7. a) Show that average energy of single particle of ideal fermi gas is 3/5 times the Fermi energy of the system. **10**
   b) Write about MB statistics. **4**

SLR-IP – 456

Seat No.	

M.Sc. (Part – I) (Semester – II) Examination, 2015
Applied Electronics
PHYSICS (Old)
Paper No. – VI : Quantum Mechanics

Day and Date : Saturday, 18-4-2015 Total Marks : 70

Time : 11.00 a.m. to 2.00 p.m.

***Instructions** : 1) Q.No. **1** and Q. No. **2** are **compulsory**.*

*2) Attempt **any three** questions from Q. No. **3** to Q. No. **7**.*

*3) **All** questions carry **equal** marks.*

1. A) Choose correct alternatives : **8**

1) For a given $\psi(x)$, $\int \psi^* \psi . d^3x = 0$ says that probability of finding the object anywhere is

a) zero b) constant

c) the wavefunction is absent d) the wavefunction vanishes

2) Dirac delta is used with

a) discrete observables b) antisymmetrized observables

c) continuous observables d) bra and ket notations

3) The points inside the box where the wavefunction is zero are called

a) Quantum numbers b) Nodes

c) energy levels d) Solutions

4) The exact solution of many-body can be obtained in

a) Classical mechanics b) Quantum mechanics

c) Cosmology d) None of the above, nor elsewhere

P.T.O.

5) Compared to the electron with a higher angular momentum, the electron having lower angular momentum is

a) Away from the nucleus b) Nearer the nucleus

c) Has a thicker orbital d) None of the above

6) The no. of electrons circulating about the positively charged nucleus in a hydrogen like atom is

a) Equal to the number of protons in nucleus

b) Equal to mass number

c) Negligible

d) One

7) In atoms having many electrons, the electron repulsion term

a) can be ignored

b) can be included in the momentum operator

c) has to be included in the potential energy term of wave equation

d) none of the above

8) The Born-Oppenheimer approximation is valid for

a) The ground electronic state of the molecule

b) The excited electronic state of the molecule

c) Both the above

d) None of the above

B) Fill in gaps. **3**

1) An observable can be represented by _____.

2) Any operator that commutes with the _____ operator is called a constant of motion.

3) Separation of electronic and nuclear function describes the _____ principle.

C) State **True** or **False** : **3**

1) ψ and its derivative with respect to its variables are continuous.

2) For a free particle the momentum operator is a constant of motion.

3) The wave function of a system must be symmetric with respect to interchange of every pair of electrons.

2. Attempt **any three** : **14**

a) Write a short note on QM wave function ψ and its interpretation.

b) State and explain the second postulate of quantum mechanics.

c) Write a note on many electron atoms.

d) Write a note on Born-Oppenheimer approximation and justify it using experimental data for the Hydrogen molecule.

3. a) What is the general procedure for setting up a quantum mechanical operator ? Illustrate it by setting up operators for **10**

i) Components of linear momentum

ii) The Hamiltonian and

iii) Components of angular momentum.

b) Find the energy jump in electron volts for the emission of visible light of wave-length 7500 Å. **4**

4. a) Considering the de Broglie wave associated with a moving particle, derive Schrodinger equation. Generalize it to three dimensions. How would interpret the wave function ψ ? **10**

b) Show that the product of two Hermitian operators is Hermitian if they commute. **4**

5. a) Define and solve the energy eigenvalue problem for a harmonic oscillator. What is zero point energy ? **10**

   b) For the ground state of the one-dimensional harmonic oscillator show that the average value of its kinetic and potential energies are equal. **4**

6. a) Formulate the Schrodinger equation for many electron atoms. Why these equations cannot be solved ? What is the method suggested by Hartree ? **10**

   b) Show that electron density in a filled shell of orbitals, like the configuration p^6 and d^{10}, is spherically symmetrical. **4**

7. a) Stating the basic assumptions involved, develop the molecular orbital theory for an n-atom molecule. **10**

   b) Show that L+ and L– are not but L – L+ and L + L – are Hermitian. **4**

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SLR-IP – 457

Seat No.	

M.Sc. (Part – I) (Semester – II) Examination, 2015
PHYSICS (Applied – Electronics) (Paper – VII) (Old)
Electromagnetic Theory

Day and Date : Tuesday, 21-4-2015 Total Marks : 70

Time : 11.00 a.m. to 2.00 p.m.

Instructions *: 1) Attempt* ***five*** *questions.*
2) Q. ***1*** *and Q.* ***2*** *are* ***compulsory****.*
3) Attempt ***any three*** *questions from Q.* ***3*** *to Q.* ***7****.*
4) Figure to the ***right*** *indicate* ***full*** *marks.*
5) ***Use*** *of calculator is* ***allowed****.*

1. A) Select the correct alternatives : **6**

1) If there are free charges at the interface of two dielectrics then which component of magnetic induction at the interface of two media is continuous ?

a) parallel b) tangential

c) normal d) inclined

2) Incident and transmitted waves are always _____

a) in phase

b) out of phase

c) out of path

d) depends on value of $\frac{n1}{n2}$

3) The relative amplitude of transmitted wave in normal incidence at the interface of two dielectrics is

a) $\frac{n1-n2}{n1+n2}$ b) $\frac{2n}{n1+n2}$

c) $\frac{n1+n2}{n1-n2}$ d) $\frac{n}{n1+n2}$

P.T.O.

4) When wave gets reflected from the surface of denser medium there is a phase change of

a) 0° b) 90° c) 180° d) 270°

5) The condition for total internal reflection is the angle of incidence must be

a) 0°

b) greater than 90°

c) greater than critical angle

d) less than critical angle

6) In case of normal incidence the transmission coefficient for the waves propagating through linear media is

a) $\frac{4n1}{(n1+n2)2}$ b) $\frac{n1\,n2}{(n1+n2)2}$

c) $\frac{4n1\,n2}{(n1+n2)2}$ d) $\frac{n1}{(n1+n2)}$

B) **True/False** : **8**

1) The potential which exhibits the dependence of potentials on the velocity of the particles known as vector potential.

2) The divergence of vector potential vanishes under Lorentz Gauge.

3) Magnetic vector potential due magnetic dipole is proportional to r^{-3}.

4) At grazing incidence ($\theta_1 = 90°$), the wave is totally reflected.

5) Current density is proportional to force per unit charge.

6) For a perfect conductor E = 0, even current is flowing through it.

7) Magnetic induction through a loop is proportional to the current through the loop.

8) In case of oblique incidence transmitted wave is always in phase with incident wave.

2. Attempt the following : **14**
   1) Scalar vector potentials **5**
   2) Motional EMF **5**
   3) Electromotive force. **4**

3. a) Explain reflection and transmission of the 1-D sinusoidal wave. **8**
   b) Explain the terminology of sin wave in 1-dimension **6**

4. a) Explain about energy and momentum in electromagnetic waves travelling through the vacuum. **9**
   b) If light ray passes from the medium of refractive index 1.7 to the medium of refractive index 1.4. Calculate the coefficient of reflection and transmission. **5**

5. a) What is wave guide ? Explain about Transverse Magnetic (TM) mode. **8**
   b) Write about Propagation constant of TE/TM wave. **6**

6. a) Explain about electromagnetic waves in a conductor. **8**
   b) Write about the reflection of electromagnetic wave at a conducting surface. **6**

7. a) What is a gauge transformation ? Explain coulomb gauge and Lorentz gauge. **10**
   a) Give the equation of continuity. **4**

SLR-IP – 458

Seat No.	

M.Sc. (Part – I) (Semester – II) Examination, 2015
PHYSICS (Applied Electronics) (Paper – VIII) (Old)
Microprocessors and Microcontrollers

Day and Date : Thursday, 23-4-2015 Max. Marks : 70

Time : 11.00 a.m. to 2.00 p.m.

***Instructions** : 1) Q. **(1)** and **(2)** are **compulsory**.*
*2) Answer **any three** questions from Q. **3** to Q. **7**.*
*3) **All** questions carry **equal** marks.*

1. Objective questions. **(14)**

a) Choose correct alternatives. **8**

1) The number of status flags present in 8085 microprocessor are

A) 8 B) 16 C) 5 D) 10

2) What is the size of the stack pointer in an 8085 MPU ?

A) 8 bit B) 16 bit C) 32 bit D) None of these

3) In an 8085 microprocessor, the I/O devices can be used in

A) Memory mapped I/O only

B) I/O mapped I/O only

C) Memory mapped or I/O mapped I/O

D) None of the above

4) How many memory cells are there in a 128 × 4 memory chip ?

A) 128 B) 512 C) 4 D) 1024

5) 8051 devices have _____ on chip program memory.

A) 1 kbyte B) 2 kbyte C) 3 kbyte D) 4 kbyte

6) The 8051 has _____ parallel I/O ports.

A) 2 B) 3 C) 4 D) 5

7) In Intel 8086, what is the size of the accumulator register ?

A) 8 bit B) 16 bit C) 32 bit D) None

8) What does the execution unit of intel 8086 contain ?

A) General purpose registers B) Flag register

C) ALU D) All of the above

P.T.O.

b) Fill in gaps/**True** or **False**. **6**

1) BIU stands for _____

2) There are _____ flags in 8086.

3) In 8085 accumulator has _____ bits.

4) Contents of RAM cannot be altered (True or False).

5) 8051 microcontroller has a four register banks (True or False).

6) 8086 needs +10V power supply (True or False).

2. Attempt following **(any three)** : **14**

a) Explain the need to demultiplexing of AD_0-AD_7. **5**

b) Explain addressing modes of 8051 microcontroller. **5**

c) Enlist the features of 8051 microcontroller. **4**

3. a) Draw the functional architecture diagram of 8085 microprocessor and explain in brief. **8**

b) What are tristate devices and discuss about the 74LS244 buffer ? **6**

4. a) Discuss the internal register set of 8051 microcontroller. **8**

b) Discuss the following signal descriptions. **6**

i) $\overline{RD}$

ii) TXD

iii) $\overline{INTO}$ / INT

5. a) Explain with neat diagram the concept of memory segmentation in 8086 microprocessor. **8**

b) Discuss about the flag register of 8086 microprocessor. **6**

6. a) Draw and explain architecture of 8086 microprocessor. **10**

b) Write a short note on clock generator of 8284. **4**

7. a) Write a program to add two 16 bit numbers and store the result to the memory location 0300H. **8**

b) Discuss about the address decoding of 8086 μp. **6**

SLR-IP – 459

Seat No.	

M.Sc. – II (Semester – III) Examination, 2015
PHYSICS (Appl. Electronics)
Paper – IX : Semiconductor Devices

Day and Date : Wednesday, 15-4-2015 Max. Marks : 70
Time : 3.00 p.m. to 6.00 p.m.

Instructions *: 1) Attempt **5** questions.*
*2) Questions **1** and **2** are **compulsory**.*
*3) Attempt **any 3** from questions **3** to **7.***
*4) **Use** of non programmable calculator is **allowed**.*

1. Choose the correct alternative : **14**

1) The safety factor for a power diode is given by _____

a) $\frac{t_a}{t_b}$ b) t_b / t_a

c) $\frac{1}{t_a \cdot t_b}$ d) $t_a \cdot t_b$

2) A transistor is said to have a forced β (β_F) when β is _____

a) $\frac{I_C(sat)}{I_B}$ b) $\frac{I_B}{I_C(sat)}$

c) $I_B \cdot I_C(sat)$ d) $\frac{1}{I_B \cdot I_C(sat)}$

3) Which of the following is better than CMOS inverter ?

a) DTL b) RTL
c) TTL d) ECL

4) MOS controlled thyristor is a combination of _____

a) Thyristor and a transistor b) Thyristor and a diode
c) Thyristor and a thyristor d) Thyristor and a MOSFET

P.T.O.

5) A triac is a combined effect of two SCR's connected in _____
   a) Series
   b) Parallel
   c) Antiparallel
   d) Both a) and b)

6) For an ideal MIS diode E_F remains constant in the semiconductor because _____
   a) $dI/dx = 0$
   b) $dI/dx \neq 0$
   c) Both a) and b)
   d) None

7) The ground state degeneracy of an accepter is _____
   a) 1
   b) 2
   c) 3
   d) 4

8) In an ideal MOS diode, the surface potential (ψ_s) deep inside the semiconductor is _____
   a) $\psi_s = \psi_{max}$
   b) $\psi_s = \psi_{min}$
   c) $\psi_s = \frac{\psi_{max}}{z}$
   d) $\psi_s = 0$

9) An intrinsic Debye length for holes is _____
   a) $\sqrt{\frac{KT \in_s}{p_{p_o}}}$
   b) $\sqrt{\frac{K.T. \in_s}{n_{p_o} \cdot q^2}}$
   c) $\sqrt{\frac{K. \in_s}{p_{p_o} \cdot q}}$
   d) $\sqrt{\frac{K. \in_s}{n_p \cdot q}}$

10) Flat band shift is due to _____ charges.
   a) Mobile ionic
   b) Fixed oxide
   c) Oxide trapped
   d) Interface trapped

11) Light emission is not possible in Si because of its _____
   a) direct band gap
   b) high mobility
   c) indirect band gap
   d) carrier concentration

12) D-MOSFET means _____ MOSFET.
   a) Double dimensional
   b) Depleted
   c) Double diffused
   d) Dimensionless

13) Resonant tunneling diode has a cut-off frequency in the _____ range.

a) KHz b) MHz

c) GHz d) THz

14) The dominating operating process in PV-detector/Solar cell is _____

a) Stimulated emission b) Absorption

c) Reflection d) Transmission

2. Attempt **any three**. **14**

1) Explain reverse recovery characteristic of a power diode. **5**

2) Write a note on triac. **4**

3) What is a CMOS ? **5**

4) Conductance measurement technique for measurement of surface traps. **4**

3. a) What is a MCT ? With a block constructional details explain the turn ON and turn OFF process in MCT's ? **10**

b) State the important applications of MCT. **4**

4. a) Explain the variation of total capacitance of an ideal MOS-system with applied voltage. **10**

b) What is flat bad condition ? State the magnitude of flat band capacitance. Interpret it. **4**

5. a) Give a brief account of two transistor analogy of a thyristor. **8**

b) Write a note on interface trapped charges. **6**

6. a) What is CCD ? With a good sketch of an energy band diagram, explain what do you mean by accumulation, depletion and inversion of the charges for the p and n-type semiconductors. **10**

b) Compare the salient features of the above processes. **4**

7. Attempt the following : **14**

a) Modern MOSFET's are fabricated on a $\langle 100 \rangle$ oriented silicon – Comment. **6**

b) Protection of a thyristor against dv/dt. **4**

c) Transferred electron effect in GaAS. **4**

_____

SLR-IP – 460

Seat No.	

M.Sc.– II (Semester – III) Examination, 2015
PHYSICS (Applied electronics)
Instrumentation (Paper – X)

Day and Date : Friday, 17-4-2015 Total Marks : 70

Time : 3.00 p.m. to 6.00 p.m.

***Instructions** : 1) Q. **(1)** and **(2)** are **compulsory**.*

*2) Answer **any three** questions from Q.**3** to Q. **7**.*

*3) All questions carry **equal** marks.*

1. Objective questions. **14**

a) Choose correct alternatives. **8**

i) In LVDT, which of the following varies with the input displacement.

a) resistance b) capacitance

c) inductance d) temperature

ii) A pH meter is used measure

a) acidity of a solution

b) alkalinity of a solution

c) neutrality of a solution

d) all of the above

iii) In signal conditioning systems, an external excitation is required for

a) Thermocouples b) Piezo-electric crystals

c) Strain gauges d) Inductive pick-ups

iv) In an op-amp logarithmic amplifier, the output voltage forms a logarithmic function of the

a) input voltage b) output voltage

c) reference voltage d) peak voltage

P.T.O.

v) In lock-in amplifier, a phase sensitive detector circuit is basically a

a) Mixer b) Comparator

c) Amplifier d) Rectifier

vi) Operations such as multiplication, division, power etc. can be done using

a) lock-in amplifier b) DC amplifier

c) logarithmic amplifier d) AC amplifier

vii) Which of the following is a – ve temperature coefficient device ?

a) Thermocouple b) Thermistor

c) Strain gauge d) Loud Speaker

viii) Supply of high voltage signals can be prevented by using

a) Instrumentation amplifier

b) Active filters

c) Operational amplifier

d) Isolation amplifier

b) Fill in the blanks. **6**

i) The output of the thermocouple is in the form of _____

ii) Photo emissive cell is an _____ transducer.

iii) Hydrogen ion concentration of a solution can be measured with _____ meter.

iv) UPS requires _____ for its operation.

v) Revolutions per minute can be measured using _____ meter.

vi) In SMPS, transistors are mainly used as _____ devices.

2. Attempt **any three**. **14**

a) Discuss the applications of temperature sensors.

b) Write the feedback fundamentals.

c) Explain the operation of RMS converter.

d) Write a note on dynamic signal filtering.

3. a) Discuss the construction and operation of different types of temperature transducers. **10**

   b) Write the advantages and disadvantages of each of them. **4**

4. a) Describe with neat diagram, the working of an isolation amplifier and explain with illustration how it is used to protect the system. **10**

   b) Write the applications of instrumentation amplifier. **4**

5. a) Describe the construction and working of a digital storage oscilloscope. **10**

   b) Write a note on power meter. **4**

6. a) With neat block diagram, explain the constructional features of a spectrum analyzer. **10**

   b) Discuss the static signal conditions. **4**

7. a) Explain the various functional blocks of a multichannel data acquisition system. **10**

   b) Write the applications of logic state analyzer. **4**

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SLR-IP – 461

Seat No.	

M.Sc. (Part – II) (Semester – III) Examination, 2015
PHYSICS (Applied Electronics)
Communication Systems (Paper – XI)

Day and Date : Monday, 20-4-2015 Max. Marks : 70
Time : 3.00 p.m. to 6.00 p.m.

Instructions** : 1) Q. **1** and **2** are **compulsory.
*2) Answer **any three** questions from Q. **3** to Q. **7.***
*3) **All** questions carry **equal** marks.*

1. Objective questions. **6**

a) Select alternatives :

1) As per FCC rule frequency tolerance of A.M. (TCXO) oscillator is _____
   a) 20 ppm b) 15 ppm c) 25 ppm d) 10 ppm

2) Carson rule for B.W. is found using the relation_____
   a) 2(fc + fs) b) 2(Δ fc + fs)
   c) (Δ fc + Fs) d) 2(Δ fc –2fs)

3) In a low level AM system, amplifier following the modulated stage must be _____
   a) Linear devices b) Harmonic devices
   c) Class c amplifiers d) Non-linear devices

4) Both digital and analog signals may be transmitted by _____
   a) TDM b) FDM c) WDM d) All of these

5) In FM radio receivers using PLL circuits _____ value of capacitor is needed for VCO to oscillate at 10.7 MHz.
   a) 10 PF b) 19 PF c) 100 PF d) 50 PF

6) _____ detector is insensitive to noise and amplitude variation.

a) Ratio b) F.M. c) Dual slope d) Diode

b) Fill in the blanks : **4**

1) The intermediate frequency of every radio receiver will be the _____
(same / different)

2) In double sideband transmission, the two sideband contain _____ information.
(Identical / Scatter)

3) A PAM signal is demodulated with _____fitter.
(High pass / Low pass)

4) Crystal oscillators can be used in the range of _____
(30 MHz / 15 MHz)

c) State **True** or **False** : **4**

1) Differential PCM system is purely analog.

2) F.M. carrier wave can be represented in frequency domain.

3) The sampling theorem is applicable to band limited signals centered at origins. (i.e. low pass signals)

4) A.M. is a non-linear modulation system.

2. Answer in brief : **14**

1) Describe the function of each circuit in exciter section of F.M. transmitters. **5**

2) Explain in brief the working of phase – shift balance modulator. **5**

3) What are full duplex modes ? **4**

3. a) Explain the operation of A.M. diode detector circuit, with suitable circuit and waveforms. **10**

b) Mention the factor to choose time constant (RC) in diode detector circuit. **4**

4. a) Explain in detail the following data formats with its wave forms and suitable example : **10**

   i) Unipolar RZ ii) Unipolar NRZ

   iii) Bipolar RZ iv) Bipolar NRZ

   b) Explain cross talk in TDM. **4**

5. a) What is sampling theorem ? Explain how aliasing effect can be reduced using sampling theorem. **.10**

   b) Compare : DM and PCM. **4**

6. a) Explain in detail the VCO master oscillator circuit in FM with its block diagram. **10**

   b) Compare : AM and FM. **4**

7. a) Explain in detail the design and working of class c power amplifier. **10**

   b) Compare : Class A audio amplifier and class B audio amplifier. **4**

SLR-IP – 462

Seat No.	

M.Sc. (Part – II) (Semester – III) Examination, 2015
PHYSICS (Applied Electronics)
Paper No. XII
Atomic, Molecular and Nuclear Physics

Day and Date : Wednesday, 22-4-2015 Total. Marks : 70

Time : 3.00 p.m. to 6.00 p.m.

Instructions : *i) Attempt **5** questions.*
*ii) Q. **1** and Q. **2** are **compulsory**.*
*iii) Attempt **any three** questions from question no. **3** to **7**.*
*iv) Figures to the **right** indicates **full** marks.*
*v) **Use** of non programmable calculator is **allowed**.*

1. A) Choose the correct alternative : **6**

1) _____ wave functions are possible for the hydrogen atom when the principle quantum number is 3 ?

a) 3 b) 6 c) 9 d) none of these

2) The spectra of two valence electron atoms contain _____

a) Doublets and quartets b) Only doublets

c) Only singlets d) Singlets and triplets

3) Spacing between energy levels of the anharmonic oscillator _____

a) is constant b) goes on increasing

c) goes on decreasing d) none of these

4) Measurement of the cross section of the neutron proton scattering determines _____

a) only scattering length b) sign and also scattering length

c) only sign d) only scattering length but not sign

P.T.O.

5) Binding energy of the deuteron is _____

a) 1.2 MeV b) 2.2 MeV

c) 3.2 MeV d) 4.2 MeV

6) In beta decay _____ are emitted.

a) neutrons b) protons

c) electrons d) gamma rays

B) Fill up the blanks : **4**

7) Infrared spectra is given by the molecules because of the change in _____

8) All the alkali atom have the ground state as _____

9) Angular momentum of deuteron is _____

10) The expression which relates level width Γ with wavelength λ is _____

C) State **true** or **false** : **4**

11) The hyperfine structure of atomic spectra is due to the electron spin.

12) The quantum number 'n' governs the shape of the orbital.

13) In a deuteron, the force between neutron and proton is short range and repulsive.

14) Nuclei with nucleons having a magnetic number are rare in nature.

2. Answer in brief (**any 3**) :

a) State and explain the role of quantum numbers in atomic spectra. **4**

b) Write the electronic configuration of neutral Titanium and neutral fluorine atoms. **4**

c) Explain the saturation of nuclear forces. **5**

d) Write a note on neutron spectroscopy. **5**

3. a) State and explain the Pauli exclusion principle. What terms you will get for two equivalent p electrons ? **10**

   b) What terms will be obtained for a dd configuration if L-S coupling is dominant ? **4**

4. a) Obtain an expression for the reduced mass and explain the energy level and spectra given by a diatomic molecule when it behaves as a rigid rotator. **8**

   b) Discuss the spectrum given by linear polyatomic molecule. **6**

5. a) State the different types of nuclear forces in the light of exchange operator and parity of the state. **10**

   b) Explain spin dependence of nuclear forces. **4**

6. a) Discuss at length the salient feature of the liquid drop model. What are the assumptions ? Give merits and demerits of this model. **10**

   b) Write a note on superconductive model of a nucleus. **4**

7. a) Discuss the nuclear reaction kinematics. Obtain an expression for the Q-values of a nuclear reaction of the Q equation. **10**

   b) What is an individual particle model ? **4**

SLR-IP – 463

Seat No.	

M.Sc. (Part – II) (Semester – IV) Examination, 2015
PHYSICS (Applied Electronics)
Paper – XIII : Computational Methods and Programming

Day and Date : Thursday, 16-4-2015 Max. Marks : 70
Time : 3.00 p.m. to 6.00 p.m.

Instructions *: 1) Q. No.* ***1*** *and Q. No.* ***2*** *are* ***compulsory****.*
2) Answer ***any three*** *questions from Q. No.* ***3*** *to Q. No.* ***7****.*
3) ***Use*** *of non programmable calculator is* ***allowed****.*
4) ***All*** *questions carry* ***equal*** *marks.*

1. a) Choose the correct alternative. **6**

i) The order of convergence in Newton Raphson method is

A) 2 B) 3

C) 0 D) 1

ii) If $y = ae^{cx}$, then the first normal equation is $\sum \log y =$

A) $an + \log c \sum x$

B) $a \sum x + c \sum x^2$

C) $n \log a + c \sum x$

D) $a \sum x + c \sum x^3$

iii) The Newtons forward difference formula is most suitable for the case where independent variable is present at

A) lower part

B) upper part

C) central part

D) any where in the difference table

P.T.O.

iv) Gauss for n = 2 for the $\int_{-1}^{1} f(x)\,dx$ is

A) $f\left(-\sqrt{\frac{5}{3}}\right)+f\left(\sqrt{\frac{5}{3}}\right)$

B) $f\left(-\sqrt{\frac{3}{5}}\right)+f\left(\sqrt{\frac{3}{5}}\right)$

C) $f\left(-\sqrt{\frac{2}{3}}\right)+f\left(\sqrt{\frac{2}{3}}\right)$

D) $f\left(-\sqrt{\frac{1}{3}}\right)+f\left(\sqrt{\frac{1}{3}}\right)$

v) Using Runge Kutta method of order four, the value of y(0.1) for $y' = x - 2y$, y(0) = 1, taking h = 0.1, is _____

A) 0.813 B) 0.825 C) 0.0825 D) 0.0813

vi) Adams Bashforth method is used for

A) Solving integral equations

B) Solving differential equation

C) Evaluating integrals

D) Differentiation

b) State **true** or **false** or fill in the blanks. **8**

i) To fit the equation $y = a + bx + cx^2$ by least square principal, the number of normal equations will be 3.

ii) The Lagrange's interpolation formula is used for both equally spaced as well as unequally spaced data.

iii) Using intermediate value theorem, the root of the equation f(x) = 0 lies between [a, b] provided f(a) . f(b) < 0.

iv) The interval in which the a real root of equation $x^3 - 2x - 5 = 0$ lies is _____

v) Gauss-Jordan matrix inversion method is valid for only if the coefficient matrix "A" is singular.

vi) To fit a straight line $y = a + bx$ the second normal equation using the method of least square will be $\sum xy = a\sum x + b\sum x^2$.

vii) In Predictor-corrector methods four initial values may be found with the help of Runge-Kutta method.

viii) The Newton Raphson method fails when _____ is zero.

2. Write short notes on :

a) Write a note on Randam Walks. **5**

b) Write note on normal equations for the curve $y = ax^b$. **4**

c) Explain Bisection method and derive its n^{th} iteration formula. **5**

3. a) The following data are taken from the steam table : **6**

Temperature T in °C	140	150	160	170	180
Pressure kgf/cm^2	3.685	4.854	6.302	8.076	10.225

Find the pressure at temperature t = 175°C.

b) Explain the principal of least square for the fitting a curve from given data. Fit a curve $y = ax^2 + bx + c$ to the following data. **8**

x :	1	2	3	4	5
y :	5	12	26	60	97

4. a) Solve for a positive root of $xe^x - 3 = 0$ by regula False method, correct to three decimal places. Also solve $x^3 - 2x - 1 = 0$ by bisection method. **10**

b) Solve the following system of equations by Gauss elimination method **4**

$x + 2y + z = 3$

$2x + 3y + 3z = 10$

$3x - y + 2z = 13$

5. a) Given $\frac{dy}{dx} = xy + y^2$ with $y(0) = 1$ find y at $x = 0.1, 0.2, 0.3$ by Runge Kutta method of fourth order. Also find the y at $x = 0.4$ using Milne's method. **8**

   b) Solve the following system of equation by Gauss Seidal method
   $8x - y + z = 18.$ **6**
   $2x + 5y - 2z = 3$
   $x + y - 3z = -16$

6. a) Use Gauss Jordan matrix inversion method to solve **8**
   $x + y + z = 8$
   $x - y + 2z = 6$
   $3x + 5y - 7z = 14$

   b) Solve $\frac{dy}{dx} = x^2y - 1$ with $y(0) = 1$ find y at $x = 0.1$ and at $x = 0.2$ by Taylor's series method. **6**

7. a) Evaluate $\int_0^1 \frac{1}{1+x}\,dx$ by two and three point Gaussian quadrature formula. **6**

   b) Evaluate $\int_{0.2}^{1.4} \left(\sin x - \log x + e^x\right) dx$ using Simpson's one third and Simpsons three eighth rule. **8**

SLR-IP – 464

Seat No.	

M.Sc. II (Semester – IV) Examination, 2015
PHYSICS (Applied Electronics) (Paper – XIV)
Microelectronics

Day and Date : Saturday, 18-4-2015 Total Marks : 70

Time : 3.00 p.m. to 6.00 p.m.

Instructions *: 1) Attempt **five** questions.*
*2) Q. **1** and Q. **2** are **compulsory**.*
*3) Attempt **any three** questions from Q. **3** – Q. **7**.*
*4) Figures to the **right** indicate **full** marks.*
*5) Use of non-programmable calculator is **allowed**.*

1. Choose the correct alternative : **14**

i) The interstitial voids in silicon for receiving an impurity atom are
a) 8 b) 4 c) 5 d) 7

ii) The impurity profile in an interstitial diffusion is
a) logarithmic b) erf.C c) linear d) gaussian

iii) For microelectronic applications, growth of single crystal silicon must be along _____ direction.
a) (111) b) (101) c) (011) d) (110)

iv) An aspect ratio is
a) L/W b) R/L c) W/L d) L/R

v) A _____ photoresist is popularly used for IC-fabrication.
a) Isofine Kodak – 820 b) Novolac
c) KPR d) Isopoly-K – 747 MR

vi) The purple plague is
a) $AuAl_2$ b) $AuAl_3$ c) Al_2O_3 d) AuAl

vii) The crystallographic structure of an epilayer and the substrate are
a) close to each other b) the same
c) different d) none of the above

P.T.O.

viii) The base width of a normal npn transistor is of the order of _____ μm .

a) 1 t0 2 μm b) 6 to 8 μm

c) 0.6 to 0.8 μm d) 0.06 to 1 μm

ix) In constant source diffusion, diffusion source consists of _____ amount of impurity.

a) a finite b) zero

c) an infinite d) finite as well as infinite

x) 1 mil = _____ inch.

a) 10^{-3} b) 10^{+3} c) 10^{4} d) 10^{-4}

xi) A dielectric isolation _____ the parasitic capacitance.

a) reduces b) does not affect

c) increases d) none of the above

xii) An important advantage of ion implantation is that the process is a _____ temperature process.

a) low b) high c) intermediate d) excessively high

xiii) Minimum aspect ratio is

a) 1 : 1 b) 1 : 5 c) 1 : 10 d) 1 : 3

xiv) In metallization, contacts are usually made with

a) Au b) Mg c) P d) AS

2. Attempt **any three** : **14**

a) Photographic mask

b) Czechrlaski technique

c) Boron gettering

d) Discuss : epitaxy Vs. diffusion.

3. a) Evaluate an epitaxial layer through :

i) Measurement of sheet resistance.

ii) Impurity profile. **10**

b) Write a note on substitutional diffusion. **4**

4. a) State and explain Fick's second law of diffusion. **10**

   b) What is projected range ? **4**

5. a) Explain how an npn transistor is integrated using planar process. **10**

   b) Write a note on positive photoresist. **4**

6. a) Give a brief account of ion implantation process. **10**

   b) What is complete oxide isolation ? **4**

7. Write a note on : **14**

   a) Phosphorus diffusion system.

   b) Etch back effect.

   c) Wedge bonding.

SLR-IP – 465

Seat No.	

M.Sc. (Part – II) (Semester – IV) Examination, 2015
PHYSICS (Applied Electronics)
Paper – XV : Microwave Engineering

Day and Date : Tuesday, 21-4-2015 Total Marks : 70
Time : 3.00 p.m. to 6.00 p.m.

Instructions *: 1) Q.* ***(1)*** *and* ***(2)*** *are* ***compulsory****.*
2) Answer ***any three*** *questions from Q.* ***3*** *to Q.* ***7****.*
3) ***All*** *questions carry* ***equal*** *marks.*

1. Objective Questions : **14**

a) Select correct alternatives : **8**

1) In microwave, for high power applications, which of the following oscillator is used ?

a) Reflex Klystron b) TWT
c) Gunn diode d) Klystron

2) C-band microwave frequency range lies in the

a) 2-4 GHz b) 4-8 GHz
c) 8-12 GHz d) 12-18 GHz

3) The velocity of propagation for the strip line transmission line is represented

a) C/f b) υ/f
c) $c/\sqrt{\mu_1 E_r}$ d) $c/\sqrt{E_r}$

4) An air filled rectangular guide has a cut off frequency 2.5 GHz, assume ratio of the guide height to width to be 2; calculate guide width.

a) 0.06 mts b) 0.6 mts
c) 0.006 mts d) 0.06 cm

5) The length of the microstrip is usually _____ to _____ wavelength.

a) $\frac{1}{2}$ to $\frac{3}{4}$ b) $\frac{1}{4}$ to $\frac{1}{2}$
c) $\frac{1}{2}$ to $\frac{1}{3}$ d) $\frac{1}{4}$ to $\frac{3}{4}$

P.T.O.

6) If $(\lambda_0 > \lambda_c)$ in a rectangular waveguide it implies that λ_g is imaginary, which indicates that _____ in the waveguide.

a) It depends on dimensions

b) There is propagation

c) There is no propagation

d) There are multiple reflection

7) In case of a lossless transmission line one of the following conditions is valid

a) R = 0 b) G = 0

c) R = 0, G = 0 d) L = C = 0

8) Reflections of microwaves cannot be observed from

a) Open circuit b) Short circuit

c) Matched load d) Unmatched load

b) State **True** or **False**/Justify/**One** line answer : **6**

1) Velocity factor in transmission lines vary from _____ to _____ approximately (0.6 to 0.8 / 1 to 1.2)

2) If one wire of a transmission line is connected to ground, the line is said to be _____ (unbalanced/balanced)

3) When SWR = _____ , all power is delivered to load. $(1/\infty)$

4) In case of lossless medium, the skin depth is $(0/\infty)$

5) The use of walls in waveguide is to confine energy in the waveguide.

6) Banana pin can be used as a pin connector in Microwaves.

2. Answer in brief : **14**

1) What are the unique advantages of microwave over low frequencies ? **5**

2) Mention the advantages of taper loads over resistor type loads in a transmission line. **5**

3) What are the uses of flanges ? Explain any one type used. **4**

3. a) Write modified Amperes law which includes time varying field. Comment on displacement current. **10**

   b) Distinguish between unpolarized electromagnetic wave and circularly polarized wave. **4**

4. a) A coaxial line has the following characteristics at 1000 MHz, R = 4 ohms/m; L = 450 nH/m ; G = 7×10^{-4} mho/m ; C = 50 PF/m, calculate Z_O , α and β. **10**

   b) Explain the mode of propagation in strip type transmission line. **4**

5. a) For a paralle plate transmission line, deduce an expression for Z_O and α. **10**

   b) Derive an expression for the inductance of the coaxial configuration. Assume that current flows along the surface of the inner conductor. **4**

6. a) Describe the development of rectangular waveguide from a parallel plate transmission line. **10**

   b) Sketch electric and magnetic fields lines for a TE 10 mode. **4**

7. a) Explain the construction and working of the rotary vane attenuator. **10**

   b) Describe current modulation in Klystron amplifier. **4**

SLR-IP – 466

Seat No.	

M.Sc. (Part – II) (Semester – IV) Examination, 2015
PHYSICS (Applied Electronics)
Paper – XVI : Microprocessor and Interfacing

Day and Date : Thursday, 23-4-2015 Total Marks : 70
Time : 3.00 p.m. to 6.00 p.m.

Instructions *: 1) Attempt* ***five*** *questions.*
2) Q. ***1*** *and* ***2*** *are* ***compulsory****.*
3) Attempt ***any three*** *from Q.* ***3*** *to Q.* ***7****.*
4) Figures to the ***right*** *indicate* ***full*** *marks.*

1. A) Choose the correct alternative : **14**

1) _____ is a nonmaskable interrupt.
a) TRAP b) INTR c) RST 7.5 d) RST 5.5

2) Accuracy of conversion for the following ADC is very accurate
a) Dual slop b) Flash c) Integrator d) Ramp

3) 74LS242 is a _____
a) Unidirectional buffer b) Latch
c) Counter d) Decoder

4) The 8085 has _____ hardware interrupts.
a) 4 b) 6 c) 8 d) 5

5) 8253 can operate with clock frequency from DC to _____
a) 12 MHz b) 8 MHz c) 10 MHz d) 2 MHz

6) _____ is an 8-bit bidirectional bus driver used to increase the driving capacity of data bus.
a) 74LS245 b) 74LS373 c) 74LS138 d) 74LS242

7) The BSR mode in 8255 A is used to set or reset the bits in _____
a) Port B b) Port A c) Port C d) Port D

8) The 3-bit D/A converter has _____ possible combinations.
a) Eight b) Four c) Two d) Three

B) State **True** or **False** :

1) EI (Enable Interrupt) is a 2-byte instruction.
2) Simplicity of R-2R ladder DAC is more than binary weighted DAC.
3) Priority encoder is used in Flash type ADC.
4) In 8279, keyboard entries are stored in the internal FIFO memory.
5) The IC 8259 can operate in BSR and I/O mode.
6) 8085 can operate 75% idle mode.

2. Attempt the following : **14**
   1) Write interpretation of the accumulator bit pattern for RIM instruction. **5**
   2) Explain in brief BSR mode in 8255 PPI. **5**
   3) Write a note on R-2R ladder. **4**

3. a) Explain initialization commands of 8259 priority interrupt controller. **8**
   b) Explain the following modes of 8259 PIC in brief. **6**
      i) Fully nested mode
      ii) Automatic Rotation mode.

4. a) Draw and explain communication between two computers (microprocessors) using 8255 PPI. **8**
   b) Draw interfacing diagram of 7 segment LED to 8085 using 8255 PPI. **6**

5. a) Draw and explain the internal block diagram of PIT 8253**.** **8**
   b) Draw and explain control word format of 8253 PIT. **6**

6. a) Draw and explain successive approximation type ADC with its advantages. **10**
   b) Compare flash type ADC and dual slope ADC. **4**

7. a) Explain 8259 A interfacing with 8085 in detail. **10**
   b) The digital I/P word for a 4-bit DAC changes from 0000 to 0101. Calculate the DAC output. (Assume V_{FS} = 15V). **4**
