SLR-MI – 571

Seat No.	

M.Sc. (Part – I) (Semester – I) (New) (CBCS) Examination, 2016
PHYSICS (Applied Electronics)
Mathematical Techniques (Paper – I)

Day and Date : Tuesday, 29-3-2016 Max. Marks : 70
Time : 10.30 a.m. to 1.00 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. 1) Choose the correct alternative : **6**

i) The solution of Integral of $(D + 1)^3 y =$ is $y =$ _____

a) $c_1e^{-x} + c_2e^{-x} + c_3e^{-x}$ b) $(c_1x^2 + c_2x + c_3)e^{-x}$

c) $\frac{x^3}{3!}e^{2x}$ d) 0

ii) The vectors X_1, X_2 and X_3 are said to be Linearly Dependent if for $c_1X_1 + c_2X_2 + c_3X_3 = 0$ we get _____

a) $c_1 = 0$, $c_2 = 0$ and $c_3 = 0$

b) $X_1 = 0$, $X_2 = 1$ and $X_3 = 1$

c) $X_1.X_2 = X_3$, $X_2.X_3 = X_1$ and $X_3.X_1 = X_2$

d) At least on of c_1, c_2, c_3 is not equal to zero

iii) Inverse Laplace Transform of $\frac{1}{(s+b)^2} =$ _____

a) $e^{-bt}\frac{t}{2!}$ b) $e^{bt}\frac{t^3}{2}$ c) $e^{-bt}\frac{t^2}{3!}$ d) $e^{bt}\frac{t^3}{3}$

iv) Fourier Cosine Integral of f(s) is given by _____

a) $\frac{2}{\pi}\int_0^\infty \sin wx \int_0^\infty f(s)\sin ws.dxds$ b) $\frac{2}{\pi}\int_0^\infty \sin wx \int_0^\infty f(s)\cos ws.dxds$

c) $\frac{2}{\pi}\int_0^\infty \sin wx \int_0^\infty f(s)\sin ws.dwds$ d) $\frac{2}{\pi}\int_0^\infty \cos wx \int_0^\infty f(s)\cos ws.dwds$

P.T.O.

v) $(a + bi)^{3/4}$ will have _____ no. of values.

a) 2 b) 3

c) 4 d) 12

vi) The value of f(z) = u + iv is analytic function then f′ (z) = _____

a) $v_y - iu_y$ b) $u_x - iv_x$

c) $v_y + iv_x$ d) $u_y + iv_x$

2) State **true** or **false** : **8**

i) $L\{e^{-bt}f(t)\} = L|\{f(t)\}|_{s-b}$.

ii) If the vectors are Linearly dependent then one vector can be expressed as linear combination of others.

iii) The Fourier series of f(x) in (–a, a) will involve sine terms if f(x) is odd.

iv) $\frac{1}{D^2+3}\cos x$ is equal to $-\frac{1}{2}\cos x$.

v) Fourier expansion of $x^2 - x^3$ in (–1, 1) has only Cosine Terms.

vi) The eigen values of A are 1, 2, 3 the eigen values of A^{-1} are 1, 1/2, 1/3.

vii) If f(z) is analytic function and f′ (z) is continuous at all points inside and on a simple closed curve C, then $\int_C f(z)dz = 0$.

viii) If u is harmonic then $u_{xx} + u_{yy} = 0$.

2. Write short notes on :

1) Write a note on Vector spaces and subspaces. **5**

2) What are non homogenous differential equations with constant coefficient explain with examples. **4**

3) Define Linear Dependance, Independence and Orthogonality of the vectors. **5**

3. 1) Evaluate $\int_C \frac{e^{2z}dz}{(z-1)^4}$ where C is circle |Z| = 2. **6**

2) Solve $(D^2 - 7D - 6)y = x^2$. **8**

4. 1) Find Fourier Series of $f(x) = 2 - \frac{x^2}{2}$ in (0, 2). **10**

   2) Prove that $(a + ib)^n + (a - ib)^n = (a^2 + b^2)^{n/2+1}\cos(n \tan^{-1}(b/a))$. **4**

5. 1) Examine the vector for linear dependance and independence hence check whether following vectors will form a bases for R^3.
   [1, 0, –3], [3, 1, –3], [–2, –2, 1]. **8**

   2) Solve $y'' + 9y' + 8y = 0$ at $y(0) = 2$, $y'(0) = 1$ and find the limit, as $t \to \infty$, of the solution. **6**

6. 1) Find Fourier cosine Transform of $f(x) = e^{-x^2}$. **8**

   2) Diagonalize the matrix if possible $\begin{pmatrix} 6 & -2 & -1 \\ -2 & 6 & -1 \\ -1 & -1 & 5 \end{pmatrix}$. **6**

7. 1) Using C-R equations show that $f(z) = ze^z$ is analytic in entire z-plane. **6**

   2) Let $a = \begin{pmatrix} 2 \\ -1 \end{pmatrix}$, $b = \begin{pmatrix} 1 \\ -3 \end{pmatrix}$, $c = \begin{pmatrix} 2/3 \\ -1 \\ 4/3 \end{pmatrix}$ and $d = \begin{pmatrix} -1 \\ 6 \\ 5 \end{pmatrix}$.

      1) Compute $\frac{a.b}{a.a}$.

      2) Find $\| a \|, \| b \|$.

      3) Show that d is orthogonal to c. **8**

SLR-MI – 572

Seat No.	

M.Sc. (Part – I) (Semester – I) Examination, 2016
PHYSICS (Applied Electronics)
(Paper – II) (New) (CBCS)
Condensed Matter Physics

Day and Date : Thursday, 31-3-2016 Total Marks : 70
Time :10.30 a.m. to 1.00 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) Intrinsic semiconductor material is characterized by a valence shell of how many electrons ?

A) 1 B) 2 C) 4 D) 6

2) What causes the depletion region ?

A) Doping B) Diffusion
C) Barrier potential D) Ions

3) What is an energy gap ?

A) The space between two orbital shells
B) The energy equal to the energy acquired by an electron passing a 1V electric field
C) The energy band in which electrons can move freely
D) An energy level at which an electron can exist

4) Silicon atoms combine into an orderly pattern called a

A) covalent bond B) crystal
C) semiconductor D) valence orbit

5) In “n” type material, majority carriers would be

A) holes B) dopants C) slower D) electrons

P.T.O.

6) Elements with 1, 2 or 3 valence electrons usually make excellent

A) conductors B) semiconductors

C) insulators D) neutral

7) Which of the following are the properties of superconductors ?

A) They are diamagnetic in nature

B) They have zero resistivity

C) They have infinite conductivity

D) All of the above

8) In superconductivity, the electrical resistance of material becomes

A) Zero B) Infinite

C) Finite D) All of the above

B) State **True** or **False** : **6**

1) The primitive unit cell is one in which only one lattice point at the corner exist.

A) True B) False

2) Each of the angle between the axes of a cubic crystal is of 90°.

A) True B) False

3) A covalent bond is when atoms lose valence shell electrons.

A) True B) False

4) When a voltage is placed across a semiconductor, free electrons move toward the negative voltage.

A) True B) False

5) Germanium is the most widely used semiconductor material because of its stability at high temperatures.

A) True B) False

6) The natural elements carbon, germanium and silicon are semiconductors.

A) True B) False

2. Attempt following :

   a) Ionic polarization. **5**

   b) Periodic zone scheme. **5**

   c) Cooper pair. **4**

3. a) What is meant by reciprocal lattice ? Discuss concept of reciprocal lattice. **8**

   b) Discuss elementary concepts of polycrystalline, noncrystalline and amorphous materials. **6**

4. a) What do you mean by Brillouin zone ? Construct Fermi surfaces in Brillouin zones for two-dimensional lattices. **8**

   b) Explain x-ray scattering from solids including Laue conditions. **6**

5. a) Explain the motion of electron in periodic potential. **8**

   b) Discuss electronic and orientational polarization. **6**

6. a) Give a brief account of experimental determination of band gap. **8**

   b) Explain Meissner effect. **6**

7. a) Derive London equation and show that it accounts for the Meissner effect. **10**

   b) Explain Type-I and Type-II superconductors with example. **4**

SLR-MI – 573

Seat No.	

M.Sc. (Part – I) (Semester – I) Examination, 2016
(New) (CBCS Pattern)
PHYSICS (Applied Electronics)
Paper – III : Analog and Digital Electronics

Day and Date : Saturday, 2-4-2016 Max. Marks : 70

Time : 10.30 a.m. to 1.00 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.*
4) ***Use*** *of non programmable calculator is* ***allowed****.*

1. a) Select the correct alternative : **8**

1) The Boolean expression B. (A + B) + A can be realized using a minimum number of

a) One AND gate b) Two AND gate
c) One OR gate d) Two OR gate

2) A _____ is similar to a demultiplexer with exception that there is no data input.

a) Decoder b) Encoder c) Multiplexer d) Counter

3) The stack in 8085 μp operates on _____ mode.

a) FIFO b) LIFO c) FILO d) FOFI

4) The 7912 regulator IC provides

a) 5 V b) – 5 V c) 12 V d) – 12 V

5) Which of the following is volatile memory ?

a) RAM b) ROM c) PROM d) EPROM

6) The input impedance of an ideal op-amp is

a) 0 b) infinite c) 1 MΩ d) 100 MΩ

P.T.O.

7) The AND gate is used for Boolean

a) Multiplication b) Addition

c) Complement d) MOD-2 Addition

8) The _____ is used to count the number of clock pulses at the output.

a) Counter b) Flip-flop c) Shift-register d) Encoder

b) State **true** or **false** : **6**

1) If the CMRR of an op-amp is large then its common mode output voltage is small.
2) For 2-bit ripple counter, 3 flip-flops are required.
3) Demultiplexer can be used as data selector.
4) When op-amp is operated in single ended mode, one input is grounded.
5) Flip-Flop can store 1-bit of information.
6) For a.c. analysis of a differential amplifier we use h-parameters.

2. Attempt the following : **14**
   1) Explain the working of 4 : 1 demultiplexer with its truth table.
   2) Explain the voltage follower with neat diagram.
   3) Write a note on astable multivibrator.

3. a) With a neat circuit diagram explain the working of a triangle wave generator. **8**
   b) What is feedback ? Explain the effect of feedback on bandwidth. **6**

4. a) Explain the circuit for a three op-amp instrumentation amplifier and obtain the expression its output voltage for a given input voltage and resistor value. **10**
   b) What is an inverting amplifier ? **4**

5. a) Explain the block and timing diagram of a 4-bit ripple counter in detail. **8**
   b) Convert the following equation into the standard SOP form and write their corresponding minterms.
   $Y = AB + BC + AC$ **6**

6. a) Explain the signals and timing diagram of 8085 with necessary waveforms. **8**
   b) Write an assembly language program to find out the smallest element in an array using 8085 μp instructions. **6**

7. a) With a neat circuit diagram explain the monostable multivibrator using op-amp. **8**
   b) What are tuned amplifiers ? Give a brief account of LC-tuned amplifier. **6**

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SLR-MI – 574

Seat No.	

M.Sc. (Part – I) (Semester – I) (New) (CBCS) Examination, 2016
PHYSICS (Applied Electronics)
Paper – IV : Classical Mechanics

Day and Date : Tuesday, 5-4-2016 Total Marks : 70
Time : 10.30 a.m. to 1.00 p.m.

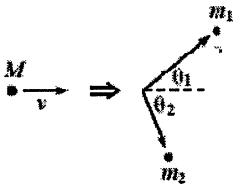
Instructions : *1) Q. **1** and **2** are **compulsory**.*
*2) Answer **any three** questions from Q. **3** to Q. **7**.*
*3) **All** questions carry **equal** marks.*
*4) **Use** of non programmable calculator is **allowed**.*

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

1) Sand drops at a rate of σ kg/s onto a moving conveyor belt. The kinetic energy gained by the sand per unit time is

a) $\frac{mv^2}{2}$ b) $\frac{\sigma v^2}{2}$ c) $\frac{mv^2}{2\sigma}$ d) $\frac{\sigma v^2}{2m}$

2) A mass moving with speed V explodes into two pieces of masses m_1 and m_2, that go off at angles θ_1 and move θ_2 (as shown in adjacent figure). The magnitudes of the momenta of the two pieces are



a) $\frac{p_1}{p_2} = \frac{\sin\theta_1}{\sin\theta}$ b) $\frac{p_1}{p_2} = \frac{\sin\theta_2}{\sin\theta_1}$

c) $\frac{p_1}{p_2} = \frac{\cos\theta_1}{\cos\theta_2}$ d) $\frac{p_1}{p_2} = \frac{\cos\theta_2}{\cos\theta_1}$

3) The degrees of freedom of a dumbbell, whose center of mass is moving on a circular wire, are

a) Four b) Two c) Five d) Three

P.T.O.

4) A satellite revolving in elliptical orbit has v1 and v2 as the maximum and minimum velocities, respectively. The eccentricity 'e' of the orbit is given as

a) v_1/v_2 b) v_2/v_1

c) $(v_1 - v_2) / (v_1 + v_2)$ d) $(v_1 + v_2) / (v_1 - v_2)$

5) The Rutherford scattering cross section has dimensions of

a) area b) time c) length d) volume

6) The Lagrangian L for a charged particle (q) in electromagnetic field is

a) $L = T + q\phi + q(v \cdot A)$ b) $L = T - q\phi + q(v \cdot A)$

c) $L = T + q\phi - q(v \cdot A)$ d) $L = T - q\phi - q(v \cdot A)$

7) The Hamiltonian H for a simple pendulum of mass m and length l is

a) $H = \frac{p_\theta^2}{2ml^2} + mgl(1 - Cos\theta)$ b) $H = \frac{p_\theta^2}{2ml^2} + mg(1 - Cos\theta)$

c) $H = \frac{p_\theta^2}{2ml^2} - mgl(1 - Cos\theta)$ d) $H = -\frac{p_\theta^2}{2ml^2} + mgl(1 - Cos\theta)$

8) Which of the following relationship holds true for the Poisons beckets between Lx, Ly and Lz ?

a) $[L_x, L_y] = -1$ b) $[L_x, L_y] = 1$

c) $[L_x, L_y] = -L_z$ d) $[L_x, L_y] = L_z$

b) **True** or **false.** **6**

1) If a frame is inertial, then any frame moving with constant velocity relative to it, is also an inertial frame of reference.

2) Scleronomic constraints do not explicitly depend on time.

3) The generalized coordinates are always spherical polar coordinates.

4) If the force between the two particles is central, then the torque created by the force is zero.

5) For a parabolic orbit, total energy $E < 0$ and $e = 1$.

6) If the Lagrangian does not depend on time explicitly, then the kinetic energy of the system is constant of motion.

2. Answer in short.
   a) Hamilton's variational principle. **5**
   b) Work energy theorem. **5**
   c) Linear harmonic oscillator. **4**

3. a) Set up Lagrangian for a simple pendulum and obtain the equations of motion. **8**
   b) Show that the shortest distance between any two points is a straight line passing through them. **6**

4. a) State the Kepler's laws of planetary motions. Derive the Kepler's third law. **8**
   b) State and prove the Poison's theorem. **6**

5. a) Define Hamiltonian H and derive the Hamilton's canonical equations of motion. **8**
   b) What are constraints ? What are their types ? Explain with suitable examples. **6**

6. a) Discuss the principle of Least action with proof. **10**
   b) Obtain the differential equation of an orbit. **4**

7. a) Obtain an expression for Rutherfords scattering crossection and interprete. **10**
   b) Show that the transformation $Q = \sqrt{q}\cos 2p$ and $P = \sqrt{q}\sin 2p$ is canonical. Find out the generating function. **4**

SLR-MI – 575

Seat No.	

M.Sc. (Part – I) (Semester – I) (Old) Examination, 2016
(CGPA)
PHYSICS (Applied Electronics)
Paper – I : Mathematical Techniques

Day and Date : Tuesday, 29-3-2016 Total Marks : 70
Time : 10.30 a.m. to 1.00 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. 1) Choose the correct alternative. **6**

i) The value of $(\cos(2\pi/3) + i\sin(2\pi/3))^{1/4} =$

a) $\frac{\sqrt{2}}{3} + i\frac{1}{2}$ b) $\frac{\sqrt{3}}{2} - i\frac{1}{2}$ c) $\frac{\sqrt{2}}{3} - \frac{1}{2}$ d) $\frac{\sqrt{3}}{2} + \frac{1}{2}$

ii) The Cauchy Riemmann Equations are given by

a) $u_x = v_y$, $v_x = -u_y$ b) $u_x = v_y$, $v_x = u_y$
c) $-u_x = v_y$, $v_x = u_y$ d) $u_x = -v_y$, $v_x = -u_y$

iii) The general solution of the ordinary differential equation is the soultion in which the number of arbitrary constants equals

a) degree of differential equations
b) order of differential equations
c) no. of terms on LHS of differential equations
d) total no. of terms of the differential equation

iv) The Particular Integral of $(D^3 - 3D^2+4)y = e^{2x}$ is

a) $\frac{x}{6}e^{2x}$ b) $\frac{x^2}{6}e^{2x}$ c) $\frac{x^3}{6}e^{2x}$ d) 0

P.T.O.

v) Inverse Laplace Transform of $\frac{1}{(S-2)^{2+1}} =$

a) $e^{2t} \cos t$ b) $e^{t} \cos t$ c) $e^{2t} \sin t$ d) $e^{t} \sin t$

vi) Fourier Sine Integral of f(s) is given by

a) $\frac{2}{\pi} \int_0^\infty \sin wx \int_0^\infty f(s) \sin ws.dxds$

b) $\frac{2}{\pi} \int_0^\infty \sin wx \int_0^\infty f(s) \cos ws.dxds$

c) $\frac{2}{\pi} \int_0^\infty \sin wx \int_0^\infty f(s) \sin ws.dwds$

d) $\frac{2}{\pi} \int_0^\infty \sin wx \int_0^\infty f(s) \cos ws.dwds$

2) State **true** or **false**. **8**

i) The value of f(z) = u + iv is analytic function then both u and v are Harmonic.

ii) If the vectors are Linearly dependent then one vector can be expressed aslinear combination of others.

iii) Matrix digitalization of symmetric matrix is possible only if it has zero eigen values.

iv) A differential equation is said to be linear if the independent variable is having degree atmost one and dependent variable terms are not in multiplication.

v) $\frac{1}{D^2+16} \sin 4x$ is equal to $-\frac{x}{8}\cos 4x$.

vi) The conditions for expansion of function in a Fourier series are known as Dirichchlet's conditions.

vii) The value of $\frac{(\cos\theta + i\sin\theta)^8}{(\sin\theta + i\cos\theta)^4}$ is $\cos 12\theta + i \sin 12\theta$.

viii) $L\{f(at)\} = \frac{1}{a^2} L\{f(t)\}|_{s/a}$.

2. Write short notes on :

   1) Write a note on Analytic functions. **5**

   2) Write a note on the Particular Integral of a Linear Differential Equations with constant Coefficient. **4**

   3) Write a Fourier Series of f(x) on General Interval. **5**

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

   2) Solve $(D^2 - 2D + 4)y = e^x \cos^2 x$. **8**

4. 1) What are Harmonic conjugates ? Find the analytic function f(z) = u + iv given that $v = e^x(x \sin y + y \cos y)$. **10**

   2) Find Laplace of $\frac{1-\cos t}{t}$. **4**

5. 1) Define adjoint of the matrix. Hence find A^{-1} of the matrix using adjoint matrix method for $\begin{pmatrix} 2 & 5 & 3 \\ 3 & 1 & 2 \\ 1 & 2 & 1 \end{pmatrix}$. **8**

   2) Solve $(5+2x)^{\frac{d^2y}{dx^2}} - 6(5+2x)\frac{dy}{dx} + 8y = 6x$. **6**

6. 1) Find Fourier Transform of $f(x) = e^{-x^2/2}$. **8**

   2) Evaluate the integral using Laplace transform method $\int_0^\infty \frac{e^{-2t} - e^{-3t}}{t}\, dt$. **6**

7. 1) Define linear Dependence, Independence and Orthogonality of the vectors. **4**

   2) Find Fourier Series of $f(x) = \frac{1}{2}(\pi - x)$ in $(0, 2\pi)$. **10**

SLR-MI – 576

Seat No.	

M.Sc. – I (Semester – I) Examination, 2016
PHYSICS (Applied Electronics) (Old) (CGPA)
Paper – II : Condensed Matter Physics

Day and Date : Thursday, 31-3-2016 Total Marks : 70
Time : 10.30 a.m. to 1.00 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) Select correct alternatives : **8**

1) The property due to which the resistance of some metal or compound vanishes under certain conditions is
   a) Semiconductivity b) Superconductivity
   c) Curie point d) Magnetostriction

2) Schottky defect generally appears in
   a) NaCl b) CsCl
   c) KCl d) All of these

3) Which of the following statements about amorphous solids is incorrect ?
   a) They melt over a range of temperature
   b) There is no orderly arrangement of particles
   c) They are anisotropic
   d) They are rigid and incompressible

4) When electrons are trapped in the crystal lattice in place of anion vacancy, the defect in the crystal is known as
   a) Frenkel defect b) Schottky defect
   c) F-centre d) Dislocations

5) In a face centered cubic lattice the number of nearest neighbours for a given lattice point are
   a) 6 b) 4
   c) 8 d) 12

P.T.O.

6) A crystal may have one or more planes of Symmetry as well as one or more than one axis of symmetry but it has only
   a) Two centres of symmetry
   b) One centre of symmetry
   c) Four centres of symmetry
   d) No centre of symmetry

7) Ionic solids with Schottky defects contain in their structures
   a) Equal number of cation and anion vacancies
   b) Interstitial anions and anion vacancies
   c) Cation vacancies only
   d) Cation vacancies and interstitial cations

8) If we mix pentavalent impurity in a crystal lattice of germanium, the type of semiconductor formed is
   a) n-type b) p-type
   c) both n and p type d) none of the two

B) State **True** or **False** : **6**

1) Electrons are shared unequally in a polar covalent bond.
   a) True b) False

2) Diamond is a molecular crystal ?
   a) True b) False

3) Sodium chloride, NaCl usually crystallizes in a FCC lattice, 8 ions are in contact with any single Na^+ ion ?
   a) True b) False

4) Percentage of free space in cubic close packed structure and in BC packed structure are 26% and 32% respectively.
   a) True b) False

5) The appearance of colour in solid alkali metal halides is generally due to Schottky defect.
   a) True b) False

6) Number of atoms per unit cell of BCC are 2.
   a) True b) False

2. Write short notes **(any three)** : **14**
   a) Concept of brillouin zones
   b) Interplanar spacing
   c) Complex dielectric constant
   d) Simple cubic structure.

3. a) What is brillouin zone ? Sketch first and second brilloun zones in square lattice. **10**
   b) Define (i) lattice and (ii) crystal structure. **4**

4. a) Derive equation for wave of electron in periodic potential. **8**
   b) Explain the periodic and extended zone schemes. **6**

5. a) Derive an expression for effective mass of an electron. **8**
   b) Derive an expression for dielectric relaxation in alternating fields. **6**

6. a) Derive London equations. **8**
   b) Discuss the static dielectric constant for gases. **6**

7. a) Write about reciprocal lattice. **8**
   b) Distinguish between type I and II superconductors. **6**

SLR-MI – 577

Seat No.	

M.Sc. (Part – I) (Semester – I) (CGPA) (Old) Examination, 2016
PHYSICS (Appl. Electronics)
Paper – III : Analog and Digital Electronics

Day and Date : Saturday, 2-4-2016 Total Marks : 70
Time : 10.30 a.m. to 1.00 p.m.

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

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

1) The input offset current equals to _____
   a) average of two base currents
   b) collector current divided by the current gain
   c) difference between two base-emitter voltages
   d) difference between two base currents

2) Instrumentation amplifiers are normally used to measure _____
   a) small differential signal voltages
   b) signals superimposed on a common-mode voltage often much larger than the signal voltage
   c) both of the above
   d) none of the above

3) Minimum frequency at which a crystal will oscillate is known as _____
   a) seventh harmonic b) third harmonic
   c) fundamental d) second harmonic

4) An op-amp integrator has a square-wave input. The output should be _____
   a) a sine wave b) a triangle wave
   c) a square wave d) pure dc

5) In 8085 _____ interrupt has highest priority.

a) INTR b) TRAP

c) RST 7.5 d) RST 6.5

6) The attenuation of the three-section RC feedback phase-shift oscillator is

a) 1/3 b) 1/9 c) 1/29 d) 1/30

7) Switching regulator efficiencies can be greater than _____ percent.

a) 60 b) 70 c) 80 d) 90

8) Which of the following is correct data for a D latch ?

a) The output toggles if one of the inputs is held HIGH

b) Q output follows the input D when the enable is HIGH

c) Only one of the inputs can be HIGH at a time

d) The output complement follows the input when enabled

b) State whether the following are **True** or **False** : **6**

1) The lead-lag circuit determines the frequency of output for a Wien-bridge oscillator.

2) A switching regulator can be configured as a step-up or a step-down voltage regulator.

3) Operational amplifiers are digital devices.

4) HL pair is known as memory pointer.

5) MVI A, 00 H is two byte instruction.

6) For a Wien-bridge oscillator, resonance occurs when $V_{out}/V_{in} = 1$.

2. Explain **any three** of the following : **14**

1) Multiplexer

2) Encoder

3) Flag register in 8085

4) Adjustable voltage regulator.

3. a) Draw the circuit of triangular wave generator using an op-amp. Explain the operation of circuit drawing output waveform. **8**

   b) Explain the following terms for an op-amp : **6**

      a) Non-inverting input

      b) Frequency response

      c) Slew rate.

4. a) Draw a practical circuit of Summing amplifier. Explain its operation. Derive expression for its gain. **8**

   b) What is common mode signal ? Find common-mode gain of differential amplifier. **6**

5. a) Draw a master slave JK flip flop. Explain its operation. **8**

   b) What are decoders ? Explain 3 to 8 decoder giving its truth table. **6**

6. a) With the help of suitable block diagram explain the bus structure in 8085 microprocessor. **8**

   b) Write a program in 8085 assembly language to add two 8-bit numbers stored in consecutive memory locations. Program must take care of carry. **6**

7. a) Draw the logic circuit using NOR gates to implement the Boolean expression $AB + \overline{B}C$. **8**

   b) Define supply voltage sensitivity. What is meant by a poorly regulated power supply ? **6**

SLR-MI – 578

Seat No.	

M.Sc. (Part – I) (Semester – I) (Old) (CGPA) Examination, 2016
PHYSICS (Applied Electronics)
Paper – IV : Classical Mechanics

Day and Date : Tuesday, 5-4-2016 Max. Marks : 70

Time : 10.30 a.m. to 1.00 p.m.

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

*2) Attempt **any three** from Q. **3** to Q. **7**.*

*3) Figures to the **right** indicates **full** marks.*

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

1) The work done by the external force, Fupon the particle in going from point 1 to 2 is

a) $W_{12} = \int F \times ds$ b) $W_{21} = \int F \times ds$

c) $W_{12} = \int_1^2 F.ds$ d) $W_{21} = \int_1^2 F.ds$

2) The restricted Hamilton-Jacobi equation which does not involve time is

a) $H(q,p,t) + \partial F / \partial t = 0$

b) $H(q_1, ... q_n; \frac{\partial F2}{\partial qi} ..... \frac{\partial F2}{\partial qn}; t) + \partial F2 / \partial t = 0$

c) $H(q_i, \partial \omega / \partial qi) = \alpha_i$

d) $K = H + \partial F / \partial t$

3) The non-holonomic constraint for a particle placed on the surface of a sphere can be expressed as

a) $(r_i - r_j)^2 - C_{ij}^2 = 0$ b) $r^2 - a^2 \geq 0$

c) $r^2 - a^2 \leq 0$ d) $(r_i - r_j)^2 + C_{ij}^2 = 0$

P.T.O.

4) In central force laws, if the potential energy, $V = -k/r$, then
   a) $f = -k/r^2$ b) $f = k/r^2$
   c) $f = k/r$ d) $f = -k/r$

5) The problem used to find the curve joining two points along which a particle falling from rest under the influence of gravity travels from the higher to the lower point in the least time refers to
   a) Bertrand's theorem b) The Brachistochrone problem
   c) Conservation theorem d) Virial theorem

6) "The motion of the system from time t_1 to t_2 is such that the line integral, $I = \int_{t_1}^{t_2} L dt$ where $L = T - V$ has a stationary value for the actual path of motion". This statement refers to
   a) D'Alembert's principle
   b) Kepler's laws
   c) Hamilton's principle
   d) Motion of artificial satellites

7) Under canonical transformations, $F_3 = p_i Q_i$, $Q_i = -q_i$ and $P_i = p_i$ correspond to which of the following generating function ?
   a) $F = F_2 (q, P, t) - Q_i P_i$
   b) $F = F_3 (p, Q, t) + q_i p_i$
   c) $F = F_1 (q, Q, t)$
   d) $F = F_4 (p, P, t) + q_i p_i - Q_i P_i$

8) If the transformation is canonical, then the Poisson bracket has _____ when evaluated w.r.t. any canonical set of variables.
   a) same value b) different value
   c) no value d) none of the above

b) **True/False** : **6**

1) Non-holonomic constraints can be put in the form of an inequality.
2) Constraints do not reduce the number of degrees of freedom of a system.
3) Kepler's laws of planetary motion are three in number similar to Newton's laws of terrestrial motion.
4) Differential scattering cross-section defines the ratio of the number of particles scattered into the solid angle per unit time to that of incident intensity.
5) The transformation is canonical if $p\,dq - P\,dQ$ is not an exact differential.
6) q_is which are present in Lagrangian are called cyclic coordinates.

2. Write short answers **any three** : **14**

   a) What are gyroscopic forces ? Explain. **4**

   b) Explain the Kepler's laws of planetary motion. **5**

   c) Explain Hamilton's variational principle. **4**

   d) Illustrate canonical transformation with an example. **5**

3. a) Describe the symmetries of space and time with conservation laws. **6**

   b) State laws of conservation of linear, angular momentum and energy of a system. **8**

4. a) Explain how constraints reduce the number of degrees of a system. **6**

   b) Set up the Lagrange's equation of motion for a bead sliding on a rotating wire. **8**

5. a) Set up the conditions for a transformation to be canonical. **6**

   b) Find under what conditions $Q = \alpha p / x, P = \beta x^2$ where α and β are constants, represents a canonical transformation for a system of one degree of freedom, and obtain a suitable generating function. **8**

6. a) What is the significance of H-J formalism ? **4**

   b) Obtain Hamilton's canonical equations in Poisson bracket notations. **10**

7. a) Explain why D'Alembert's formalism is called a differential formalism. **6**

   b) Describe any one example of Hamilton's equation of motion. **8**

SLR-MI – 579

Seat No.	

M.Sc. (Part – I) (Semester – II) (New CBCS) Examination, 2016
PHYSICS (Applied Electronics)
Paper – V : Statistical Mechanics

Day and Date : Wednesday, 30-3-2016 Total Marks : 70
Time : 10.30 a.m. to 1.00 p.m.

Instructions *: 1) Q.* ***1*** *and Q.* ***2*** *are* ***compulsory****.*
2) Attempt ***any three*** *form Q.* ***3*** *to Q.* ***7****.*
3) Figures to the ***right*** *indicate* ***full*** *marks.*
4) ***Use*** *of nonprogrammable calculator is* ***allowed****.*

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

1) If r be the ratio of the probability that the two particles are found in the same state to the probability that two particles belongs to different states, then the ratio $r_{MB} : r_{BE} : r_{FD}$ is _____

a) $\frac{1}{2} : 1 : 0$ b) $1 : 0 : 2$ c) $1 : 1 : 2$ d) $1 : \frac{1}{2} : 0$

2) The fluctuation in velocity in MB distribution is related to temperature as _____

a) $\alpha\ T$ b) αT^2 c) αT^3 d) $\alpha T^{1/2}$

3) The entropy change can be calculated by using the expression $\Delta S = q_{rev}/T$. When water freezes in a glass beaker, choose the correct statement amongst the following

a) ΔS (system) decrease but ΔS (surroundings) remains the same

b) ΔS (system) increases but ΔS (surroundings) decreases

c) ΔS (system) decreases but ΔS (surroundings) increases

d) ΔS (system) decreases and ΔS (surroundings) also decreases

P.T.O.

4) Thermodynamics mainly deals with _____

a) Interrelation of various forms of energy and their transformation from one form to another

b) Energy changes in the processes which depend only on initial and final states of the microscopic systems containing a few molecules

c) How and at what rate these energy transformations are carried out

d) The system in equilibrium state or moving from one equilibrium state to another non-equilibrium state

5) The ratio of two specific heats ($\gamma = C_p/C_v$) of a diatomic gas is _____

a) 1.66 b) 1.40 c) 1.33 d) 1.52

6) The phase space diagram of system is _____

a) Momentum vs. velocity

b) Momentum vs. energy

c) Momentum vs. wave vector

d) Momentum vs. position

7) The extensive property of a thermodynamic system is _____

a) Viscosity b) Surface tension

c) Refractive index d) Heat capacity

8) With rise of temperature, the specific heat of water _____

a) Increases

b) Decreases

c) First decreases to minimum then increases

d) Remains constant

B) Fill in the blanks/State **true** or **false** : **6**

1) _____ ensemble is related to thermal equilibrium of system.

2) Plank's radiation law can be derived by using _____ Statistics.

3) Fermi energy gives the value of energy in F.D. system upto which all the energy states _____

4) B.E. statistics is applicable to photons and symmetric particles. (True/False).

5) The partition function represents the number of thermally accessible energy levels at a given temperature. (True/False).

6) Equipartition theorem is a classical theorem that states that every degree of freedom for motion has an energy of $\frac{1}{2}k_BT$. (True/False).

2. Attempt the following : **14**

a) Derive mean energy of classical one dimensional harmonic oscillator. **5**

b) What is phase space ? **5**

c) Prove that, $N = kT\{[\partial /nZ]/[\partial \mu]\}$; where μ is the chemical potential. **4**

3. Answer the following :

a) Discuss the condition for ideal Bose gas. **8**

b) Establish the relations : $E = \{[\partial(\beta F)]/[\partial \beta]\}_v$. **6**

4. Answer the following :

a) Show that the Sackur-Tetrode equation, may be written in the form :

$$S = NK\{-/np + \left(\frac{5}{2}\right)/nT + \left(\frac{3}{2}\right)/n\left(\frac{2m\pi}{h^2}\right) + \left(\frac{5}{2}\right)(/nk + 1)\}$$

where p is the pressure of the ideal gas. **10**

b) Write a short note on Bose-Einstein's condensation. **4**

5. Answer the following :

   a) Prove, in quantum statistical mechanics that, **10**

   $$\left\langle E^2 \right\rangle - \left\langle E \right\rangle^2 = kT^2 C_v$$

   b) Write a short note on Ensembles. **4**

6. Answer the following :

   a) Show that an average energy of a single partied of ideal Femi gas is 3/5 the Femi energy of a system. **10**

   b) Write down Langevin's suggestion on force related to Brownian motion of particles. **4**

7. Answer the following :

   a) Verify Liouville's theorem in the case of the motion of three particles in a constant gravitation alfield. **8**

   b) Discuss the conditions under which two phases remain in equilibrium with each other. **6**

SLR-MI – 580

Seat No.	

M.Sc. (Part – I) (Semester – II) (New) (CBCS) Examination, 2016
PHYSICS (Applied Electronics)
Paper – VI : Quantum Mechanics

Day and Date : Friday, 1-4-2016 Total Marks : 70

Time : 10.30 a.m. to 1.00 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.*
*4) Use of non-programmable calculator is **allowed**.*

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

1) Consider the states, $|\psi_1\rangle = \frac{1}{\sqrt{6}}|1\rangle + \frac{1}{\sqrt{2}}|0\rangle + \frac{1}{\sqrt{3}}|-1\rangle$ and

$|\psi_2\rangle = -\frac{1}{\sqrt{6}}|1\rangle + a|0\rangle - \frac{1}{\sqrt{3}}|-1\rangle$ then value of a for which these states are orthogonal is _____

a) $\frac{1}{\sqrt{2}}$ b) $\sqrt{2}$ c) $-\frac{1}{\sqrt{2}}$ d) $-\sqrt{2}$

2) For the Gaussian wave function $\psi(x) = Ne^{-x^2/2\sigma^2}$ where $-\infty < x < +\infty$, the value of N is _____

a) $\pi\sigma^2$ b) $\frac{1}{\sqrt{\pi\sigma^2}}$ c) $\sqrt{\pi\sigma^2}$ d) $\frac{1}{\pi\sigma^2}$

3) If a proton and electron have a same de-Brogalie wavelength of $3\,\mathring{A}$ then _____

a) Both have same kinetic energy
b) Both have same velocity
c) Both have same momentum
d) Kinetic energy of an electron is less than that of a proton

P.T.O.

4) If the wave function for a particle moving in x direction is $\psi(x) = A\, e^{ikx}$, where $0 < x < L$, then the Normalization Constant A is _____

a) $\frac{\sqrt{2}}{\sqrt{L}}$ b) $\frac{1}{\sqrt{L}}$ c) $\frac{\sqrt{2}}{\sqrt{x}}$ d) $\frac{1}{\sqrt{x}}$

5) A particle of mass m is confined in the ground state of a one dimensional box extending from x = –2L to x = +2L. The wave function is $\psi(x) = \psi_0 \cos\left(\frac{\pi x}{4L}\right)$ where ψ_0 is constant. The energy corresponding to this state is _____

a) $\frac{\hbar^2\pi^2}{2mL^2}$ b) $\frac{\hbar^2\pi^2}{4mL^2}$ c) $\frac{\hbar^2\pi^2}{8mL^2}$ d) $\frac{\hbar^2\pi^2}{32mL^2}$

6) The ground state energy of the hydrogen atom is –13.6 eV. The energy of the second excited state is _____

a) –0.5 eV b) –1.5 eV c) –4.5 eV d) –6.8 eV

7) The graph of probability density versus r for a Hydrogen atom in state n = 2 shows _____ peaks.

a) none b) one c) two d) three

8) The average nuclear charge for an electron in an atom _____ for larger values of 'l'.

a) increases b) decreases
c) first increases and then decreases d) none of these

9) The linear combination of atomic orbitals gives _____ energies and molecular orbital.

a) Accurate b) Approximate
c) Depending on Hamiltonian d) None of these

10) The electrons in K shell have _____ spins.

a) parallel b) antiparallel c) no d) none of these

11) Quantum mechanical Harmonic Oscillator approaches the classical oscillator for _____

a) small values of quantum number n
b) large values of quantum number n
c) independent of n
d) none of these

12) The force constant k is given as _____
a) $m\omega^2$ b) $m^2\omega^2$ c) $m^2\omega$ d) $m\omega^3$

13) Which of the following matrices is Hermitian ?
a) $\begin{bmatrix} i & 0 \\ 0 & i \end{bmatrix}$ b) $\begin{bmatrix} i & 0 \\ 0 & -i \end{bmatrix}$ c) $\begin{bmatrix} 0 & i \\ i & 0 \end{bmatrix}$ d) $\begin{bmatrix} 0 & i \\ -i & 0 \end{bmatrix}$

14) Eigen values of an unitary operator are
a) real b) imaginary c) ± 1 d) zero

2. Write short answer of the following :
a) With proper operators, derive Schrödinger's equation. Separate the time dependent form of the equation. **5**
b) Taking into consideration all interactions, derive an expression for the Hamiltonian of many electron atom. **5**
c) Show that the eigen functions ψ_1 and ψ_2 of a Hermitian operator having eigen values m and n are orthogonal to each other. **4**

3. a) Solve the Schrödinger equation for the system of particle in a box and obtain the expression for energy eigen value and normalized wave function. **10**
b) Which parameters affect the energy eigen value of a particle in a box ? **4**

4. a) Discuss the Harmonic Oscillator problem in one dimension. Solve the Schrödinger equation and obtain the energy and normalized wave functions. **10**
b) Show the graphs of first few wave functions and probability densities of harmonic oscillator. **4**

5. a) Set up a Schrodinger equation in spherical polar co-ordinates for hydrogen atom. **6**
b) Solve the (H) part of the above equation. Write the normalized eigen functions for (H) part. **8**

6. a) What is spin orbital ? **2**
b) Using Pauli's principle define the wave function ψ for two electron atom. **4**
c) Generalize this equation for the system of n electrons and explain the slater determinant. **8**

7. a) Give details of the LCAO approximation and hence explain the secular equation. **10**
b) Explain the Hamiltonian of hydrogen molecule. **4**

SLR-MI – 581

Seat No.	

M.Sc. – I (Semester – II) (New-CBCS) Examination, 2016
PHYSICS (App.Elec.)
Paper – VII : Electrodynamics

Day and Date : Monday, 4-4-2016 Total Marks : 70
Time : 10.30 a.m. to 1.00 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.*
*4) **Use** of non programmable calculator is **allowed**.*

1. Objective questions : **14**

a) Choose correct alternatives : **8**

1) Which one of the fundamental equation was modified by Maxwell to form the basis of electromagnetic theory ?
   a) Gauss law of electrostatic
   b) Gauss law of magnetostatic
   c) Faraday law
   d) Ampere law

2) A magnetic field strength of $H_o \mu A/m$ is measured at a point $\theta = \pi/2$, d km from four antennas in air-a Hertzian dipole of length $\lambda/2$, a half wave dipole, a quarter wave monopole and a 5 turn loop antenna of radius $\lambda/20$. The maximum power transmitted is by
   a) Quarter wave monopole b) A half wave dipole
   c) Hertzian dipole d) Loop Antenna

3) The displacement current J_D is
   a) Hypothetical
   b) Dominant at low frequencies
   c) Dominant at high frequencies
   d) Dominant in time independent case

4) For a circular loop of constant surface area, the Faraday law gives $\nabla \times E = -dB/dt$. The electric field in this case is
   a) Conservative
   b) Equal to ∇V
   c) Quasi-conservative
   d) Non-conservative
5) Maxwell inserted the expression for displacement current J_D in Ampere's law to satisfy
   a) Ampere's law for time varying case
   b) Faraday's law
   c) Gauss law
   d) Equation of continuity
6) The effective length of an antenna depends on
   a) The current distribution
   b) Angle of radiation
   c) The wavelength of radiation
   d) Area of cross section
7) Which of the following circuit element will oppose the change in circuit current ?
   a) Capacitor b) Resistor
   c) Inductor d) All of the above
8) Electromagnetic wave is incident on a dielectric conductor interface at a certain angle θ. The non zero electric field E will be always at an angle
   a) 0° b) 45°
   c) 60° d) 90°

B) **True** or **False** : **6**

1) Lorentz condition is invariant in those gauge functions which are the solutions of homogeneous wave equations.
2) The incident, reflected, refracted waves and also the normal to the interface do not lie in the same plane.
3) The normal component of electric displacement is not continuous across the interface and changes by an amount equal to the free surface density of charge at the interface.

4) Even if Poynting vector is zero, some electromagnetic energy can flow across a closed surface.

5) Maxwell's equations are viewed as a unification of magnetic and electric forces.

6) The field vectors E and H are attenuate exponentially as the wave penetrates the conducting medium.

2. Write short answers : **14**

a) State and explain the Faraday's laws of electromagnetic induction. **5**

b) Write the Maxwell's equation for free space in differential form. **5**

c) Write Maxwell's equation for a moving media. **4**

3. a) Prove the Poynting's theorem relating to the flow of energy at a point in space in an electromagnetic field. **8**

b) A plane electromagnetic wave is incident on a dielectric surface. Find the amplitudes of the reflected and refracted wave and discuss their phase change. **6**

4. a) Obtain Lorentz condition which exhibits interrelationship of electromagnetic potentials. **8**

b) Obtain Wave equations in terms of electromagnetic potentials. **6**

5. a) What is the physical meaning of radiation resistance ? Obtain its value for a dipole antenna. Justify the selection of $\lambda/2$ antenna on this basis. **8**

b) Find out the power radiated by an oscillating electric dipole and describe its angular distribution. **6**

6. a) Establish the boundary conditions for electromagnetic field. **8**

b) Write a note on Gauge transformations. **6**

7. a) Explain the propagation of EM waves in a conducting media. **8**

b) Show that the electrostatic energy density is equal to magnetostatic energy density. **6**

SLR-MI – 582

Seat No.	

M.Sc. (Part – I) (Semester – II) Examination, 2016
(New) (CBCS)
PHYSICS (Applied Electronics)
Paper – VIII : Microprocessors and Microcontrollers

Day and Date : Wednesday, 6-4-2016 Max. Marks : 70
Time : 10.30 a.m. to 1.00 p.m.

Instructions : *1) Question (**1**) and (**2**) are **compulsory**.*
*2) Answer **any three** questions from Q. **3** to Q. **7**.*
*3) **All** questions carry **equal** marks.*
*4) **Use** of non programmable calculator is **allowed**.*

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

1) 8086 has a _____ bit address bus and can access upto 1 MB memory locations.

a) 20 b) 16 c) 8 d) 32

2) The minimum mode of 8086 is _____ microprocessor configuration.

a) multi b) single c) double d) both a) and c)

3) The _____ segment in 8086 microprocessor holds the program instruction codes.

a) code b) data c) extra d) stack

4) In 8051, which interrupt has highest priority ?

a) IE1 b) TF0 c) IE0 d) TF1

5) In 8051, after reset, SP register is initialized to _____ address.

a) 08 H b) 07 H c) 09 H d) 06 H

6) _____ pin of port 3 in 8051 has an alternate function as write control signal for external data memory.

a) P 3.8 b) P 3.6 c) P 3.3 d) P 3.1

P.T.O.

7) How many bytes of bit addressable memory is present in 8051 ?

a) 8 bytes b) 32 bytes c) 16 bytes d) 128 bytes

8) In 8086, BIU prefetches the instructions from memory and store them in ___

a) queue b) register c) memory d) stack

B) State **True** or **False**. **6**

1) Addressing modes indicate a way of locating data or operands.
2) The 8086 has clock generator inside the chip.
3) In maximum mode operation of 8086 microprocessor, the control signals are issued by the 8288 bus controller.
4) The RST pin requires a HIGH to reset the 8051 microcontroller.
5) The address range of SFRs in the 8051 is 80-0FH.
6) PSEN pin of the 8051 is used to select external code memory.

2. Attempt the following : **14**
   1) Explain the concept of segmented memory. What are its advantages ? **5**
   2) Briefly explain the maximum mode configuration of 8086. **5**
   3) List the features of 8051 microcontroller. **4**

3. a) Draw and explain the architecture of 8086 microprocessor. **10**
   b) Describe the function of the following pins and their use in 8086 based system.
      i) NMI ii) HLT iii) NOP iv) WAIT **4**

4. a) Explain the data transfer instruction in 8086 with suitable example for each. **10**
   b) Write a short note on interrupts of 8086. **4**

5. a) Draw and explain the pin configuration of 8086 µp and explain the function of each pin. **10**
   b) Write an assembly language program for multiplication of 16-bit number using 8086 µp instructions. **4**

6. a) Explain the operating modes of timer in 8051. **10**
   b) Write an ALP to find out maximum value in an array using 8051 instructions. **4**

7. a) Explain the programming model of 8051 in detail. **8**
   b) Explain the interfacing of LED with 8051 microcontroller. **6**

SLR-MI – 583

Seat No.	

M.Sc. (Part – I) (Semester – II) Examination, 2016
PHYSICS (Applied Electronics)
Paper – V : Statistical Mechanics (Old) (CGPA)

Day and Date : Wednesday, 30-3-2016 Total Marks : 70

Time : 10.30 a.m. to 1.00 p.m.

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

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

i) For _____ ensemble $\frac{\partial \varrho}{\partial T} = 0$.

a) Non stationary b) Stationary
c) Vibrating d) All

ii) The chemical potential for photon gas is

a) Greater than zero b) Less than zero
c) Equal to zero d) Not defined

iii) μ -Space for single particle is

a) Two dimensional b) Three dimensional
c) Six dimensional d) Dimensionless

iv) If the system is to be equilibrium state, what three quantities are constant thought the system ?

a) T, S, P b) T, S, μ c) T, P, μ d) E, V, N

v) Which law of thermodynamics is the law of conservation of energy ?

a) 0^{th} b) 1^{st} c) 2^{nd} d) 3^{rd}

P.T.O.

vi) In grand canonical ensemble, system exchange

a) Only matter b) Only energy

c) Only temperature d) Both energy and matter

vii) How much dimension phase space have ?

a) N b) 3N c) 6N d) 2N

viii) For classical ideal gas C_v =

a) 3/2 NkT b) 2/3 NkT c) 2Nk d) 3/2 Nk

B) Fill in the blanks/state **true** or **false** : **6**

i) In _____ order phase transition heat is evolved or absorbed.

ii) Critical temperature corresponding to the critical point Tc = _____

iii) Louville's equation gives the rate of change in _____

iv) Diffusion process is irreversible (True/False).

v) In canonical ensemble, the system exchange only energy (True/False).

vi) A quantitative explanation of Brownian motion was given by Plank (True/False).

2. Attempt the following :

a) Explain triple point. **5**

b) Clausius-Clayperon equation. **5**

c) Fugacity of the gas. **4**

3. A) Write about classical ideal gas. **10**

B) Write the condition for the system to be in equilibrium. **4**

4. A) What is Gibb's paradox ? **4**

B) How Gibb's paradox is resolved using partition function ? **10**

5. A) What is Phase transition ? **4**

B) Give the condition for phase equilibrium. **10**

6. A) Write in detail about critical indices and Vander Walls constants. **10**

B) Give the equation of reduced states. **4**

7. A) Write about Brownian motion. **4**

B) Give the Fokker-Plank equation. **10**

_____

SLR-MI – 584

Seat No.	

M.Sc. (Part – I) (Semester – II) (Old CGPA) Examination, 2016
PHYSICS (Applied Electronics)
Paper – VI : Quantum Mechanics

Day and Date : Friday, 1-4-2016 Max. Marks : 70

Time : 10.30 a.m. to 1.00 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 **full** marks.*

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

i) The de Brogalie wavelength of a charge q, accelerated through a potential difference of V volts is

a) $\lambda = \frac{h}{\sqrt{mqV}}$ b) $\lambda = \frac{hm}{\sqrt{qV}}$ c) $\lambda = \frac{h}{\sqrt{2mqV}}$ d) $\lambda = \frac{h}{mqV}$

ii) For a particle moving in x direction and having a wave function ψ = A sin (kx – wt), its energy is

a) $\frac{k^2\hbar^2}{2m}$ b) $\frac{k\hbar}{2m}$ c) $\frac{\hbar^2k^2}{m}$ d) $m^2\hbar^2$

iii) The uncertainty product $\Delta x \,.\, \Delta p$ for a harmonic oscillator is

a) $\frac{h}{2\pi}$ b) $\frac{h}{4\pi}$ c) $\frac{nh}{2\pi}$ d) $(n+1)\frac{h}{2\pi}$

iv) The operator $\frac{d^2}{dx^2}$ has the eigen value corresponding to an eigen function sin(α x) as

a) 4 b) 2 c) 2i d) – 2i

P.T.O.

v) The zero point energy of an electron in a one dimensional box of length 'a' is

a) $\frac{h^2}{8m_e a^2}$ b) $\frac{h^2}{4\pi m_e a^2}$

c) $\frac{h^2}{4m_e a^2}$ d) $\frac{h^2}{8m_e a^2}$

vi) The energy of hydrogen like atoms depends on

a) n^2 b) $\frac{1}{n^2}$ c) $\frac{1}{n}$ d) n^3

B) Write whether following statements are **True** or **False** : **4**

vii) The quantity $\frac{\hbar^2}{me^2}$ has the dimension of length.

viii) Eigen values of the Hermitian operator are not real.

ix) The eigen value of the first excited state of the one dimensional harmonic oscillator is 2 $\hbar w$.

x) The 1s orbital is the lowest energy orbital of the hydrogen.

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

xi) The system of H_2^+ is composed to two protons and _____

xii) Eigen functions of Harmonic oscillator are _____ polynomials.

xiii) The operator which represents energy in quantum mechanics is _____

xiv) Long form of LCAO is _____

2. Answer in brief : **14**

a) Explain the Dirac Delta function and its properties.

b) Prove that if Ψ_1 and ψ_2 are the eigen functions of the Hermitian operator with eigen values a_1 and a_2, then these eigen functions are orthogonal to each other.

c) Show that the total wave function of a many electron system is given by a product of one electron functions and not by a sum.

3. a) Set up Schrödinger equation for one dimensional box. Obtain energy eigen values and zero point energy. **6**

   b) Obtain the normalized eigen function for the particle in a box and also discuss orthogonality. **8**

4. a) Using the Schrödinger equation, obtain the eigen functions and energy levels for a one dimensional harmonic oscillator. **10**

   b) Show that $H_3(\xi) = 8\xi^3 - 12\xi$, where $H_3(\xi)$ is Hermite polynomial. **4**

5. a) Solve the Radial wave eqn. of hydrogen like atom. Discuss the r dependent part of the wave eqn. **10**

   b) State and explain normalized wave function for $R_{nl}(r)$. **4**

6. a) The Hamiltorian of Helium is given as $H = H_1 + H_2 + \frac{1}{r_{12}}$, where Hi = $-\frac{1}{2}\nabla_i^2 - \frac{2}{ri}$

   use the wave function. $\psi_0 = \frac{1}{\sqrt{2}}[1s(1)1s(2)][\alpha(1)\beta(2) - \beta(1)\alpha(2)]$ where, all symbols have usual meanings in the context of Helium atom. **10**

   b) Obtain the ground state energy of Helium. **4**

7. a) Within the framework of LCAO approximation evaluate the energy of a H_2 molecule. Define various integrals and the observed potential energy curves. **10**

   b) Write a note on Slaters rule. **4**

SLR-MI – 585

Seat No.	

M.Sc. – I (Semester – II) (Old CGPA) Examination, 2016
PHYSICS (Applied Electronics)
Paper – VII : Electrodynamics

Day and Date : Monday, 4-4-2016

Time : 10.30 a.m. to 1.00 p.m. Max. Marks : 70

***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 :

A) Choose correct alternative. **8**

1) Electric potential ϕ is a _____ potential.

a) Vector b) Scalar c) Both d) None of the above

2) Transmitted and incident waves are always

a) in phase b) out of phase

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

3) For quadrapole

a) $v \sim 1/r^2$ b) $v \sim 1/r^3$ c) $v \sim 1/r^1$ d) $v \sim 1/r^4$

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

6) In region far form electric charge the scalar potential become _____ known as _____ gauge.

a) Zero, radiation b) Infinite, radiation

c) Finite, radiation 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) Lorentz transformation itself in the sense A^{μ} is not a true 4-vector in coulomb gauge.

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

3) Half wave antenna is a simply straight conductor.

4) The speed which is significant proportion of the speed of light called relativistic.

5) All Maxwell's equations are homogenous.

6) When light passes from air to glass, R is less than T.

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

1) Hertz potential.

2) Skin depth.

3) Terminology of sin wave.

4) Gauge transformation.

3. a) Give energy relations in quasi stationery current systems. **8**

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

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

   b) Explain radiation form half wave antenna. **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 reflection and refraction of electromagnetic wave across the interface for the case of oblique incidence. **8**

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

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SLR-MI – 586

Seat No.	

M.Sc. (Part – I) (Semester – II) (Old – CGPA) Examination, 2016
PHYSICS (Applied Electronics)
Paper – VIII : Microprocessor and Microcontrollers

Day and Date : Wednesday, 6-4-2016 Total Marks : 70
Time : 10.30 a.m. to 1.00 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) PC in 8086 microprocessor is
   a) Program counter b) Personal computer
   c) Program controller d) Program count

ii) AX is
   a) 17-bit Register b) 16-bit Register
   c) 8-bit Register d) 64-bit Register

iii) Number of interrupt sources in 8051 microcontroller
   a) 5 b) 7 c) 8 d) 10

iv) Control transfer instruction in 8086 microprocessor
   a) JMP b) JNZ
   c) MOV d) Both a) and b)

v) Logical instruction
   a) AND b) ADD c) ROR d) MUL

vi) Co-processor of 8086 microprocessor
   a) 8087 b) 8085 c) 8084 d) 8284

vii) 8051 microcontroller has
   a) 42 Pins b) 40 Pins c) 20 Pins d) 10 Pins

viii) Size of PSW in 8051
   a) 8-bit b) 9-bit c) 7-bit d) 16-bit

P.T.O.

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

i) Microcontroller can be defined as _____

ii) Number of data and address lines in 8086 microprocessor _____

iii) The vector addresses of $\overline{INT}0$ and $\overline{INT}1$ are _____

iv) SI and DI are _____

v) What is the role of ALE pin in 8051 _____

vi) What is the size of bit addressable memory in 8051 _____

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

a) Explain the role of M/$\overline{IO}$ and $\overline{BHE}$ pins of 8086 microprocessor.

b) Discuss the addressing modes of 8086 microprocessor with examples.

c) Describe the salient features of 8051.

d) Explain arithmetic instructions of 8051 microcontroller.

3. A) With the help of diagram explain the architectural features of 8086 microprocessor. **10**

B) Differentiate minimum and maximum mode operations of 8086 microprocessor. **4**

4. A) Discuss the classification of instruction set of 8086 microprocessor. **10**

B) Write an ALP to convert 8-bit HEX number into corresponding BCD number. **4**

5. A) Draw the block diagram of 8051 microcontroller. Explain the working of parallel ports of 8051. **10**

B) Explain the working of logical instructions of 8051 microcontroller. **4**

6. A) With a neat diagram explain interfacing of 16KB of program memory with 8051 microcontroller. **10**

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

7. A) Explain the interfacing of DAC with 8051 microcontroller. Write ALPs to generate square and triangular wave forms. **10**

B) Write an 8051 ALP to arrange the given array of numbers in the ascending order. **4**

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SLR-MI – 587

Seat No.	

M.Sc. – II (Semester – III) (New) (CGPA) Examination, 2016
PHYSICS (Applied Electronics)
Paper – IX : Semiconductor Devices

Day and Date : Tuesday, 29-3-2016 Max. Marks : 70
Time : 2.30 p.m. to 5.00 p.m.

Instructions : *1) Attempt **five** questions.*
*2) Q. **1** and Q. **2** are **compulsory**.*
*3) Solve **any three** from Q. **3** – Q. **7**.*
*4) **Use** of non-programmable calculator is **allowed**.*

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

1) The safety factor in power diode is

a) $\frac{t_a}{t_b}$ b) $\frac{t_b}{t_a}$ c) $t_a . t_b$ d) $\frac{1}{t_a . t_b}$

2) CMOSFET uses only _____ type MOSFET's.

a) Enhancement b) Depletion c) Both a) and b) d) IGBT

3) In a triac, the most sensitive mode of operation is the mode that requires _____ gating signal.

a) least b) maximum c) zero d) intermediate

4) When a MOS-diode is biased with a large voltage (V > 0), _____ crosses _____ to establish an inversion.

a) E_i, E_c b) E_i, E_v c) E_F, E_i d) E_i, E_F

5) The ground state degeneracy for an acceptor is

a) 6 b) 9 c) 1 d) 4

6) Modern MOSFET's are fabricated on a _____ Si.

a) < 111 > b) < 110 > c) < 101 > d) < 100 >

7) The wavelength (λ) and photon energy ($h\nu$) are related as

a) $\lambda = h\upsilon$ b) $\lambda = \frac{1.24}{h\upsilon}$ c) $\lambda = \frac{h\upsilon}{1.24}$ d) $\lambda = 1.24.h\upsilon$

P.T.O.

8) In NMOS technology _____ MOSFET are used.

a) Both N-channel b) Both P-channel

c) N and P channels d) Channel not required

9) The figure of merit of tunnel diode is

a) I_p b) I_v c) $\frac{I_p}{I_v}$ d) $\frac{I_v}{I_p}$

10) For a LED, the dominating operating process is

a) spontaneous emission b) stimulated emission

c) absorption d) reflection

11) MCT is a combination of _____ and _____

a) Thyristor and a transistor b) Thyristor and a diode

c) Thyristor and a FET d) Thyristor and a MOSFET

12) For a pocket calculator or wrist watch, which of the following device can be wired as a circuit element ?

a) BJT b) Power diode

c) SIT d) CMOS

13) The maximum human eye sensitivity is at

a) 0.490 μm b) 0.555 μm

c) 0.520 μm d) 0.700 μm

14) Γ point is a point where the bottom of the conduction band is at

a) $K = +\ \pi$ b) $K = +\ 2\pi$

c) $K = 3\pi$ d) $K = 0$

2. Answer the following : **14**

a) CMOS inverter action

b) dv/dt rating

c) PUT

3. a) Discuss the reverse recovery characteristic of a diode. **10**

   b) Two transistor analogy of a SCR. Explain. **4**

4. a) Explain how IGBT behaves as a MOSFET and a BJT. **10**

   b) Write a note on fast recovery diode. **4**

5. a) Discuss the hydraulic system for charge storage mechanism. **10**

   b) Find the characteristic impedance of a nearly loss-less line (R-very small) that has unit length inductance of 10 nH and a unit length capacitance of 4pF. **4**

6. a) Discuss and compare transferred Electron effect in GaAs and I_n P. **10**

   b) What is velocity-field characteristic ? **4**

7. Write notes on (**any three**) : **14**

   a) IR – LED

   b) SCR

   c) CCD

   d) Interface traps can follow both gate bias and the ac signal at low frequencies. Comment.

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SLR-MI – 588

Seat No.	

M.Sc. – II (Semester – III) (New) (CGPA) Examination, 2016
PHYSICS (Applied Electronics)
Paper – X : Instrumentation

Day and Date : Thursday, 31-3-2016 Total Marks : 70
Time : 2.30 p.m. to 5.00 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.*
4) ***Use*** *of non programmable calculator is* ***allowed****.*

1. Objective questions. **14**

a) Select correct alternatives. **8**

i) In strain gauges, which of the following varies in accordance with the input signal

a) resistance b) capacitance
c) inductance d) none of the above

ii) Piezo-electric crystal can be used as a transducer to measure

a) pressure b) acidity
c) speed d) distance

iii) In an OPAMP logarithmic amplifier, the output voltage forms a logarithmic function of the

a) reference voltage b) input voltage
c) peak voltage d) rms voltage

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

a) comparator b) mixer
c) rectifier d) amplifier

P.T.O.

v) Study of energy distribution of a signal as a function of frequency can be done by

a) frequency meter b) timer

c) spectrum analyzer d) oscilloscope

vi) A sample and hold circuit is normally placed between

a) MUX and DEMUX b) Source and DAC

c) Source and ADC d) Transducer and amplifier

vii) Thickness can be measured with

a) Thermistor b) Thermocouple

c) Strain gauge d) LVDT

viii) Q-meter is used for the measurement of

a) quotient factor b) force

c) pressure d) quality factor

b) State **true** or **false** : **6**

i) In microphone, the capacitance varies in accordance with the input.

ii) Displacement can not be measured with LVDT.

iii) Thermistor is a positive temperature coefficient device.

iv) In SMPS, FETs are used as switching devices.

v) Potentiometers can be used to vary resistance of circuit.

vi) ADCs and multiplexers are used in multichannel data acquisition system.

2. Write short notes. **14**

a) Classify the transducers according to the principle of operation. **5**

b) Explain the working of a RMS converter. **5**

c) Explain the measurement of R, L and C using bridge circuit. **4**

3. a) With neat diagram, explain the working of LVDT. **10**

b) Write a note on chemical sensors. **4**

4. a) With a neat diagram, explain the working of an instrumentation amplifier. State its basic characteristics. **10**

   b) Write a note on proportional controller. **4**

5. a) Draw the diagram of a lock-in amplifier and explain its functioning. **10**

   b) Write a note on proximity detector. **4**

6. a) Describe with necessary diagram, the operation of a digital multimeter. **10**

   b) What is PID controller ? Explain. **4**

7. a) Describe with examples, the standard interface systems. **10**

   b) Write a note on dynamic signal filtering. **4**

SLR-MI – 589

Seat No.	

M.Sc. – II (Semester – III) Physics (Appl. Electronics) Examination, 2016
Paper – XI : COMMUNICATION SYSTEMS (New) (CGPA)

Day and Date : Saturday, 2-4-2016 Total Marks : 70

Time : 2.30 p.m. to 5.00 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 alternatives : **8**

1) AM causes the amount of transmitter power to

a) Decrease b) Increase c) Double d) Remain same

2) A circuit that has the function of demodulating the frequency modulated signal is

a) AFC b) Envelop detector

c) Decoder d) Foster-seeley discriminator

3) What is the higher percentage of modulation for AM ?

a) 50% b) 75% c) 100% d) 80%

4) Two binary values are represented by two different frequencies in

a) ASK b) PSK c) FSK d) None

5) The PAM signal can be detected by

a) Band pass filter b) High pass filter

c) Band stop filter d) Low pass filter

6) AM frequency band is from _____ to _____ KHz.

a) 540 to 1600 b) 1000 to 2000

c) 800 to 1600 d) 540 to 2000

7) Converting analog signals to digital is done by sampling and

a) Companding b) Quantizing

c) Pre-emphasis d) Mixing

8) If used in FM is _____

a) 455 KHz b) 10.7 MHz c) 88 MHz d) 1 MHz

b) State whether **true** or **false** : **6**

1) PPM can be generated from PWM signals.

2) An FM signal has infinite band width.

3) The ratio of maximum deviation to maximum modulating frequency is called Modulating Index.

4) The limiter stage of a FM receiver limits the overall bandwidth of the IF stages.

5) BPSK stand for Binary Pulse Shifting Key.

6) In full duplex communication the flow of information takes places in both directions simultaneously.

2. a) Write a note on low and high level of modulation. **5**

b) State and explain the sampling theorem. **5**

c) Discuss briefly about half duplex communication system. **4**

3. a) Explain the operation of AM receiver and detection circuits. **10**

b) Write and advantage of FM over AM. **4**

4. a) Explain the operation of class A, B, C modulated power amplifier circuits. **10**

b) Write a note on side bands. **4**

5. a) With neat diagram, explain the pulse amplitude modulation and demodulation. **10**

b) Write a note on PLL. **4**

6. a) Discuss in detail about generation and demodulation of pulse time modulation (PTM). **10**

b) Write a note on cross talk in TDM. **4**

7. a) Explain in detail about Amplitude Shift Keying and Frequency Shift Keying. **10**

b) Write a note on asynchronous transmission. **4**

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SLR-MI – 590

Seat No.	

M.Sc. (Part – II) (Semester – III) (New) (CGPA) Examination, 2016
PHYSICS (Applied Electronics) (Paper No. – XII)
Atomic, Molecular and Nuclear Physics

Day and Date : Tuesday, 5-4-2016 Max. Marks : 70

Time : 2.30 p.m. to 5.00 p.m.

Instructions : *i) Attempt **5** questions.*
*ii) Questions **1** and **2** are **compulsory**.*
*iii) Attempt **any 3** questions from question numbers **3** to **7**.*
*iv) Figures to the **right** indicate marks.*
*v) **Use** of non programmable calculator is **allowed**.*

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

1) Identify the term which is wrongly written

a) $^2P_1$ b) $^3P_0$ c) $^2D_{5/2}$ d) $^1S_0$

2) The 'd' sub shell contains _____ electrons.

a) 8 b) 10 c) 14 d) 18

3) The anomalous Zeeman effect is between

a) Singlet-singlet states b) Doublet-doublet states
c) Singlet-triplet states d) None of these

4) The spectrum of vibrating rotator contains

a) P branch b) R branch
c) P-R branches d) P, Q and R branches

5) The spacing between energy levels of harmonic oscillator is

a) In increasing order b) In decreasing order
c) Equidistant d) None of these

6) The ground state of alkali elements is

a) $^3S_1$ b) $^1S_0$ c) $^1P_1$ d) $^2S_{\frac{1}{2}}$

P.T.O.

7) The typical wavelength emitted by diatomic molecules in purely vibrational and purely rotational transitions are respectively in the region of
   a) Infrared and visible b) Visible and infrared
   c) Infrared and microwave d) Microwave and infrared

8) Cross sections are measured in
   a) MeV b) Barns
   c) Nucleons per cm^3 d) Fermi

9) Binding energy after A = is nearly constant (A is mass number)
   a) 16 b) 32 c) 50 d) 108

10) Binding energy of a deuteron is
   a) 0.22 MeV b) 2.22 MeV c) 2 BeV d) 2.2 eV

11) An atom of mass number 17 and atomic number 8 captures α particles and then exists a neutron. The resulting atom will be having a mass number and atomic number as
   a) 22, 10 b) 20, 11 c) 21, 10 d) 20, 10

12) A nucleus of medium mass with excess of neutrons may decay with the emission of
   a) Electron b) Proton c) Positron d) Neutron

13) Life time of the compound nucleus is of the order of
   a) 10^{-8} sec. b) 10^{-11} sec.
   c) 10^{-14} sec. d) 10^{-21} sec.

14) In the nuclear shall model, the spin parity of ^{13}N is
   a) $\frac{3^+}{2}$ b) $\frac{1^+}{2}$ c) $\frac{3^-}{2}$ d) $\frac{1^-}{2}$

2. Answer in brief : **14**
   a) Using L-S coupling what are the terms obtained for pd configuration ?
   b) Calculate the energy in ev of one wave number.
   c) Determine the reduced mass of $C^{12}O^{16}$ molecule.

3. a) Obtain an expression for the energy levels and resulting spectrum given by vibrating rotator when the Born-Oppenheimer approximation breaks down. **9**
   b) Classify the molecules based on their moments of inertia. **5**

4. a) What are equivalent and non equivalent electrons ? Using Pauli's principle obtain the terms for two equivalent p electrons. **10**

   b) Comment on the ground state of oxygen atom. **4**

5. a) Using spin orbit potential, explain the energy levels of a shell model. How this potential helps to explain the occurrence of magic numbers ? Draw the diagram. **10**

   b) Obtain spin angular momentum and parity of

   i) $_{29}Cu^{63}$ ii) $_{27}Co^{60}$ **4**

6. a) What are exchange forces ? How they are classified ? **8**

   b) Discuss the measurable properties of deuteron. **6**

7. a) Explain the nuclear reaction kinematics obtain an expression for Q value. Discuss the general solution of the Q equation. **10**

   b) Write a note on compound Nucleus model. **4**

SLR-MI – 591

Seat No.	

M.Sc. – II (Semester – III) Examination, 2016
PHYSICS (Appl. Elect.) (Old – CGPA)
Paper – IX : Semiconductor Devices

Day and Date : Tuesday, 29-3-2016 Max. Marks : 70

Time : 2.30 p.m. to 5.00 p.m.

***Instructions** : 1) Attempt **five** questions.*

*2) Questions **1** and **2** are **compulsory**.*

*3) Attempt **any 3** questions from Q. **3** to Q. **7**.*

*4) **Use** of nonprogrammable calculators is **allowed**.*

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

1) In the saturation mode, the base to collector junction of a transistor is _____ biased.

a) reverse b) forward c) both a and b d) requires no bias

2) Virtual channel exists in _____ power MOSFETS.

a) n-channel depletion b) p-channel depletion

c) n-channel enhancement d) both a and b

3) In a MIS diode system, the capacitance due to _____ is voltage independent.

a) semiconductor b) insulatory

c) metal d) space charge

4) Zero surface potential means _____ condition.

a) flat band b) accumulation c) depletion d) inversion

5) A CCD is an array of

a) closely spaced BJT's b) closely spaced FET's

c) closely spaced thyristors d) closely spaced MOS diodes

P.T.O.

6) The figure of merit of a tunnel diode is given as

a) I_p b) I_v c) I_p/I_v d) I_v/I_p

7) _____ in GaAs makes it feasible for ultra-high-speed CCD's.

a) high electron mobility b) low electron mobility
c) high hole mobility d) high electron concentration

8) The major limitation of a surface channel CCD is

a) Interface trap effect b) bias voltage effect
c) fringing field effect d) intermittent effect

9) TFT is fabricated on _____ substrates.

a) metal b) insulator c) silicon d) Cds

10) The width of junction barrier varies inversely as the _____ of impurity concentration.

a) square b) square root c) cube d) cube root

11) When ($\alpha_1 + R_2$) approaches _____, the SCR triggers.

a) 1 b) 0.5 c) 10 d) 100

12) A triac is a _____ controlled device.

a) current b) voltage c) power d) both a and b

13) Power consumption of a CMOS is interms of ____

a) Watt b) mW c) MW d) nW

14) Γ -point means

a) $K = \pm\pi$ b) $K = \pm 2\pi$ c) $K = 0$ d) $K = \frac{1}{2\pi}$

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

1) Write a note on CMOS. **5**

2) Modern MOSFET's are fabricated on <100> Si – Comment. **5**

3) Write and explain PWT as a relaxation oscillator device. **4**

4) Write a note on PIN diode. **4**

3. a) Using Poissons equations, establish the relations between surface potential (ψ_s), surface charge (Q) and the electric field (E) across a MIS-diode in deep depletion. **10**

   b) Give the principle of charge storage mechanism. **4**

4. a) Discuss the I-V curve of tunnel diode referred to : **10**
      i) tunneling current
      ii) thermal current.

   b) Determine the characteristic impedance of a nearly loss less transmission line (R very small) that has an unit length inductance of 10 nH and an unit length capacitance of 4 pF. **4**

5. a) Discuss the complex I-V characteristic of an SCR. Explain the effect of gate control on it. **10**

   b) Write a note on interface trapped charges. **4**

6. a) Sketch and explain basic 3-phase CCD. Discuss how a charge packet is transferred along the surface of a continuous substrate. **10**

   b) Write a note on photo SCR. **4**

7. a) Write a note on solar cell. **14**

   b) Give a brief account of reverse recovery characteristic of a power diode.

   c) What is flat band shift ?

SLR-MI – 592

Seat No.	

M.Sc. (Part – II) (Semester – III) (Old) (CGPA) Examination, 2016
PHYSICS (Applied Electronics)
Paper – X : Instrumentation

Day and Date : Thursday, 31-3-2016 Total Marks : 70
Time : 2.30 p.m. to 5.00 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.*
*4) **Use** of non-programmable calculator is **allowed**.*

1. a) Select the correct alternative : **8**

1) Type T thermocouple is made from _____

a) Chromel constantan b) Iron constantan

c) Copper constantan d) Chromel alumel

2) The high value of CMMR is used in the following _____ amplifier.

a) Instrumentation b) D.C.

c) Isolation d) All of these

3) ADC used in digital voltmeter is _____

a) Dual slope b) Counter

c) Integrator d) Successive approximation

4) The _____ is similar to an RTD but has a negative temperature coefficient.

a) Thermistor b) Thermocouple

c) Linear IC d) None of the above

5) Piezoelectric transducers work when we apply _____ to it.

a) Mechanical force b) Vibrations

c) Illuminations d) Heat

6) _____ is measure of the output changes uniformly with input.

a) Linearity b) Accuracy

c) Sensitivity d) Precision

7) The ADC is used for conversion of _____

a) Analog to digital b) Digital to analog

c) Analog to analog d) Digital to digital

8) Which of the following is displacement transducer ?

a) LVDT b) RTD

c) Thermostat d) Piezoelectric

b) State **True** or **False** : **6**

1) The capacitive transducers are normally employed for static measurements.

2) Logarithmic amplifier gives the output proportional to the logarithm of input signal.

3) The input signal for instrumentation amplifier usually comes from a Wheatstone bridge.

4) The principle of Q meter is based on series resonance.

5) The sample and hold circuit is used for conversion of discrete to continuous values.

6) The resistance of LDR decreases when exposed to radiant energy.

2. Attempt the following : **14**

1) Explain the measurement of velocity using inductive transducer.

2) Enumerate the applications of instrumentation amplifier.

3) Write a note on classification of transducers.

3. a) Draw the block diagram showing the basic functional elements of a Q meter and explain the function of each. **8**

   b) With a neat diagram explain potentiometer resistance transducer. List advantages and disadvantages of it. **6**

4. a) What is RTD ? Explain its principle and working. What are its advantages and disadvantages ? **10**

   b) Draw and describe voltage to frequency converter using op-amp. **4**

5. a) Explain with neat circuit diagram the working of successive approximation type DVM. **10**

   b) Explain in detail the measurements of R in bridge circuit. **4**

6. a) Draw and explain the block diagram of multichannel data acquisition system. **10**

   b) Briefly describe the peak detector circuit using op-amp. **4**

7. a) Explain in detail the construction and working of instrumentation amplifier. **10**

   b) Explain the operation of SMPS. **4**

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SLR-MI – 593

Seat No.	

M.Sc. (Part – II) (Semester – III) Examination, 2016
PHYSICS (Applied Electronics) (Old – CGPA)
Paper – XI : Communication System

Day and Date : Saturday, 2-4-2016 Total Marks : 70
Time : 2.30 p.m. to 5.00 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. A) Select correct alternatives. **8**

1) The process of sampling an analog signal at higher speed is called _____
a) PAM b) PWM c) PPM d) DM

2) The IF for FM is _____
a) 455 kHz b) 900 kHz c) 88 MHz d) 10.7 MHz

3) The AFC circuit corrects for frequency drift in the _____ circuit.
a) RF amplifier b) IF amplifier
c) Local oscillator d) Mixer

4) The gain of bipolar class A amplifier can be varied by changing the _____
a) Base current b) Collector current
c) Emitter current d) Base width

5) The minimum sampling rate for a signal with 5kHz bandwidth is _____
a) 15 kHz b) 20 kHz c) 10 kHz d) 25 kHz

6) Most TDM system used today, utilize _____ to transmit analog signal.
a) PCM b) PWM c) PPM d) PAM

7) The most commonly used filters in SSB generation are _____
a) RC b) LC c) LPF d) Mechanical

8) An FM broadcast carrier is deviated by $\pm$15 kHz, then percentage of modulation is _____
a) 15% b) 20% c) 25% d) 30%

B) State **True** or **False** : **6**

1) Quantization noise occurs in PAM.
2) In balanced modulator, carrier is cancelled and side bands are generated.
3) In AM if m = 1 then the maximum transmitted power is 1.5Pc.
4) Inspecting the block diagram presence of limiter circuit is an indication of FM receiver.
5) For frequency doubler in FM the conduction angle lies between 45° – 55°.
6) Most of the gain and selectivity in an AM receiver is obtained in R. F. amplifier.

2. Attempt the following : **14**
   1) Sketch different types of pulse modulation (PAM, PWM and PPM) and explain in brief its importance. **5**
   2) Explain the term PLL as FM detector. **4**
   3) Explain the use of AGC in A.M. receiver. **5**

3. a) Draw the block diagram of superheterodyne receiver, explain in brief the function of each block. **8**
   b) Explain sample and hold circuit which will modify the PAM signal to flat-top PAM signal. **6**

4. a) Explain in detail PCM system with suitable wave forms and block diagram. **8**
   b) Explain the working of ratio detector in FM. **6**

5. a) Explain phase shift method of SSBSC, with phase shift network and vector diagram. **10**
   b) Define baseband signal and band pass signal. **4**

6. a) Explain frequency shift keying, how it is used in telegraphy ? **8**
   b) Explain class B audio amplifier. **6**

7. a) Explain the data formats (Unipolar and Bipolar) with suitable example. **8**
   b) Explain in brief basic working of Delta modulation. **6**

SLR-MI – 594

Seat No.	

M.Sc. (Part – II) (Semester – III) (Old – CGPA) Examination, 2016
PHYSICS (Applied Electronics)
Paper No. XII : Atomic, Molecular and Nuclear Physics

Day and Date : Tuesday, 5-4-2016 Max. Marks : 70

Time : 2.30 p.m. to 5.00 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** indicate **full** marks.*
*v) Use of nonprogrammable calculator is **allowed**.*

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

1) Find the uncorrect spectroscopic term.
a) $^2P_{3/2}$ b) $^2P_{1/2}$ c) $^2D_{5/2}$ d) $^2D_{1/2}$

2) The ^2P term split up in to two components $^2P_{3/2}$ and $^2P_{1/2}$ because of
a) Zeeman effect b) Spin-orbit interaction
c) Paschen Back Effect d) Hyperfine interaction

3) The relation between the harmonic frequency ω and rotational constant B is
a) $4B^3/\omega^2$ b) $4B^2/\omega^3$ c) $4B^3/\omega$ d) $4B^2/\omega^2$

4) The binding energy after A = ? is nearly constant, where A is atomic mass number
a) 20 b) 30 c) 40 d) 50

5) The positive sign of the quadruple moment of the deuteron shows that the distribution is
a) Shapeless b) Prolate c) Oblate d) Spherical

6) The Gaussian type of function is
a) $V = V_0 \exp(-\alpha/r)$ b) $V = V_0 \exp(-r/\alpha)$
c) $V = V_0 \exp(-\alpha^2/r)$ d) $V = V_0 \exp -(r/\alpha)^2$

P.T.O.

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

7) The possible values of the total angular momentum for ^3F term are _____

8) For P branch rotational lines ΔJ = _____

9) Binding energy of the deuteron is _____

10) The inverse process of the stripping reaction is _____ reaction.

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

11) The alkaline earth elements have two equivalent s electrons.

12) Nucleons are bosons.

13) Probability of the radiative capture reaction in a neutron proton scattering at high energy neutron is low.

14) Exchange forces depend on the symmetry of the wave functions.

2. Answer in short **(any 3)** : **14**

a) State and explain Hund's rules. **5**

b) Classify molecules based on moment of inertia. **4**

c) Explain saturation property, charge independence and shape of the potential in Nuclear forces. **5**

d) Define nuclear cross section. **4**

3. a) Differentiate between the normal and anomalous Zeeman effects. Obtain an expression for the interaction energy and state the selection rules for s and p components. **8**

b) Draw the energy level diagram for a Zeeman pattern of $^2P - ^2S$ transition. Show the transitions along with frequencies of the spectral lines. **6**

4. a) Give the theory of the vibrating rotator when the Born-Openheimer approximation is Valid and derive the expression for P and R branch lines. **8**

b) Explain the spectrum of the harmonic oscillator model of a diatomic molecule. **6**

5. a) Explain the properties of Dueteron. Also discuss the bound state of Dueteron. Assuming a square well potential. **10**

   b) State and explain the types of Nuclear forces. **4**

6. a) In the light of magic numbers, explain shell model of nuclei. What are the predictions based on this model ? **10**

   b) Comment on superconductivity model. **4**

7. a) Carry out the partial wave analysis and hence obtain the expressions for total cross section. Discuss the role of phase shift. **10**

   b) Write a note on compound nucleus model. **4**

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SLR-MI – 595

Seat No.	

M.Sc. (Part – II) (Semester – IV) (New – CGPA) Examination, 2016
PHYSICS (Applied Electronics)
Paper – XIII : Computational Methods and Programming

Day and Date : Wednesday, 30-3-2016 Total Marks : 70
Time : 2.30 p.m. to 5.00 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 are* ***compulsory****.*

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

i) For solving set of equation AX = B, in which method, coefficient matrix A is transformed to upper triangular matrix

A) Gauss-Seidal method B) Gauss elimination method
C) Gauss Jordan method D) Gauss Jacobi method

ii) In solving a set of simultaneous ordinary differential equations by 4^{th} order Runge Kutta method, if y(0) = 0, h = 0.1, $k_1 = 0.2$, $k_2 = 0.2150$, $k_3 = 0.2171$ and $k_4 = 0.2359$ then value of y(0.1) = ?

A) 0.2066 B) 0.1618
C) 0.2166 D) 0.3616

iii) Using the principle of least square, first normal equation of the curve $y = ce^{dx}$ will be

A) $\Sigma \log y = n\Sigma \log c + d\Sigma \log x$

B) $\Sigma y = n\Sigma c + d \log x$

C) $\Sigma \log y = n\Sigma c + d\Sigma \log x$

D) $\Sigma \log y = n\Sigma \log c + d\Sigma x$

iv) Gauss Seidal method converges only, if the coefficient matrix is

A) Singular matrix B) Non-singular matrix
C) Diagonally dominant D) Upper triangular matrix

P.T.O.

v) Using Bisection method the $(n + 1)^{th}$ approximation formula for the real root of the equation $f(x) = 0$ is given by

A) $\frac{x_n + x_{n-1}}{3}$ B) $\frac{x_{n-1} + x_{n-2}}{2}$

C) $\frac{x_n + x_{n-1}}{2}$ D) $\frac{x_{n-1} + x_{n-3}}{3}$

vi) Milne method is used

A) To solve ordinary D.E.

B) To find out the root of algebraic equation

C) To evaluate integration

D) None of these

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

i) The Principle of least square is based on Maximizing the ΣE_i^2, where $E_i = (y_i - y)^2$.

ii) The positive real root of the equation $x^3 + 3x - 1 = 0$ lies between 1 and 2 subpart. To predict Adam's Method at least 2 values of y, prior to the desired values are required.

iii) In Newton's Cotes formula if f(x) is interpolated at equally spaced nodes by a polynomial of degree two then it represents three eight rule.

iv) To fit the straight line $y = b + xa$ to N observations, the normal equations are $\Sigma y = a\Sigma x + bN$; $\Sigma xy = a\Sigma x^2 + b\Sigma x$.

v) The value of $I = \int_0^{0.5} x\,dx$ by Simpson's $1/3^{rd}$ rule is 0.125.

vi) Gauss Jordan method for solving the system AX = B fails if matrix A is diagonally dominant.

vii) Gauss Elimination is an iterative method.

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

2. Write short notes on :

   a) Write a note on Quadratures and explain how to arrive at Simpson's one third rule. **5**

   b) What are random numbers ? Explain its use. **4**

   c) Write a note on need of numerical solution of the differential equations. **5**

3. a) Write a note on Newton Raphson method. Find a positive root of $x \sin x + \cos x = 0$ by False Position Method. **8**

   b) Using improved Euler method find y at x = 0.1 and y at x = 0.2, given $\frac{dy}{dx} = y - \frac{2x}{y}$ with y(0) = 1. **6**

4. a) Evaluate the integral $I = \int_0^2 \frac{dx}{x^2 + x + 1}$ by Simpson's one third rule by dividing interval in eight parts. **6**

   b) Find the value of y(0.638) for the following data : **8**

x	0.61	0.62	0.63	0.64	0.65	0.66	0.67
y	1.840431	1.858928	1.877610	1.896481	1.915541	1.934792	1.954237

5. a) The curve $y = cd^x$ is fitted to the data :

x:	2	3	4	5	6	8
y:	8.3	15.4	33.1	65.2	126.4	146

   Find the best values of c and d. **8**

   b) Solve the system of equation by Gauss-Jordan method, **6**

   $10x - 7y + 3z + 5w = 6$

   $-6x + 8y - z - 4w = 5$

   $3x + y + 4z + 11w = 2$

   $5x - 9y - 2z + 4w = 7$

6. a) Perform four iterations of false position method to find the positive root of the equation $x\tan x - 1 = 0$ by taking $x_0 = 2.5$ and $x_1 = 3$. **8**

   b) Solve the following system of equation by Gauss Seidal method :

   $28x + 4y - z = 32$

   $2x + 17y + 4z = 35$

   $x + 3y + 10z = 24$. **6**

7. a) Evaluate $\int_0^{0.8} e^{-x^2} dx$, using Romberg's method. **8**

   b) Given $\frac{dy}{dx} = \frac{1}{2}\left(1 + x^2\right)y^2$ and y(0) = 1, y(0.1) = 1.06, y(0.2) = 1.12, y(0.3) = 1.21, find y(0.4) by Milne's Prdictor Corrector Method. **6**

SLR-MI – 597

Seat No.	

M.Sc. (Part – II) (Semester – IV) Examination, 2016
PHYSICS (Applied Electronics) (New CGPA)
Paper – XV : Microwave Engineering (C)

Day and Date : Monday, 4-4-2016 Max. Marks : 70

Time : 2.30 p.m. to 5.00 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.*
4) ***Use*** *of nonprogrammable calculator is* ***allowed****.*

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

A) Choose correct alternative : **8**

1) The largest applications of microwaves is in

a) Industry b) Research c) Cooking d) Communication

2) In which of the following two ground planes are used ?

a) Stripline b) Co-axial line

c) Parallel wire lines d) Microstriplines

3) The effect of an ideal klystron oscillator is closure to

a) 25% b) 50% c) 75% d) 90%

4) Which transmission lines are ideal in handling high powers ?

a) Co-axial line b) Microstripline

c) Stripline d) Rectangular waveguide

5) A waveguide can be considered as

a) Band pass filter b) Band-stop filter

c) Low pass filter d) High-pass filter

6) TWT is basically

a) An oscillator b) Tuned amplifier

c) Wideband amplifier d) None of these

P.T.O.

7) Which of the following wave does not exists in waveguide ?

a) TM waves b) TE waves

c) TEM waves d) TE/TM waves

8) Maxwell's equations in free space is

a) $\nabla.B = 0$ b) $\nabla.\vec{B} = \rho$ c) $\nabla.\vec{B} = \vec{J}$ d) $\nabla.\vec{B} = \sigma\vec{J}$

B) Fill in the gaps. **6**

1) The value of VSWR which is taken as infinity and the line is _____ circuited.
2) The attenuation in a waveguide near the cut-off frequency is _____
3) The input impedance of a short circuited line is known as _____ fire.
4) Cavity is used as _____ elements.
5) The wavelength of a wave in waveguide is _____ than under the free space.
6) The wavelength corresponding to microwave frequency range is from 3 to _____.

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

1) Write a note on wave polarization. **5**
2) Write a note on TWT. **5**
3) Explain briefly about stripline shifter. **4**

3. a) Write the Maxwell's equation in both integral and differential forms. **8**
   b) Write a note on wave propagation in perfect insulators. **6**

4. a) Explain in detail the basic principles of two cavity klystrons. **8**
   b) Write a note on Gunn-effect and principle of its application. **6**

5. a) Give the theory of rectangular waveguide transmission. **8**
   b) What are the basic concepts of open two-wire lines ? **6**

6. a) With a neat diagram explain the functioning of phase shifters. **8**
   b) Write a note on dielectric bead supports. **6**

7. a) Explain in detail the waveguide attenuators. **8**
   b) What do you understand by adjustable short circuits ? Explain in brief. **6**

SLR-MI – 598

Seat No.	

M.Sc. (Part – II) (Semester – IV) Examination, 2016
PHYSICS (Applied Electronics)
Paper – XVI : Microprocessors and Interfacing (CGPA) (New)

Day and Date : Wednesday, 6-4-2016 Total Marks : 70

Time : 2.30 p.m. to 5.00 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.*
*4) Use of non programmable **calculator** is allowed.*

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

1) The standard I/O is called as
   a) I/O mapped I/O b) Isolate I/O
   c) Both a) and b) d) Memory mapped I/O

2) Which mode is used for single handshake in 8255 ?
   a) Mode 0 b) Mode 1 c) Mode 2 d) Both (a) and (b)

3) The speciality of the 8253 counter is that they can be easily read on line without disturbing the _____ input to the counter.
   a) Gate b) CLK c) OUT d) WR

4) In 8279, the data entered from left side of the display unit is of
   a) Left entry mode
   b) Right entry mode
   c) Left and right entry mode
   d) Other than this

5) An example of non maskable interrupt is
   a) TRAP b) INTR c) RST 5.5 d) RST 6.5

P.T.O.

6) _____ is a programmable interrupt controller.
   a) 8255 b) 8253 c) 8259 d) 8279
7) The ADC _____ is an 8-bit successive approximation type ADC with in-built 8-channel multiplexer.
   a) 0809 b) 0805 c) 1408 d) Both (a) and (b)
8) Memory mapped I/O can address _____ locations.
   a) 64 K b) 256 K c) 16 K d) 8 K

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

1) INTR is non-vectored interrupt.
2) 8259 A requires three types of command words.
3) I/O interface transfers the binary information between internal storage and external device.
4) A successive approximation A/D convertor is a low speed convertor.
5) The 8085 checks for an interrupt during the execution of every instruction.
6) In 8279, the keyboard section has a built in FIFO 8 character buffer.

2. Attempt the following : **14**
   1) Explain binary weighted resistor D/A convertor in detail. **5**
   2) Explain the output modes used in 8279. **5**
   3) Write a short note on interrupt acknowledgement. **4**

3. a) Explain interfacing of RAM (62xx) to 8085 microprocessor. **10**
   b) Briefly describe the features of 8259. **4**

4. a) Sketch and explain the keyboard interfacing of 8279 to 8085 microprocessor. **10**
   b) Distinguish between : ADC and DAC. **4**

5. a) What are the different modes of operation of 8253 programmable timer ? **10**
   b) Write a short note on address mapping. **4**

6. a) Draw and describe the interfacing of D/A convertor to 8085 microprocessor. **10**
   b) Explain in brief DAC characteristics. **4**

7. a) Draw and explain the block diagram of 8259 A in detail. **10**
   b) What are the disadvantages of memory mapped I/O scheme ? **4**

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SLR-MI – 599

Seat No.	

M.Sc. (Part – II) (Semester – IV) (Old) (CGPA) Examination, 2016
PHYSICS (Applied Electronics)
Paper – XIII
Computational Methods and Programming

Day and Date : Wednesday, 30-3-2016 Max. Marks : 70

Time : 2.30 p.m. to 5.00 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) Gauss Seidal method converges only, if the coefficient matrix is

A) Singular matrix

B) Diagonally dominant

C) Upper triangular matrix

D) Non singular matrix

ii) In solving a set of simultaneous ordinary differential equations by 4^{th} order Runge Kutta method, if $y(0) = 1$, $h = 0.1$, $k_1 = 0.1$, $k_2 = 0.1150$, $k_3 = 0.1171$ and $k_4 = 0.1359$ then value of $y(0.1) = ?$

A) 0.11668 B) 1.16186 C) 1.11668 D) 0.16186

iii) The normal equation of geometric curve $y = ax^b$ are

A) $\sum \log y = \sum \log a + b \sum \log x;\ \sum \log x \log y = \log a \sum \log x + b \sum (\log x)^2$

B) $\sum \log y = \log a + b \sum \log x;\ \sum \log xy = \log a \sum x + b \sum \log x^2$

C) $y = ax + b;\ \sum xy = na + b \sum x^2$

D) None of these

P.T.O.

iv) When Gauss elimination method is used to solve set of equation AX = B matrix A is transformed to

A) Diagonal matrix

B) Upper triangular matrix

C) Identity matrix

D) Lower triangular matrix

v) The positive real root of the equation $x^3 - x - 11 = 0$ lies between

A) 0 and 1 B) 2 and 3 C) 1 and 2 D) 3 and 4

vi) Adam-Bashforth method is used

A) To find out the root of algebraic equation

B) To solve ordinary D.E.

C) To evaluate integration

D) None of these

b) State **true** or **false**. **8**

i) In Euler's method, given initial value problem $y' = \frac{dy}{dx} = f(x, y)$ with $y(x_0) = y_0$, then the n^{th} approximation is given by $y_{n+1} = y_n + hf(x_{n-1}, y_{n-1})$.

ii) To predict Adam's method at least 2 values of y, prior to the desired values are required.

iii) Gaussian quadrature formula is used to solve differential equations.

iv) To fit the straight line y = ax + b to N observations, the normal equations are $\sum y = a\sum x + bN; \sum xy = a\sum x^2 + b\sum x$.

v) The value of $I = \int_0^{0.5} x^2\,dx$ by Simpson's $1/3^{rd}$ rule is 1.00073.

vi) The positive real root of the equation $x^3 + 3x - 1 = 0$ lies between 0 and 1.

vii) Gauss elimination is an iterative method.

viii) Gauss Jordan method for solving the system AX = B fails if matrix A is not diagonally dominant.

2. Write short notes on :

   a) Write a note on quadratures and explain how to arrive at Simpson's one third rule. **5**

   b) What are random numbers ? Explain its use. **4**

   c) What are algebraic and transcendental equations ? Explain with example. **5**

3. a) Evaluate the integral $I = \int_0^1 e^{-x^2}\, dx$ by taking h = 0.2 using Trapezoidal Rule. **6**

   b) Find the value of f(1) and f(1.8) using for the following data. **8**

x	1	1.1	1.2	1.3	1.4	1.5	1.6	1.7	1.8
y	0.84147	0.89121	0.93204	0.96356	0.98545	0.99749	0.99957	0.99385	0.97385

4. a) The curve $y = ce^{bx}$ is fitted to the data

x :	1	2	3	4	5	6
y :	1.5	4.6	13.9	40.1	125.1	299.5

   Find the best values of c and b. **8**

   b) Solve the system of equation by Gauss-Jordan method,

   $x + 2y + z = 8$

   $2x + 3y + 4z = 20$

   $4x + 3y + 2z = 16$. **6**

5. a) Perform five iterations of bisection method to find the smallest positive root of the equation $x^3 - 5x + 1 = 0$ and $\cos x - xe^x = 0$. **8**

   b) Solve the following system of equation by Gauss Seidal method,

   $30x - 2y + 3x = 75$

   $2x + 2y + 18z = 30$

   $x + 17y - 2z = 48$. **6**

6. a) Evaluate $\int_0^1 \frac{dx}{1+x^2}$, using Romberg's Integration. And Evaluate $\int_2^4 (2x^2+1)\,dx$ by Gaussian Quadrature method with n = 3. **8**

   b) Given $\frac{dy}{dx} = \frac{1}{2}(1+x^2)y^2$ and $y(0) = 1, y(0.1) = 1.06, y(0.2) = 1.12, y(0.3) = 1.21$, find y (0. 4) by Milne's Predictor Corrector Method. **6**

7. a) Write a note on Newton Raphson Method. Find a positive root of $3x - \sqrt{1+\sin x} = 0$ by False Position Method. **8**

   b) Using improved Euler Method find y at x = 0.1 and y at x = 0.2, given $\frac{dy}{dx} = y - \frac{2x}{y}$ with y(0) = 1. **6**

SLR-MI – 600

Seat No.	

M.Sc. – II (Semester – IV) (Old) (CGPA) Examination, 2016
PHYSICS (Applied Electronics) (Paper – XIV)
Microelectronics

Day and Date : Friday, 1-4-2016 Total Marks : 70
Time : 2.30 p.m. to 5.00 p.m.

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

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

i) Boron guttering is used to increase the _____
   a) Resistivity b) Conductivity
   c) Mobility d) Carrier concentration

ii) Emitters are normally fabricated by _____ diffusion.
   a) Constant source b) Instantaneous source
   c) Self diffusion d) Both a) and b)

iii) Burried layer is diffused to _____ the conductivity of an epitaxial layer.
   a) Decrease b) Increase
   c) Maintain invariant d) Both a) and b)

iv) Passing of steam through the diffusion furnace is to _____ the oxide layer thickness.
   a) Increase b) Decrease
   c) Maintain the same d) None of above

P.T.O.

v) The tetrahedral radius of silicon is _____
a) 11.8 A° b) 8.11 A° c) 0.18 A° d) 1.18 A°

vi) Sheet resistance of an epilayer is usually measured by _____ a technique.
a) Capacitance b) An inductance
c) Four probe d) Two probe

vii) The closest plane of silicon is _____
a) (001) b) (100) c) (111) d) (101)

viii) An upper limit of an impurity concentration in IC fabrication is _____
a) 10^{20} atoms/cm^3 b) 10^{18} atoms/cm^3
c) 10^{19} atoms/cm^3 d) 10^{21} atoms/cm^3

ix) The photographic mask determines the location of _____
a) Impurity concentration b) Windows
c) Photographic plate d) IC-Component

x) In the projected range, distribution of impurity atoms follow almost _____ behaviour.
a) Exponential b) Gaussian c) Linear d) erf.

xi) Glassivation is usually done by _____
a) CVD b) CBD c) ECD d) MBE

xii) Novolac is a _____ photoresist.
a) Positive b) Negative
c) Both a) and b) d) Neither a) nor b)

xiii) Which isolation is better ?
a) pn-junction b) dielectric c) both a) and b) d) neither a) nor b)

xiv) Very stable resistances are fabricated by a _____
a) Trimming b) Diffusion
c) Laser trimming d) Ion implantation

2. Attempt **any three** : **14**
   a) What is an autodoping ?
   b) Write a note on interstitial diffusion.
   c) Zone process.
   d) To-5 package.

3. a) What is an epitaxy ? Discuss how it is realised in practice. **10**
   b) What is negative photoresist ? **4**

4. a) State and explain Fick's first law of diffusion. **10**
   b) Give a brief account of pn-junction isolation. **4**

5. a) Explain, what do you mean by metallisation ? **6**
   b) Describe in brief a gas-source system for diffusion of boron in silicon. **8**

6. a) What is photolithography ? Discuss with reference to :
      1) photographic mask and
      2) photoresist patterning. **10**
   b) What is doping in melt ? **4**

7. Give a short account of **(any two)** : **14**
   a) Measurement of sheet resistance by 4-probe method.
   b) Fabrication of planar diode.
   c) Ball bonding.

SLR-MI – 601

Seat No.	

M.Sc. (Part – II) (Semester – IV) Examination, 2016
PHYSICS (Applied Electronics)
Paper – XV : Microwave Engineering (Old) (CGPA)

Day and Date : Monday, 4-4-2016 Total Marks : 70

Time : 2.30 p.m. to 5.00 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 the correct alternatives : **8**

1) The dominant mode in a waveguide is characterized by

A) Longest cutoff wavelength B) Shortest cutoff wavelength

C) Infinite attenuation D) Zero attenuation

2) To couple a coaxial line to a parallel wire line, it is best to use a

A) Slotted line B) Balun

C) Directional coupler D) $\lambda/4$ transformer

3) Which one of the following modes of transmission will not be supported by a rectangular waveguide ?

A) TE_{10} B) TE_{11} C) TM_{11} D) TM_{10}

4) Maxwell's divergence equation for the electric field is

A) $\nabla \cdot \overline{E} = \frac{\rho}{\varepsilon_0}$ B) $\nabla \cdot \overline{E} = \frac{\rho}{2\pi\varepsilon_0}$

C) $\nabla \times \overline{E} = \frac{\rho}{\varepsilon_0}$ D) $\nabla \cdot \overline{E} = -\frac{\rho}{\varepsilon_0}$

P.T.O.

5) Which one of the following can be used for amplification of microwave energy ?

A) Travelling wave tube B) Magnetron

C) Reflex klystron D) Gunn diode

6) In circular waveguide with radius r, the dominant mode is

A) TM_{01} B) TE_{01} C) TM_{11} D) TE_{11}

7) When the phase velocity of an electromagnetic wave depends on frequency in any medium, the phenomenon is called

A) Scattering B) Polarization

C) Absorption D) Dispersion

8) A reflex klystron oscillator is a

A) Low power device B) High power device

C) High efficiency device D) Both B) and C)

b) State **True or False/justify/one line** answer : **6**

1) A $\lambda/4$ line is also called _____

(Half wavelength/quarter wavelength transformer)

2) In a reflex klystron oscillator the repeller is at _____ potential.

(Negative/positive)

3) If a line is terminated in characteristic impedance, VSWR = _____

(One/zero)

4) If a short line is terminated in characteristic impedance it behaves as an infinite line.

5) In a travelling wave tube distribution interaction between an electron beam and travelling wave takes place.

6) A circular waveguide has infinite set of TE and TM modes.

2. Answer in brief : **14**

   1) Name different electromagnetic frequency spectrum region and microwave frequency designations for various bands and list the typical applications of microwaves. **5**

   2) How waveguides are different from normal two wire transmission lines ? Discuss the similarities and dissimilarities. **5**

   3) Find out the R, L, C, G parameters for a co-axial transmission line. **4**

3. a) Derive the expressions for the field components due to TM waves in rectangular waveguide. **8**

   b) Explain in brief about strip line transmission lines. **6**

4. a) With a neat diagram, explain the working of reflex klystron oscillator. **8**

   b) Explain the principle of operation of Gunn diode based on valley model theory. **6**

5. a) With a neat sketch describe the waveguide matching terminations and attenuators. **10**

   b) Explain the construction and working of SMA connector. **4**

6. a) Find the expression for characteristic impedance of a short-circuited and open circuited line. Find also the values of reflection coefficient and SWR under such conditions. **10**

   b) Write a note on coaxial and stripline shifters. **4**

7. a) List the types of phase shifters and discuss the working of one in detail. **10**

   b) Write a short note on waveguide attenuators. **4**

SLR-MI – 602

Seat No.	

M.Sc. (Part – II) (Semester – IV) (Old) (CGPA) Examination, 2016
PHYSICS (Applied Electronics)
Paper – XVI : Microprocessor and Interfacing

Day and Date : Wednesday, 6-4-2016 Total Marks : 70

Time : 2.30 p.m. to 5.00 p.m.

***Instructions** : 1) Attempt **five** questions.*
*2) Q. **1** and **2** are **compulsory.***
*3) Attempt **any three** from **Q. 3** to Q. **7.***

1. Objective questions. **14**

a) Select correct alternatives : **8**

1) The advantage of memory mapped I/O over I/O mapped I/O is _____

A) Faster

B) Many instructions supporting memory mapped I/O

C) Require a bigger address decoder

D) All the above

2) What is meant by maskable interrupts ?

A) An interrupt which can never be turned off

B) An interrupt that can be turned off by the programmer

C) An interrupt which can never be turned on

D) An interrupt which can never be turned on or off

3) The 8259 – A is a _____

A) Priority Interrupt Controller B) Priority Resolver

C) Interrupt Request Registry D) Control Logic

P.T.O.

4) _____ is used to transfer data between microprocessor and I/O process.

A) 8255 A B) 8279 C) 8254 A D) 8237 A

5) 8255 A contains _____ ports each of 8 bit lines.

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

6) Which mode of 8253 acts as a square wave generator ?

A) Mode – 1 B) Mode – 2

C) Mode – 4 D) Mode – 3

7) The 8279 normally provides a maximum of _____ seven segment display interface with CPU.

A) 8 B) 16 C) 32 D) 18

8) In ADC 0808 if _____ pin is high it enables output.

A) EOC B) I/P0 – I/P7

C) SOC D) OE

b) Fill in the blanks or state **True/False** : **6**

1) In 8255 A _____ is used to perform bidirectional operation.

2) In 8279 Strobe input mode, the control line goes low. The data on return lines is strobe in the _____

3) RIM is used to check whether, the _____

4) An interrupt which can be never being turned off (i.e. disabled) is known as Non-Maskable interrupt.

5) Three I/O lines are available at port C, viz PC2 – PC0.

6) 8255 is a programmable peripheral interface which operates in five modes.

2. Attempt the following : **14**

1) What are the difference between memory mapped I/O and I/O mapped I/O ?

2) With suitable schematic explain the block diagram of A to D convertor.

3) With a neat diagram discuss the interrupts structure of 8085.

3. A) Draw the functional block diagram of 8259 A and explain how to program 8259 A. **8**

   B) Explain what is :

      a) Memory Mapped I/O Scheme

      b) I/O Mapped I/O Scheme. **6**

4. A) Explain the operating modes of 8255 programmable peripheral interface. **8**

   B) Discuss how to determine the control word for 8255. **6**

5. A) Draw the block diagram of 8253 and explain about each block in detail. **8**

   B) Explain about control word format and programming of 8253. **6**

6. A) Explain the functional block diagram and working of IC 8279. **8**

   B) Interface 8 × 4 key matrix keyboards to 8085 microprocessor using 8255. Write an 8085 assembly language program to initialize 8255 and to read the key code. **6**

7. A) With a suitable diagram explain how to interface Analog to Digital Convertor (ADC) with a microprocessor and explain its working. **8**

   B) Explain the different techniques to convert a digital quantity into its equivalent analog quantity. **6**

SLR-MI – 596

Seat No.	

M.Sc. – II (Semester – IV) Examination, 2016
PHYSICS (Applied)
Paper – XIV : Microelectronics (CGPA) (New)

Day and Date : Friday, 1-4-2016 Max. Marks : 70
Time : 2.30 p.m. to 5.00 p.m.

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

1. Select the most correct alternative : **14**

1) For microelectronic applications, growth of single crystal Si along _____ is favoured.

a) 110 b) 100 c) 101 d) 111

2) The effective impurity concentration for a reliable diffusion of boron in Si is _____ atoms/cm^3.

a) 10^{19} b) 10^{18} c) 10^{20} d) 10^{21}

3) Glassivation is usually done by

a) CVD b) CBD c) ECD d) MBE

4) Which photoresist is specially developed for LSI/VLSI circuit fabrication ?

a) ISO-fine Kodak – 820 b) Novolac
c) Hunt-way HPR 256 d) ISO-fine-Kodak – 280

5) In a constant source diffusion, surface concentration is always

a) decreasing b) increasing
c) constant d) both a) and b)

6) An important advantage of ion implantation is that it is a _____ process.

a) low pressure b) low temperature
c) high temperature d) high pressure

P.T.O.

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

8) Fick's first law of diffusion is expressed as
   a) $j = D\frac{\partial N}{\partial x}$
   b) $j = -\frac{\partial^2 N}{\partial x^2}$
   c) $j = -D\frac{\partial N}{\partial x}$
   d) $j = -\frac{\partial N}{\partial x}$

9) The tetrahedral radius of Si is
   a) 1.18 nm
   b) 1.18 mm
   c) 1.18 A°
   d) 0.118 A°

10) Base diffusion in transistor is usually carried out by _____ source diffusion.
   a) constant
   b) instantaneous
   c) both a) and b)
   d) none of the above

11) Molecular Beam Epitaxy (M B E) is a _____ process.
   a) CVD b) ECD c) Non-CVD d) Sputter

12) Eutectic process assures
   a) low moisture packages
   b) low shear strength
   c) contamination
   d) low thermal stress

13) In electron beam lithography, the stored energy in the resist forms
   a) an actual image
   b) virtual image
   c) diffraction phenomena
   d) scattering only

14) Virtually all MOS technologies use Si - wafers with the crystal surface as _____ orientation.
   a) < 100 >
   b) < 111>
   c) <101>
   d) <110 >

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

   a) An etchback effect **5**

   b) Characteristics of a good photoresist **5**

   c) Substitutional diffusion. **4**

3. a) Give a brief account of vapour phase epitaxy for the growth of single crystal silicon. **10**

   b) What is a negative photoresist ? **4**

4. a) State and explain Fick's 1st law of diffusion. **10**

   b) Explain in brief an interstitial diffusion. **4**

5. a) Discuss a CVD technique for deposition of polysilicon. **10**

   b) What is metallization ? **4**

6. a) Give a brief account of gas-source system for diffusion of boron in silicon. **10**

   b) Write a note on electron beam lithography. **4**

7. a) Explain an NMOS IC-technology referred to **10**

      i) fabrication process sequence and

      ii) special considerations

   b) Write a note on wirebonding. **4**
