SLR-MM – 473

Seat No.	

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

Day and Date : Monday, 16-11-2015 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** 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 $(\cos(\pi/3) + i \sin(\pi/3))^{1/3}$ =

a) – 1 b) 0 c) i d) – i

ii) The Cauchy Riemann Equations are given by

a) $u_x = v_y$, $v_x = -u_y$ b) $u_{xx} + u_{yy} = 0$, $v_{xx} + v_{yy} = 0$

c) $-u_x = v_y$, $v_x = u_y$ d) $u_{xx} - u_{yy} = 0$, $v_{xx} - v_{yy} = 0$

iii) The particular integral of the ordinary Differential Equation (DE) is

a) General solution of DE b) General solution of associate DE

c) Solution of Associate DE d) Solution of ODE

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

a) $\frac{x}{6}e^x$ b) $\frac{x^2}{6}e^x$

c) $\frac{1}{3}e^x$ d) 0

P.T.O.

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

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 $f'(z)$ for $f(z) = u + iv$ is $u_x + iv_y$.

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

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

iv) Laplace Transform is possible only if $t > 0$.

v) $\frac{1}{D^2-16}\cos 4x$ is equal to $\frac{1}{-32}\cos 4x$.

vi) The conditions for expansion of function in a Fourier series are known as Eulers 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) $L\{e^{-t}\sin 3t\} = \frac{3}{(s+1)^2+9}$.

2. Write short notes on :

1) Write a note on Harmonic conjugates of an Analytic Function. **5**

2) Write a note on the principle of superposition of the homogeneous differential equation. **4**

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

3. 1) Find Inverse Laplace Transform of $\frac{s^2}{(s^2+9)(s^2+1)}$. **6**

   2) Consider all the non zero solutions of the equation $y'' + 12y' + 36y = 0$, determine their behaviour as $t \to \infty$. **8**

4. 1) Show that $u = \frac{1}{2}\log(x^2 + y^2)$ is harmonic and find its harmonic conjugate. **10**

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

5. 1) Define Adjoint of the matrix. Hence find A^{-1} of the matrix using adjoint matrix method for $\begin{pmatrix} 2 & 3 & 4 \\ 3 & -8 & 5 \\ 4 & 5 & -9 \end{pmatrix}$. **8**

   2) Solve $y'' - 6y' + 25y = 0$ at y(0) = 2, $y'(0) = 1$ and find the limit, as $t \to \infty$, of the solution. **6**

6. 1) Find Fourier sine transform of f(x) = $\frac{e^{-ax}}{x}$. **8**

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

7. 1) Find Laplace of $\frac{d}{dt}t\sin 2t$. **4**

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

SLR-MM – 474

Seat No.	

M.Sc. (Part – I) (Semester – I) Examination, 2015
PHYSICS (Applied Electronic)
(Paper – II) (New) (CBCS)
Condensed Matter Physics

Day and Date : Wednesday, 18-11-2015 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) If conductance increases as temperature increases, this is known as a

A) positive coefficient B) negative current flow

C) negative coefficient D) positive resistance

2) Which of the following cannot actually move ?

A) majority carriers B) ions

C) holes D) free electrons

3) What electrical characteristic of intrinsic semiconductor material is controlled by the addition of impurities ?

A) conductivity B) current

C) power D) all of the above

4) In superconductivity the conductivity of a material becomes

A) Zero B) Finite

C) Infinite D) None of the above

P.T.O.

5) The temperature at which conductivity of a material becomes infinite is called

A) Critical temperature B) Absolute temperature

C) Mean temperature D) Crystallization temperature

6) What is a type of doping material ?

A) extrinsic semiconductor material

B) pentavalent material

C) n-type semiconductor

D) majority carriers

7) Minority carriers are many times activated by

A) heat B) pressure C) dopants D) forward bias

8) Which material may also be considered a semiconductor element ?

A) carbon B) ceramic C) mica D) argon

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

1) The solid in which periodicity of atoms extended throughout the material is known as amorphous.

A) True B) False

2) Lattice + Basis = Crystal structure

A) True B) False

3) The forward voltage drop for a germanium transistor is 0.7 V and for a silicon transistor is 0.3 V.

A) True B) False

4) When a depletion region of a transistor is large, the barrier voltage is also large.

A) True B) False

5) The Bravais lattice of CsCl crystal is body centre.

A) True B) False

6) The atomic packing fraction of a b.c.c. lattice is 74%.

A) True B) False

2. Attempt the following.
   a) Absence of five fold symmetry. **5**
   b) Electronic polarization. **5**
   c) Meissner's effect. **4**

3. a) Give a brief account of thermodynamics of a superconductor. **10**
   b) Explain BCC structures of a solids. **4**

4. a) Explain the Schottky and the Frenkel defects. **6**
   b) What do you mean by Brillion zone ? Draw Brillion zones for two-dimensional lattices. **8**

5. a) Explain the behaviour of an electron in periodic potential. **10**
   b) What is dielectric polarization ? Give the expression for ionic polarizability. **4**

6. a) Derive Clausius Mostti equation. **10**
   b) What are Cooper pairs ? How are they formed ? **4**

7. a) What is Josephson effect ? Show that for ideal superconductor **10**
   d/dt $(\theta_2 - \theta_1) = 0$.
   b) What is critical current ? Explain Sisbees rule. **4**

SLR-MM – 475

Seat No.	

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

Day and Date : Friday, 20-11-2015 Max. 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) Select the correct alternative : **8**

1) _____ circuit is used as a unity gain amplifier.
a) Voltage follower b) Difference amplifier
c) Single ended diff. amplifier d) Comparator

2) The voltage gain of a basic instrumentation amplifier is set by using
a) Diode b) Capacitor c) Resistor d) Inductor

3) How many flip flops are required to produce a divide-by-128 devices ?
a) 1 b) 4 c) 6 d) 7

4) The function of a multiplexer is
a) To decode information
b) To select 1 out of N input data sources and transmit it to single channel
c) To transmit data on N lines
d) To perform serial to parallel conversion

5) Address bus of 8085 is
a) Unidirectional b) Bidirectional
c) Tri-directional d) Directionless

P.T.O.

6) The practical value of CMRR for 741 Op-Amp is
   a) 30 dB b) 40 dB c) 90 dB d) 25 dB

7) The 7812 regulator IC provides
   a) 5 V b) – 5V c) 12 V d) – 12 V

8) Which of the following is non-volatile memory ?
   a) RAM b) ROM c) SRAM d) DRAM

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

1) The operational amplifier can be nulled by using offset voltage compensating network.
2) The LM 317 is used as adjustable negative voltage regulator.
3) The race around condition occurs in master-slave J-K flip-flop.
4) The ROM in 8085 is used as a stack.
5) The differential amplifier is used as high gain direct coupled amplifier.
6) Every flip flop is triggered by the clock in synchronous counter.

2. Attempt the following : **14**
   1) Explain the phase shift oscillator using op-amp.
   2) Explain effect of feedback on closed loop gain.
   3) Explain AND gate using transistor.

3. a) Explain with neat circuit diagram the working of differential amplifier using different circuit configurations. **10**
   b) Write a note on summing amplifier. **4**

4. a) Draw the pin configuration of 8085 μ p and explain the function of each. **8**
   b) Write an assembly language program for multiplication of 8-bit number using 8085 μ p instructions. **6**

5. a) With a neat sketch obtain an expression for output frequency of a square wave generator. **8**
   b) Explain the working of op-amp as an integrator. **6**

6. a) Using a suitable logic diagram explain the working of 4 to 1 multiplexer. **8**
   b) Explain Demorgans theorems with its necessary truth tables. **6**

7. a) What is a shift register ? Explain the block diagram and operation of a 4-bit SIPO mode of register. **8**
   b) Reduce the following expressions using Boolean relations.
   $(A\overline{B} + A\overline{C})(BC + B\overline{C})(ABC)$ **6**

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SLR-MM – 476

Seat No.	

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

Day and Date : Monday, 23-11-2015 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) A wheel of mass 5 kg and radius of gyration 40 cm is rotating at 200 rpm. The rotation kinetic energy of the wheel is

a) 0.35 J b) 3.5 kJ c) 0.35 kJ d) 3.5 J

2) The force F is non-conservative if,

a) $\oint F \cdot dr = 0$ b) $\nabla \times F = 0$

c) $F = -\nabla V$ d) $\oint F \cdot dr \neq 0$

3) The angular momentum J of system of particles is expressed as,

a) $L = R \times P + L_{CM}$ b) $L = R \cdot P + L_{CM}$

c) $L = R \times P - L_{CM}$ d) $L = P \times R + L_{CM}$

4) A rigid rod of length l is moving freely inside a hallow sphere of radius r, (r > 1) such that it's both ends are always in contact with the inner surface of the sphere. The degrees of freedom of the rod are,

a) Four b) Three

c) Two d) One

P.T.O.

5) The square of the period of revolution of a planet around the sun is proportional to,
   a) cube root of semi-major axis of the ellipse
   b) cube root of semi-minor axis of the ellipse
   c) cube of semi-minor axis of the ellipse
   d) cube of semi-major axis of the ellipse

6) For elliptical orbit
   a) $E = 0$ and $e = 1$
   b) $E > 0$ and $e = 0$
   c) $E < 0$ and $e < 1$
   d) $E < 0$ and $e > 1$

7) The Lagrangian of ideal spring-mass system (mass m is attached to one end of spring of constant k) is

   a) $L = \frac{m\dot{x}^2}{2} + \frac{k x^2}{2}$
   b) $L = \frac{m\dot{x}^2}{2} - \frac{k x^2}{2}$
   c) $L = \frac{m\dot{x}^2}{2} + k x^2$
   d) $L = \frac{m\dot{x}^2}{2} - k x^2$

8) Which of the following relationship holds true for the Poisons beckets between p_x, L_y ?
   a) $[p_x, L_y] = z$
   b) $[p_x, L_y] = -z$
   c) $[p_x, L_y] = 0$
   d) $[p_x, L_y] = 1$

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

1) If the total internal force on the system is zero, its total linear momentum is constant of motion.
2) The generalized momentum corresponding to every generalized coordinate is constant of motion.
3) Under the central force motion, the radius vector sweeps equal area in equal time intervals.
4) In a given Lagrangian $L(q, q, \dot{t})$ if $df(q_1, q_2, q_3, ... q_n)/dt$ is added, the Lagrangian equations of motion remain invariant.
5) If $F(q, p, t)$ and $G(q, p, t)$ are constants of motion, then $[F, G]$ is not constant of motion.
6) For elliptical orbit the total energy solely depends on the major axis.

2. Answer in short :
   a) Keplers Third Law of planetary motion. **5**
   b) Derive Jacobi Integration. **5**
   c) D'Alembert's principle. **4**

3. a) Derive Eular Lagrangian differential equation. **10**
   b) Using the technique of calculus of variation, show that the distance between two points in a plane is shortest. **4**

4. a) Find the Hamiltonian corresponding to the Lagrangian $L(\dot{q}) = (1 - \dot{q}^2)^{1/2}$ $(|\dot{q}| \leq 1)$ and Lagrangian corresponding to Hamiltonian $H(p, q) = \left(\frac{1}{2}p^2 + p\sin q\right)$. **8**
   b) State and prove the Poison's theorem. **6**

5. a) Show that the transformation defined as $P = 2\left(1 + q^{1/2}\cos p\right)q^{1/2}\sin p$ and $Q = \log\left(1 + q^{1/2}\cos p\right)$ is canonical. Find the corresponding generating function. **8**
   b) Write the Hamiltonian for a simple pendulum and deduce the Hamiltonian canonical equations of motion. **6**

6. a) Explain the reduction of two body problem in to one body problem. **10**
   b) Find $[L_x, L_y]$ and $[L_x, P_y]$. **4**

7. a) Discuss Rutherfords scattering theory of unbounded motion. **10**
   b) Write a note on differential cross-section. **4**

SLR-MM – 477

Seat No.	

M.Sc. (Part – I) (Semester – I) (Old-CGPA) Examination, 2015
PHYSICS (Applied Electronics)
Paper – I : Mathematical Techniques

Day and Date : Monday, 16-11-2015 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-Programmable Calculator is allowed.*
4) ***All*** *questions carry* ***equal*** *marks.*

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

i) The Cauchy Riemann equations are for the analytic function $f(z) = v + iu$ are

A) $v_x = u_y$ and $u_x = -v_y$ B) $u_x = v_y$ and $v_x = u_y$

C) $u_x = -v_y$ and $v_x = u_y$ D) $u_x = u_y$ and $v_x = v_y$

ii) A function v is said to be Harmonic if it satisfy

A) $v_{xx} + u_{yy} = 0$ B) $v_{xy} - u_{xy} = 0$

C) $v_{xx} + v_{yy} = 0$ D) $u_{xy} - v_{xy} = 0$

iii) The particular solution of the ordinary differential equation is the solution obtained by putting particular values to

A) Dependent variable B) Independent variable

C) Arbitrary constants D) All of the above

iv) The vectors [0, 1,0], [1, 0, –1], [1, 0, 1] are

A) Linearly independent

B) Linearly dependant

C) Orthogonal

D) Linearly independent and orthogonal

v) The Fourier series of f (x) in (–a, a) will involve _____ if f (x) is even.

A) Only cosine terms B) Constants

C) Both sine and cosine terms D) Only sine terms

vi) The vectors X_1, X_2 and X_3 are said to be orthogonal if

A) $X_1 . X_2 = 0$, $X_2 . X_3 = 0$ and $X_3 . X_1 = 0$

B) $X_1 . X_2 = 1$, $X_2 . X_3 = 1$ and $X_3 . X_1 = 1$

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

D) None of the above

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

i) The value of the integral $\int_c \frac{dz}{z^2 - 2z}$ c : | z | = 1 is 0.

ii) Fourier series of the function exists if it satisfy continuity condition.

iii) Laplace transform is derived from Integral Transform by taking t < 0.

iv) Cosecx cannot be expressed as Fourier series in $(-\pi, \pi)$.

v) Fourier cosine transform of $\frac{1}{x}$ is $\sqrt{2/\pi}$.

vi) If $L\{f(t)\} = \phi(s)$ then $L\{e^{-at} f(t)\} = \phi(s + a)$.

vii) If the vectors are linearly independent then one vector can be expressed as linear combination of others.

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

2. Write short notes on :

a) State and explain Cauchy Residue theorem with an example. **5**

b) Define Orthogonal and Unitary matrices. **4**

c) Write a note on Integral Transform. **5**

3. a) Show that the function $u = x^2 - y^2$ and $v = \frac{y}{x^2 + y^2}$ are harmonic, but they are not harmonic conjugates of each other. **8**

   b) Find the eigen values and eigen vectors corresponding to negative eigen values $\begin{pmatrix} 2 & 1 & 1 \\ 2 & 3 & 2 \\ 3 & 3 & 4 \end{pmatrix}$. **6**

4. a) Solve $(2x-1)^3 \frac{d^3y}{dx^3} + (2x-1)\frac{dy}{dx} + (-2y) = 0$. **6**

   b) Find the Fourier Series of $f(x) = x^3$ in $[-\pi, \pi]$. **8**

5. a) Define Laplace transform and hence find Laplace transform of $\int_0^t e^{-u} u^3 \, du$. **8**

   b) Use Cauchy Integral formula to evaluate $\int_C \frac{4 - 3z}{z(z-1)(z-2)} dz$ where C is the circle $|z| = 3/2$. **6**

6. a) 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**

   b) Solve $(D^4 + 8D^2 + 16)y = \sin^2 x$. **6**

7. a) Express the function, $f(x) = \begin{cases} 1, & |x| < 1; \\ 0, & |x| > 1 \end{cases}$. Hence evaluate $\int_0^\infty \frac{\sin \omega \sin \omega x}{\cos \omega} d\omega$. **8**

   b) Evaluate the integral using Laplace transform method $\int_0^\infty \frac{e^{-at} - e^{-bt}}{t} dt$. **6**

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Seat No.	

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

Day and Date : Wednesday, 18-11-2015 Max. 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) Atomic radius (r) of the atom in FCC structure is

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

2) Miller indices of the plan parallel to 'x' and 'z' axes are

a) (0 0 1) b) (1 0 0) c) (0 1 0) d) (1 0 1)

3) Dielectric power loss is given by the relation

a) $V^2\ \omega c \cos(90-\phi)$ b) $V^2\ j\omega c \sin(90-\phi)$

c) $V^2\ j\omega c \sin\phi$ d) $V^2\ j\omega c \cos(90+\phi)$

4) Dielectric constant of air is

a) 2 b) 0.5 c) 0 d) 1

5) Polarization is said to be effective, if the ratio of average dipole energy to the average thermal energy is

a) < 1 b) > 1 c) = 1 d) = 0

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

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

P.T.O.

7) Electric susceptibility is given by the relation

a) P/E b) $\frac{E}{4\pi}$ c) E/P d) $\frac{(\varepsilon - 1)E}{4\pi}$

8) Packing fraction of FCC structure is

a) 74% b) 68% c) 52% d) 69%

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

1) Impedance is nothing but the internal resistance.
2) Lattice constant is less than atomic radius.
3) Frequency of x-ray is around 10^{18} to 10^{20} Hz.
4) Ewald sphere is drown with a diameter $1/\lambda$.
5) Effective mass is greater than real mass.
6) The addition of penta valent impurity creates n-type semiconductor.

2. Attempt following : **14**

1) Clausius-Mosotti equation. **5**
2) Schottky effect. **5**
3) Penetration depth (λ). **4**

3. a) What is superconductor ? Give its types and explain Meissner's effect. **10**

b) Write about direct and indirect band gap semiconductor. **4**

4. a) What is dielectric polarization ? Give the expression for Lorentz internal field. **10**

b) Explain complex dielectric constant of solid. **4**

5. a) What is reciprocal lattice ? Show that BCC is the reciprocal of FCC. **10**

b) Give the elementary concept of poly crystalline, nano crystalline and amorphous materials. **4**

6. a) What is extrinsic semiconductor ? Write the expression for carrier concentration in n-type semiconductor. **10**

b) Calculate London penetration depth of mercury at 5 K, Given λ at 0 K = 30 nm and Tc = 4.12 K. **4**

7. a) Write the thermodynamics of superconductor. **10**

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

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SLR-MM – 479

Seat No.	

M.Sc. (Part – I) (Semester – I) Examination, 2015
PHYSICS (Appl. Elect.) (Old-CGPA)
Paper – III : Analog and Digital Electronics

Day and Date : Friday, 20-11-2015 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) Figures to **right** indicate **full** marks.*

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

1) The major difference between ground and virtual ground is that virtual ground is only a
   a) voltage reference b) current reference
   c) power reference d) difference reference

2) The common-mode voltage gain is
   a) smaller than differential voltage gain
   b) equal to voltage gain
   c) greater than differential voltage gain
   d) none of the above

3) _____ is a key characteristic of an instrumentation amplifier.
   a) High CMRR b) High output offset
   c) High output impedance d) None of the above

4) _____ is the total phase shift requirement, around the feedback loop, for a phase-shift oscillator.
   a) 90° b) 180° c) 270° d) 360°

5) Decimal value of binary 10010 is
   a) 6 b) 9 c) 18 d) 20

P.T.O.

6) The register in the 8085A that is used to keep track of the memory address of the next op-code to be run in the program is the
   a) stack pointer b) program counter
   c) accumulator d) flag

7) A differentiator is used to measure
   a) the sum of the input voltage
   b) the difference between two voltages
   c) the area under a curve
   d) the rate of change of the input voltage

8) The lead-lag circuit in the Wein-bridge oscillator has a resonant frequency at which the attenuation is
   a) 1/2 b) 1/3 c) 1/4 d) 1/5

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

1) 8085 microprocessor has 14-bit address bus.

2) The output voltage of a summing amplifier is proportional to the sum of the input voltages.

3) 8085 microprocessor has 1k of internal ROM.

4) The open loop gain of an op-amp depends on the values of the resistors used in the electrical circuit.

5) LC feedback elements are normally used in oscillators for frequencies greater than 1 MHz.

6) A reliable method for eliminating decoder spikes is to use strobing.

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

1) Demultiplexer

2) Synchronous counter

3) Op-amp used as differentiator

4) LC tunable oscillator.

3. a) State and explain the characteristics of an Ideal Op-Amp. **8**

b) What are the factors that affect the input offset voltage, input bias and input offset current ? **6**

4. a) With the help of neat labelled diagram explain RC phase shift Oscillator. Explain its operation. Write its merits and demerits. **8**

   b) Draw the circuit of square wave generator using an op-amp. Explain the operation of circuit drawing output waveform. **6**

5. a) Draw the logic circuit of R-S flip flop using NOR gate. Explain its operation by using state transition table. **8**

   b) What is D flip-flop ? Describe how the JK flip flop is realized. What is its advantage over RS flip-flop ? **6**

6. a) Explain the function of following in 8085 microprocessor : **8**

      i) Flags

      ii) Accumulator

      iii) Program counter

      iv) Stack pointer

   b) Write a program in 8085 assembly language to divide two 8-bit numbers stored in consecutive memory locations. **6**

7. a) What is switching regulator ? List four major component of switching regulator. **8**

   b) Define the CMRR and explain the significance of relatively large value of CMRR. **6**

SLR-MM – 480

Seat No.	

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

Day and Date : Monday, 23-11-2015 Max. Marks : 70

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

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

*2) Attempt **any 3** from Q. **3** – Q. **7**.*

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

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

1) If N = dL/dt = 0, where N is the torque and L, the angular momentum, then which of the following is conserved ?

a) Torque b) Angular momentum

c) Linear momentum d) Energy

2) If the Hamilton's principal function is $S = 2\alpha \int (\cos^2(\omega t + \beta) - 1/2)$, then the Lagrangian, L is

a) $L = 2\alpha(\cos^2(\omega t - \beta) + 1/2)$ b) $L = 2\alpha(\cos^2(\omega t + \beta) - 1/2)$

c) $L = 2\alpha(\cos^2(2\omega t + \beta) - 1/2)$ d) $L = 2\alpha(\cos^2(2\omega t + \beta) + 1/2)$

3) Constraints introduce which of the following difficulties in the solution of mechanical problems ?

a) The coordinates are no longer all independent

b) The force of constraint is not furnished a priori

c) Both (a) and (b)

d) None of the above

P.T.O.

4) In a central force motion, if the circular orbit is stable, then a small increase in the particle energy above the value for a circular orbit results in

   a) A drastic variation of the orbital radius

   b) Constancy of the orbital radius

   c) Only a slight variation of orbit radius

   d) A large variation of orbit radius

5) The physical quantities defined without reference to a set of generalized principles is a merit of

   a) D' Alembert' s principle
   b) Variational principle
   c) Hamilton's principle
   d) Lagrange's principle

6) A monogenic system refers to the motion of those mechanical systems for which all forces are derivable from a generalized scalar potential that may be a function of

   a) Coordinates
   b) Velocities
   c) Time
   d) All of the above

7) Under canonical transformations, $F_2 = q_i P_i$, $Q_i = q_i$ 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) The fundamental Poisson brackets are _____ under canonical transformations.

   a) Variant
   b) Invariant
   c) Jacobian
   d) Partial derivatives

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

1) Holonomic constraints can be put in an equation form.

2) Constraints cannot introduce restrictions in the motion of a mechanical system.

3) According to Kepler's laws of planetary motion, the square of the periods of the various planets are proportional to the square of their major axes.

4) In Rutherford's scattering, the scattering angle is a smooth monotonic function of the impact parameter.

5) As per Euler's theorem, the general displacement of a rigid body with one point fixed is a rotation about some axis.

6) If coordinates are cyclic in a Lagrangian, then they are also cyclic in a Hamiltonian.

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

a) Deduce the work-energy theorem. **5**

b) Explain briefly the general analysis of orbits. **4**

c) Explain the principle of least action. **5**

d) What are the conditions for the transformation to be canonical ? Explain. **4**

3. a) State the conservation of energy for a single particle system. **4**

b) Prove conservation of linear and angular momentum for a single particle system. **10**

4. a) What is meant by virtual work ? Explain D' Alembert's principle. **6**

b) Obtain the Lagranges equation of motion for Atwood's machine. **8**

5. a) Set up the equations of canonical transformation. **6**

b) Prove that the transformation $Q_1 = q_1$, $P_1 = p_1 - 2p_2$, $Q_2 = p_2$, $P_2 = -2q_1 - q_2$ is canonical and find a generating function. **8**

6. a) Explain Jacobian identity. **4**

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

7. a) Explain why Hamilton's formalism is called an integral formalism ? **6**

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

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SLR-MM – 481

Seat No.	

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

Day and Date : Tuesday, 17-11-2015 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) μ -space for a single particle is _____
a) two dimensional b) three dimensional
c) six dimensional d) dimensionless

ii) If the system is in equilibrium state, following three quantities are constant through the system.
a) T, S, P b) T, S, μ c) T, P, μ d) μ , P, S

iii) Ideal gas is one for which mutual interaction between the molecules is _____
a) high b) negligible c) zero d) repulsive

iv) In B.E. statistics, particles are _____
a) distinguishable b) indistinguishable
c) dimensionless d) weightless

v) Work done by ideal gas during isothermal expansion is W = _____
a) $S_2 - S_1$ b) $T (S_2 - S_1)$ c) $R \log (V_2/V_1)$ d) Q/T

vi) _____ law of thermodynamics is the law of conservation of energy.
a) 0^{th} b) 1^{st} c) 2^{nd} d) 3^{rd}

vii) Phase space have _____ dimensions.
a) N b) 6N c) 3N d) 2N

viii) Sakur-tetroid formula gives the relation for _____
a) entropy b) enthalpy c) internal energy d) Gibb's energy

P.T.O.

B) **True** or **false** : **6**

i) At critical point $g_1 = g_2 \neq g_3$.

ii) In grand canonical ensemble, system exchanges both energy and matter.

iii) Diffusion is reversible process.

iv) Liouvilles equation gives the rate of change in temperature.

v) Critical indices are nothing but the reduced indices.

vi) As per Bose Einstein condensation, if $T \rightarrow 0$, $No \rightarrow N$.

2. Attempt **any three** of the followings : **14**

a) Explain phase transition using P-T diagram.

b) Give the law of corresponding states.

c) Nernst heat theorem.

d) Microstates and macrostates.

3. Answer the followings :

a) Derive the Einstein's equation of Brownian motion. **8**

b) Discuss the Fluctuation dissipation theorem. **6**

4. a) Discuss the laws of thermodynamics. **6**

b) Derive the expression for entropy of mixing of different gases. **8**

5. a) Give in detail the expression for classical ideal gas. **8**

b) Derive Clausius-Clapeyron's equation. **6**

6. a) Derive the condition for phase equilibrium. **6**

b) Give the expression for critical indices. **8**

7. a) What is micro canonical ensembles ? Give the condition for equilibrium between two system in thermal contact. **6**

b) Write about Boltzmann's canonical distribution law $ni = Ae^{-\beta\varepsilon i}$. **8**

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SLR-MM – 482

Seat No.	

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

Day and Date : Thursday, 19-11-2015 Max. Marks : 70

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

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

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

i) Which of the following is a Hermitian operator ?

a) $\frac{\partial}{\partial t}$ b) $-\frac{\partial}{\partial x}$ c) $\frac{\partial^2}{\partial t \partial x}$ d) $i\frac{\partial}{\partial t}$

ii) If potential is symmetric then the wave function of a particle will be
a) symmetric
b) antisymmetric
c) either symmetric or antisymmetric
d) neither symmetric nor antisymmetric

iii) If ψ_1 and ψ_2 are two states defined by

$\psi_1 = \phi_0 - 2\phi_1 + 3\phi_2$

$\psi_2 = \phi_0 - \phi_1 + \alpha\phi_2$

where, α is constant. The value of α for which ψ_1 is orthogonal to ψ_2 is

a) 2 b) 1 c) –1 d) – 2

iv) The spectrum of hydrogen atom has
a) discrete energy levels which are equally spaced
b) a ground state which is degenerate
c) a ground state which shows minimum uncertainty
d) degenerate excited states

P.T.O.

v) The ground state wave function of a linear harmonic oscillator
   a) has exactly one node
   b) is Gaussian in momentum space
   c) is an eigen state of position operator
   d) has odd parity

vi) If two observables A and B can be simultaneously measured, then
   a) $[A, B] = 0$
   b) $A = B^{+}$
   c) Commutator of A and B is unit operator
   d) None of these

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

vii) The radial part of the wave functions of the hydrogen atom is expressed in terms of Legendre polynomials.

viii) The parity of a wave function $\psi(x) = \sin x$ is odd.

ix) The first Bohr radius is $5\,\mathring{A}$.

x) The average nuclear charge decreases for a electron having large l values.

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

xi) As per Pauli principle an orbital can accommodate 2 electrons having the spins _____

xii) The momentum operator in x dimension is _____

xiii) In a DeBroglie relation momentum is given by _____

xiv) Nitrogen atom has _____ p electrons.

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

a) What are the properties of an acceptable wave function ?

b) Show that the commutate bracket $\left[x^2, \frac{d}{dx} \right]$ is equal to –2.

c) For hydrogen atom show that the maximum radial density occurs at a distance a_0 where a_0 is Bohr radius.

d) Write the Hamiltonian for many electron atom and explain it.

3. a) A one dimensional box is defined by a potential v = 0 for 0 < x < a and v = ∞ for x < 0 and x > a where a is width of a box. Obtain the solutions and normalized eigen function. **10**

   b) Show that the longer wavelengths depend on larger width of a box. **4**

4. a) Solve the following equation to get E **10**

$$\frac{\partial^2 \psi}{\partial x^2} + \frac{8\pi^2 m}{h^2}\left(E - \frac{1}{2} k x^2\right)\psi = 0$$

   b) Obtain the normalized ψ of above equation and show them on a diagram along with energy levels. **4**

5. a) Write the Schrodinger equation for hydrogen like atom in spherical polar co-ordinates and separate the three equations exclusive functions of ϕ, θ and r. **4**

   b) Solve the radial part to get the expression for energy. **10**

6. a) Set up a Hamiltonian for helium atom using the slater determinant, overall wave function and using the minimization of energy. Obtain the ground state energy of the helium atom. **10**

   b) State and explain Heisenberg's uncertainty principle. **4**

7. a) Describe the LCAO approximation and discuss the secular equation. **6**

   b) Write a note on Slater's rules. **8**

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SLR-MM – 483

Seat No.	

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

Day and Date : Saturday, 21-11-2015 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. Objective questions. **14**

A) Choose correct alternative **8**

1) Work done per unit charge by the source is

a) EMF b) MMF

c) Poynting's vector d) Potential

2) As per the second law of reflection, angle of incidence is equal to

a) $\theta i = 0$ b) $\theta i = \theta r$

c) $\theta i < \theta r$ d) $\theta i > \theta r$

3) Maxwell's corrections to Ampere's circuital law is

a) div B = 0 b) curl $E = -\frac{\partial B}{\partial t}$

c) curl $H = J + \frac{\partial D}{\partial t}$ d) div $D = \rho$

4) The law of conservation of energy for EM waves is

a) $T \times R = 1$ b) $T - R = 1$

c) $\frac{T}{R} = 1$ d) $T + R = 1$

P.T.O.

5) Minkowski is a _____ dimensional _____ space.
   a) One, scalar and vector
   b) Four, real scalar
   c) Four, real vector
   d) All of these

6) Magnetic vector potential 'A' and scalar potential 'ϕ' are related to _____ potential.
   a) Hertz
   b) Coulomb
   c) Lorentz
   d) None of these

7) Potential function $2x^2 + 2y^2 + 2z$ satisfy _____ equation.
   a) $\nabla^2\phi = 0$
   b) $\nabla^2\phi \neq 0$
   c) $\nabla^2\phi = \rho/\varepsilon_0$
   d) All of these

8) Radiation resistance for half wave antenna is _____ ohms.
   a) 70
   b) 70.2
   c) 73.2
   d) 71.2

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

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

2) Electromagnetic waves are transverse in nature.

3) $\frac{\partial\rho}{\partial t} = J$

4) The total power radiated is independent of radius of the sphere, which is according to law of conservation of force.

5) Thomson scattering is an important phenomenon in plasma physics.

6) All Maxwell's equations are homogenous.

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

1) Radiation damping

2) Skin depth

3) Faraday's law for stationary media

4) Polarization of EM wave.

3. a) Explain Poynting's theorem. **8**

   b) Show that momentum density is related to Poynting's vector. **6**

4. a) Give the relations in quasistationary electric and magnetic systems. **8**

   b) Give the interaction between two current loops. **6**

5. a) Write the field equations for the electromagnetic waves passing through the conductor. **8**

   b) Write the Maxwell's correction to Ampere's theorem. **6**

6. a) What is retardation ? Write the solution of in-homogenous wave equation on the basis of retarded and advance potential. **10**

   b) Explain Maxwell's in homogenous and homogenous wave equations. **4**

7. a) What is radiation emission ? Explain radiation from half wave antenna. **10**

   b) Explain the wave equation in terms of electromagnetic potential. **4**

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SLR-MM – 485

Seat No.	

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

Day and Date : Tuesday, 17-11-2015 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) Figure to ***right*** *indicates* ***full*** *marks.*

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

1) How much dimension phase space has
a) N b) 3 N c) 6 N d) 2 N

2) When system is in equilibrium state, which quantities will remain constant through the system.
a) T, P, K b) T, P, μ c) T, P, D d) T, P, η

3) Which law of thermodynamics is the law of conservation of energy
a) 0^{th} b) 1^{st} c) 2^{nd} d) 3^{rd}

4) The chemical potential photon gas (μ) is
a) $\mu > O$ b) $\mu < O$ c) $\mu = O$ d) $\mu = \infty$

5) Pressure at critical point is
a) 3 b b) 8/27R c) 3b/27Rb d) 8a/27Rb

6) For which gas mutual interaction between the molecules is zero
a) Real gas b) Fermi gas c) Ideal gas d) Bose gas

7) In micro canonical ensemble following parameters remains constant.
a) TVN b) EVN c) EVT d) EVμ

8) In F.D. statistics particles are
a) distinguishable b) indistinguishable
c) dimension less d) weightless

P.T.O.

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

1) Clausius-Clapeyron's equation gives the change of temperature with pressure.

2) In microcanonical ensample, large number of systems having EVT Constant.

3) Sakur-tetroid relation is related with the entropy.

4) Critical temperature is the highest temperature at which the gas can be liquified by increasing the pressure alone.

5) For canonical ensemble temperature is not constant.

6) The phase equilibrium curve between solid and gas is the fusion curve.

2. Attempt following : **14**

a) Canonical ensemble. **5**

b) P-T diagram of the phase transition. **4**

c) Classical ideal gas. **5**

3. A) Derive Clausius-Clayperon's equation. **8**

B) Derive conditions for phase equilibrium. **6**

4. A) Explain Gibb's grand canonical distribution. **8**

B) Calculate the increase in entropy when 746 gm water is converted in to vapor at 100°C (The latent heat of vaporization of water is 540 cal/gm.) **6**

5. A) Derive Ehrenfest's equation. **8**

B) Explain the difference between micro canonical and grand canonical ensembles. **6**

6. A) Explain fluctuation dissipation theorem. **8**

B) What is the density matrix ? **6**

7. A) Give the condensation for Ideal Bose gas. **10**

B) Discuss the Boltzmann's limit for Bosons and Fermions. **4**

SLR-MM – 486

Seat No.	

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

Day and Date : Thursday, 19-11-2015 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.*

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

i) With the symbols having the usual meaning the wavelength of an electron is _____

a) $\frac{2h}{mE}$ b) $2mE$ c) $\frac{2\sqrt{2}ME}{h}$ d) $\frac{h}{\sqrt{2mE}}$

ii) If $\Phi = Ae^{im\varphi}$ then A after normalization is _____

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

iii) The momentum operator in x dimension is _____

a) $\frac{\hbar}{2i}\frac{\partial}{\partial x}$ b) $\frac{\hbar}{i}\frac{\partial}{\partial x}$ c) $-i\hbar\frac{\partial}{\partial z}$ d) $\frac{1}{i\hbar}\frac{\partial}{\partial y}$

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

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

P.T.O.

v) The normalized ground state wave function of Hydrogen atom is given by _____

$$\psi = \frac{1}{\sqrt{4\pi}} \frac{2}{a^{3/2}} e^{-\frac{r}{a}}$$

where, a is Bohr radius and r is distance of electron from nucleus.

Expectation value of $\frac{1}{r^2}$ is

a) $\frac{4}{a^2}$ b) $\frac{2}{a^2}$ c) $\frac{1}{a^2}$ d) $\frac{4\pi}{a^2}$

vi) The energy separation between two successive energy levels of an infinite square well potential is proportional to _____

a) n b) $\sqrt{2n+1}$

c) 2n d) 2n + 1

vii) The quantum mechanical tunneling through a barrier is an example of _____

a) β decay b) α-decay

c) γ decay d) X-rays

viii) If a 10 MeV α as well as β particles are incident on a potential barrier of height 15 MeV and 5 fm in width. The probability of transmission is _____

a) higher for α particle

b) higher for β particle

c) equal for both particles

d) zero for both particles

ix) A particle is moving in x direction. The wave function is given as $\psi = Be^{ikx}$ for 0 < x < L. The value of normalization constant B is _____

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

x) The uncertainty product $\Delta x \cdot \Delta p$ for a harmonic oscillator is _____

a) $\hbar$ b) $\frac{\hbar}{2}$ c) $n\hbar$ d) $(n + 1)\hbar$

xi) A system is described by the wave function

$$\psi(\theta, \varphi) = \frac{1}{\sqrt{30}}\left[5Y_4^0 + Y_6^0 - 2Y_6^3\right]$$

where, Y are the spherical harmonics. The probability of finding the state for $l = 6$ is _____

a) $\frac{2}{15}$ b) $\frac{13}{15}$

c) $\frac{1}{6}$ d) $\frac{4}{\sqrt{30}}$

xii) The energy of the ground state of Helium atom is _____

a) – 79 MeV b) 79 MeV

c) – 79 eV d) – 79 keV

xiii) The selection rules for harmonic oscillator is _____

a) $\Delta v = \pm 1$ b) $\Delta v = +2$

c) $\Delta v = 0$ d) none of these

xiv) The N shell contains _____ electrons.

a) 8 b) 18 c) 28 d) 32

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

a) Using the proper operators derive the one dimensional Schrödinger equation.

b) Write the formula for Hermite polynomials and calculate the Hermite Polynomials $H_3(\xi)$.

c) Write the Hamiltonian for many electron atom.

d) Write a note on many electron atoms.

3. a) Derive an expression for the energy eigen values of a one dimensional box. What is zero point energy ? **7**

b) Obtain the normalized eigen functions for a particle in a box. **7**

4. a) By proper substitution of potential energy in a one dimensional Schrödinger equation, obtain the energy of a harmonic oscillator. **10**

   b) Write the eigen function of first excited state of the harmonic oscillator. **4**

5. a) Using spherical polar co-ordinates set up Schrödinger equation for Hydrogen atom. Separate the r, θ and φ parts. **10**

   b) Solve the equation for φ part and write normalized wave function. **4**

6. a) The Hamiltonian of Helium is given as

   $$H = H_1 + H_2 + \frac{1}{r_{12}} \text{ where } H_i = -\frac{1}{2}\nabla_i^2 - \frac{2}{ri}$$

   and wave function is

   $$\psi_0 = \frac{1}{\sqrt{2}}\left[1s(1)\ 1(s_2)\right]\ \left[\alpha(1)\,\beta(2) - \beta(1)\,\alpha(2)\right]$$

   where symbols have their usual meanings. Obtain the ground state energy of Helium atom. **10**

   b) What is LCAO approximation ? **4**

7. a) Set up a Hamiltonian for Hydrogen molecule ion. Calculate the H_{aa} and H_{ab} type of integrals where they have usual meanings. **10**

   b) Write a note on slater determinant. **4**

SLR-MM – 487

Seat No.	

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

Day and Date : Saturday, 21-11-2015 Max. 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** questions from Q. **3** to Q. **7**.*
*4) Figure to the **right** indicate **full** mark.*
*5) **Use** of calculator is **allowed**.*

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

1) Self inductance per unit length of long solenoid having n turns per unit length and area of cross section A is

a) $\mu_0 nA$ b) n^2A c) $\mu_0 n^2A$ d) nA

2) Total outward flux of magnetic induction 'B' through any close surface 'S' is equal to

a) One b) Infinite c) Φ d) Zero

3) EMF around a close path is equal to the time derivative of which quantity associated with the surface bounded by the path.

a) Magnetic field b) Electric field
c) Magnetic induction d) Electric field intensity

4) The law of conservation of energy for transmission and reflection of the e.m. waves is

a) $T \times R = 1$ b) $T - R = 1$ c) $\frac{T}{R} = 1$ d) $T + R = 1$

5) Incident, reflected and transmitted wave vectors are in a plane _____ to the surface.

a) Normal b) Tangential c) Oblique d) Parallel

6) $P = VI = I^2R$ is the _____ heating law.

a) Ohm's b) Faraday's law
c) Inductive d) Joule's

P.T.O.

B) **True** or **false**. **8**

1) The zero value for curl of vector field implies that there are no point sources of magnetic field.
2) For transverse magnetic wave $E_{oz} = 0$.
3) The perpendicular component of H is discontinuous by an amount proportional to the free surface current density.
4) In case of oblique incidence the angle of incident is equal to the angle of reflection.
5) The displacement current in RC circuit with A.C. generator leads the conduction current by 90 degree.
6) The divergence of vector potential vanishes under Lorentz Gauge.
7) The pointing vector S = ExH.
8) At grazing incidence ($\theta_1 = 90°$), the wave is totally reflected.

2. Attempt the following : **14**
   1) Neumann formula of mutual inductance. **5**
   2) Motional EMF. **5**
   3) Example When light passes from air $n_2 = 1$ in to glass $n_1 = 1.5$. Show that most of the light gets transmitted. **4**

3. a) Give the wave equations in 1-dimension. **7**
   b) Give the terminology of sin wave in 1-dimension. **7**

4. a) What is radiation ? Explain electric dipole radiation. **8**
   b) Explain magnetic dipole radiation. **6**

5. a) Explain reflection and transmission of the E.M. waves at normal incidence. **7**
   b) Explain reflection and transmission of the E.M. waves at oblique incidence. **7**

6. a) Explain about electromagnetic waves in a conductor. **10**
   b) Write about the reflection of electromagnetic wave at a conducting surface. **4**

7. a) What is a gauge transformation ? Explain Coulomb gauge and Lorentz gauge. **8**
   b) Explain group velocity and phase velocity of EM waves. **6**

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SLR-MM – 489

Seat No.	

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

Day and Date : Monday, 16-11-2015 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) Attempt **any three** out of Q. **3** – Q. **7**.*
*4) **Use** of nonprogrammable calculator is **allowed**.*

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

1) In the linear region power MOSFET's have _____ I/P impedance

a) In terms of Ohms b) In terms of K-Ohms

c) In terms of M-Ohms d) In terms of m-Ohms

2) In TFT, the channel layer is

a) Polycrystalline Si b) Polycrystalline GaAs

c) Monocrystalline Si d) Monocrystalline GaAs

3) A simple pn-junction diode in which both p and n are degenerate is

a) Tunnel diode b) Schottky diode

c) Gunn diode d) Zener diode

4) Burried channel CCD has a transfer inefficiency of

a) $10^{-1} - 10^{-2}$ b) $10^{-2} - 10^{-3}$

c) $10^{-3} - 10^{-4}$ d) $10^{-4} - 10^{-5}$

5) In the active region of a transistor, base to collector junction is always _____ biased.

a) Forward b) Reverse

c) Forward-Reverse d) Requires no bias

P.T.O.

6) The NDR is due to field induced transfer of conduction band electrons from _____ to _____ satellite valeys.

a) Low energy high mobility, high energy low mobility

b) Low energy low mobility, high energy low mobility

c) Low energy low mobility, low energy low mobility

d) Low energy low mobility, low energy high mobility

7) Filling the potential well by the carriers causes surface potential to

a) decrease

b) increase

c) remains unaffected

d) gets converted into some another form

8) For a MIS-diode the capacitance due to _____ is voltage independent.

a) semiconductor b) metal

c) insulator d) space charge

9) The light modulation band width is given by

a) $Af = \frac{\Delta\omega}{2\pi}$ b) $Af = \Delta\omega.2\pi$

c) $Af = \frac{2\pi}{\Delta\omega}$ d) $\Delta\omega^{2\pi}$

10) $\frac{dv}{dt}$ can be limited by connecting a

a) resistance in series with the device

b) capacitance in series with the device

c) series resistance and capacitance in series with device

d) series resistance and capacitance in shunt with device

11) In a MIS-diode, strong inversion occurs at

a) $V < V_T$ b) $V_T = 0$

c) $V = V_T$ d) $V = 0$

12) Dominating operating process for laser diode is
   a) stimulated emission
   b) transmission
   c) absorption
   d) spontaneous emission

13) _____ in GaAs makes it feasible for ultra high speed CCD's.
   a) Low electron mobility
   b) High electron mobility
   c) Low hole mobility
   d) High electron concentration

14) Triac is a _____directional device.
   a) uni
   b) bi
   c) tri
   d) none of the above

2. Attempt the following (**any three**) : **14**
   a) Modern MOSFET's are fabricated on <100 > oriented Si, – Comment.
   b) Switching characteristic of a transistor
   c) Photodiode
   d) Burried Channel CCD.

3. a) Discuss the potential well model for the charge storage mechanism. **10**
   b) Calculate the modulation band width of a GaAs LED with a carrier life time of 100 ps. **4**

4. a) With a good sketch of I-V characteristic describe Gate Turn Off thyristor (GTO). **10**
   b) Write a note on CMOS inverter. **4**

5. a) Discuss in detail the Thyrister - MOSFET characteristic of a MCT. **10**
   b) Mention its merits and demerits. **4**

6. a) Based on a single temperature model, obtain velocity - field characteristic for a GaAs. **10**
   b) Mention the important conclusions drawn from this V-F characteristic. **4**

7. Write notes on (**any two**) : **14**
   a) IGBT
   b) Triac
   c) TFT
   d) Tunnel diode.

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SLR-MM – 490

Seat No.	

M.Sc. – II (Sem. – III) Examination, 2015
PHYSICS (Applied Electronics) (New-CGPA)
Instrumentation (Paper – X)

Day and Date : Wednesday, 18-11-2015 Total Marks : 70
Time : 2.30 p.m. to 5.00 p.m.

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

i) Which of the following is digital transducer ?
   a) Strain Gauge b) Encoder
   c) LVDT d) Thermistor

ii) Strain Gauge, LVDT and thermister are examples of
   a) Active transducers b) Passive transducers
   c) Analog transducers d) Digital transducers

iii) Piezo-electric transducer produces emf, when it is subjected to
   a) Mechanical force b) Humidity
   c) Illuminations d) Heat

iv) The standard supply voltages for ordinary operational amplifier is
   a) ± 15V b) ± 20V c) ± 9 V d) ± 10V

v) A differential amplifier amplifies
   a) Addition of two signals b) Difference of two signals
   c) Multiplication of two signals d) All of the above

vi) The gain of the voltage follower is
   a) 1 b) 2 c) 100 d) 0

vii) Function generator is used to generate
   a) Sine wave b) Square wave
   c) Triangular d) All of the above

P.T.O.

viii) The output of the DAC can be either

a) Voltage or resistance b) Voltage or current

c) Voltage or capacitance d) Current or resistance

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

i) The resistance of LDR _____ when exposed to light energy.

ii) The humidity is expressed in _____

iii) _____ is used to recover the signal buried in noise.

iv) Spikes can be obtained by differentiating _____ wave.

v) The resolution of the ADC is given by _____

vi) Multiplexer is used to _____

2. Attempt the following : **14**

a) Write a note on optical transducers.

b) Explain principle of phase sensitive detector.

c) Discuss the working of Q-meter.

3. a) Discuss the principle and working of various digital transducers. **10**

b) Explain voltage to frequency converter. **4**

4. a) With neat diagram discuss the principle and working of flow transducers. **10**

b) Write applications of logarithmic amplifiers. **4**

5. a) With a neat schematic explain the working of lock-in amplifier. **10**

b) Describe the operation of isolation amplifier. **4**

6. a) With neat block diagram explain the working of dual trace oscilloscope. **10**

b) Write a note on wave analyzer. **4**

7. a) Describe the working of dual slope type ADC with diagrams. **10**

b) Explain principle of frequency meter. **4**

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SLR-MM – 491

Seat No.	

M.Sc. – II (Semester – III) (New CGPA) Examination, 2015
PHYSICS (Appl. Electronics)
Paper – XI : Communication Systems

Day and Date : Friday, 20-11-2015 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) The PWM needs
   a) More power than PPM
   b) More bandwidth than PPM
   c) More Samples per second than PPM
   d) None

2) What is the highest percentage of modulation for AM ?
   a) 50% b) 75% c) 100% d) 80%

3) A carrier signal has
   a) Constant amplitude
   b) A frequency of 20 KHz and above
   c) A varying amplitude
   d) The information content

4) Two binary values are represented by two different frequencies in
   a) ASK b) PSK c) FSK d) None

5) The main advantage of TDM over FDM is that it

a) Needs less power

b) Needs less bandwidth

c) Needs simple symmetry

d) Gives better S/N ratio

6) Find % modulation if the instantaneous message is 80 sinwt and 40 sinwt.

a) 33.33% b) 33% c) 50% d) 100%

7) What is the category of data transmission, if the binary pulse is maintained for the entire bit time ?

a) Return to zero b) Bipolar

c) Unipolar d) Non-return to zero

8) In AM if m = 0, then which of the following signal exists ?

a) Upper side band b) Lower side band

c) Carrier signal d) Message signal

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

1) The function of the low pass filter in PAM modulator is to smooth the pulse.

2) AM transmission power increases with frequency.

3) The ratio of maximum deviation to maximum modulation frequency is called Modulation Index.

4) The process of impressing intelligence on the carrier is called mixing.

5) In full duplex communication system the flow of information takes place in both directions simultaneously.

6) Pulse modulation is often used in telegraphy.

2. a) Discuss about balanced modulation. **5**

b) Write a note on PLL. **5**

c) Discuss briefly about data formats. **4**

3. a) With neat block diagram discuss about AM receiver and detector. **10**

   b) Write a note on Class B audio amplifiers. **4**

4. a) With neat block diagram explain the working of FM transmitter. **10**

   b) Write a note on frequency trippler. **4**

5. a) Explain in detail about pulse width modulation. **10**

   b) Write a note on quantization of signals. **4**

6. a) Explain in detail about Pulse Time Modulation (PTM) and demodulation. **10**

   b) Write a note on delta modulation. **4**

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

   b) Write a note on full duplex in data format. **4**

SLR-MM – 492

Seat No.	

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

Day and Date : Monday, 23-11-2015 Max. Marks : 70

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

Instructions : *i) Attempt **5** questions.*
*ii) Question **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 nonprogrammable calculator is **allowed**.*

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

1) The J values associated with 3_F term are
a) 0, 1, 2 b) 1, 2, 3 c) 2, 3, 4 d) 3, 4, 5

2) Resultant spin S is zero. The term then will have _____ as a multiplicity.
a) singlet b) doublet c) triplet d) quartet

3) In the Zeeman effect $^2D_{3/2}$ term will split in to _____ levels.
a) one b) two c) three d) four

4) The hyperfine structure of an atom arises due to an interaction between the angular momenta
a) L and I b) S and I c) L and S' d) J and I

5) The quantum number _____ determines the energy and size of the orbital of the atom.
a) n b) l c) m_l d) m_s

6) For the lines of Q branch $\Delta J = ?$
a) +1 b) zero c) –1 d) +2

P.T.O.

7) The intensity of a band is determined by
   a) Frank-Condon principle b) Hunds rules
   c) Pauli principle d) Quantum numbers

8) The binding energy per nucleon is maximum around mass number A =
   a) 12 b) 37 c) 56 d) 108

9) The density of nuclear matter is around
   a) 10^{17} kg/(meter)^3 b) 10^{19} kg/(meter)^3
   c) 10^{21} kg/(meter)^3 d) 10^{23} kg/(meter)^3

10) The ratio of sizes of the nuclei $_{82}Pb^{208}$ and $_{12}Mg^{26}$ is approximately
   a) 16 b) 8 c) 4 d) 2

11) Nuclei having same mass number but different proton number are called
   a) isotones b) isobars
   c) isotopes d) minor nuclei

12) $_{92}U^{238}$ has a decay chain involving 8 alpha decay and 6 β decays. The resulting nucleus at the end of the process will have
   a) z = 76 ; A = 200 b) z = 88 ; A = 206
   c) z = 82 ; A = 206 d) z = 84 ; A = 224

13) The inverse process of stripping reaction is _____ reaction.
   a) Exothermic b) Pick-up
   c) Endothermic d) None of these

14) Angular momentum of the deuteron is
   a) zero b) one half c) one d) two

2. Answer in brief : **14**

a) Write an electronic configuration of following elements.
   i) Sodium ii) Argon

   Can you guess about their atomic spectra ?

b) Calculate Lande'g factor for the term $^2D_{5/2}$.

c) The separation between the lines of a microwave spectrum of a rigid diatomic molecule is 0.7143 cm^{-1}. Calculate the moment of inertia.

Atomic masses are :

Proton : 1.007276, Neutron = 1.008665

$1H^2$: 3.016056, Helium = 3.016030

All masses are in mu.

3. a) Give the theory of L-S coupling. Derive an expression for interaction energy in L-S coupling. **9**

   b) What terms are obtained in pd configuration using L-S coupling ? **5**

4. a) Derive an expression for the energy levels of a rigid rotator. Draw the energy level diagram. State the selection rule and discuss the resulting spectrum. **10**

   b) What is the effect on the spectrum due to an isotopic molecule ? **4**

5. a) Discuss at length the semi empirical mass formula. Give details of all components involving in binding energy. **11**

   b) Define packing fraction. **3**

6. a) Discuss the evidences for the existence of magic numbers. **10**

   b) In brief, explain the Fermi model. **4**

7. a) Using a partial wave analysis obtain an expression for the total cross section. What is the role of phase shift ? **10**

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

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SLR-MM – 493

Seat No.	

M.Sc. – II (Semester – III) Examination, 2015
PHYSICS (Applied Electronics) (Old-CGPA)
Paper – IX : Semiconductor Devices

Day and Date : Monday, 16-11-2015 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** from Q. **3** to Q. **7**.*
*4) **Use** of nonprogrammable calculator is **allowed**.*

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

1) The over-drive of a BJT is given by _____

a) $\frac{I_c}{I_{c(sat)}}$ b) $\frac{I_b}{I_{b(sat)}}$ c) $\frac{I_{c(sat)}}{I_c}$ d) $\frac{I_{b(sat)}}{I_b}$

2) Power MOSFET's are _____ controlled devices

a) Power b) Current

c) Voltage d) Both b) and c)

3) Burried channel CCD has a transfer inefficiency as _____

a) 10^{-1} to 10^{-2} b) 10^{-2} to 10^{-3}

c) 10^{-3} to 10^{-4} d) 10^{-4} to 10^{-5}

4) Enhancement MOSFET's respond only to _____

a) Negative V_{GS} b) Positive V_{GS}

c) Both a) and b) d) No voltage required

P.T.O.

5) In a MIS diode, the ON-set of strong inversion occurs at _____

a) $\psi_S = 2\psi_B$ b) $\psi_S = \psi_B$ c) $\psi_S = 0$ d) $\psi_S = \infty$

6) Transferred electron devices operates at _____

a) H_z b) KH_z c) MH_z d) GH_z

7) Wavelength and photon energy are related as _____

a) $\lambda = \frac{1.24}{h\upsilon}$ b) $\frac{12.4}{h\upsilon}$ c) $\frac{h\upsilon}{1.24}$ d) $\frac{h\upsilon}{12.4}$

8) It is possible to transfer last bit of signal in a CCD because of the presence of _____

a) Thermal diffusion b) Self induced drift

c) Fringing field d) Interface

9) Dominating operating mechanism for LASER is _____

a) Stimulated emission b) Absorption

c) Transmission d) Spontaneous emission

10) In a current controlled NDR devices, _____ are formed.

a) High current filament b) Low current filament

c) High field domains d) Low field domains

11) Interface traps are normally reduced by_____ annealing.

a) O_2 b) N_2 c) H_2 d) Cl_2

12) Tunnel diode exhibits _____controlled NDR.

a) Current b) Voltage c) Power d) None

13) In a Si – SiO_2 MOS diode, the layer SiO_X is stoichiometric when _____

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

14) The maximum sensitivity of the eye is at _____μm.

a) 0.5 μm b) 0.555 μm

c) 0.70 μm d) None of the above

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

   a) Role of fringing field in charge transfer mechanism. **5**

   b) Write a note on IR-LED. **4**

   c) Triac. **5**

   d) Measurement of interface trap density. **4**

3. a) Discuss the potential well model for the charge storage mechanism in a CCD. **10**

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

4. a) Discuss and compare transferred electron effect in GaAs and InP. **10**

   b) What is stretch out ? Why is it ? **4**

5. a) What are dV/dt and $\frac{dI}{dt}$ effects ? **10**

   b) Write a note on frequency response of a CCD. **4**

6. a) Explain how transfer efficiency can be improved with a Burried Channel CCD. **10**

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

7. a) Based on a single temperature model, obtain velocity-field characteristic for GaAs. **10**

   b) Draw the important conclusions of V – F characteristics. **4**

SLR-MM – 494

Seat No.	

M.Sc. – II (Semester – III) (C.G.P.A.) Examination, 2015
PHYSICS (Appl. Elect.) (Paper – X) (Old)
Instrumentation

Day and Date : Wednesday, 18-11-2015 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 correct alternatives : **8**

i) Displacement can be measured using
a) Thermistor b) RTD c) LVDT d) Microphone

ii) Which of the following is a voltage generating type transducer ?
a) microphone b) tube light c) solar cell d) thermistor

iii) A pH value of 7, indicates the solution is
a) acidic b) alkaline c) neutral d) none of the above

iv) An instrumentation amplifier consists of
a) thermistor b) lock-in amplifier
c) op-amps d) all of the above

v) In lock-in amplifier, the term lock-in comes from the fact that the instrument locks into frequency of
a) Input signal b) IF signal
c) Reference signal d) Output signal

vi) The sample and hold circuit uses the following device as a switch
a) relay b) on-off switch
c) FET d) BJT

vii) The instrument which presents graphically the energy distribution of a signal as a function of frequency is
a) oscilloscope b) frequency meter
c) spectrum analyser d) X – Y recorder

viii) A piezo-electric crystal can be used as a transducer to measure
a) sound b) light c) pressure d) speed

P.T.O.

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

i) Loudspeaker converts _____ energy into _____ energy.

ii) An instrumentation amplifier is constructed using _____ amplifiers.

iii) Thermistor is a _____ temperature coefficient device.

iv) Thickness can be measured with _____

v) Spectrum analyser is used to measure _____

vi) Hydrogen ion concentration of a solution can be measured using _____

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

a) Discuss the working of thermo electric transducers.

b) Explain the feedback transducer system.

c) Explain the working of Q-meter.

d) How does a S/H circuit work ? Explain.

3. a) Discuss the classification of transducers in detail with examples. **10**

b) What is Hall effect ? Explain. **4**

4. a) Explain in detail, the working of a temperature balance system. **10**

b) Mention the basic characteristics of an instrumentation amplifier. **4**

5. a) With neat block diagram, explain the operation of a digital frequency meter. **10**

b) Write a note on current to voltage converter. **4**

6. a) Draw the block diagram of a lock-in amplifier and explain the operation in detail. **10**

b) Write a note on frequency to voltage converter. **4**

7. a) Discuss in detail, the working of a standard interface system. **10**

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

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SLR-MM – 495

Seat No.	

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

Day and Date : Friday, 20-11-2015 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** question carry **equal** marks.*

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

1) Each FM station is allowed _____ carrier swing.
a) 150 kHz b) 75 kHz c) 50 kHz d) 88 kHz

2) The telephony system routinely uses _____ system to allow many conversations to be carried on a signal cable.
a) TDM b) FDM c) PLL d) PPM

3) In AM transmitter (low level) modulation an amplifier following the modulated RF amplifier is used.
a) Class A b) Class C c) Class B d) Class D

4) AM is generated by combining carrier and intelligence frequency through a _____ device.
a) Linear b) Non-linear c) Exponential d) None of the above

5) An FM signal with a modulation index m_f is passed through a frequency tippler. The wave in the output of the tippler will have modulation index
a) $m_f/3$ b) m_f c) $3m_f$ d) $9m_f$

6) If Emax (P-P) = 50 V, Emin = 10 V, then percentage of modulation is
a) 50.25% b) 60.63% c) 70% d) 66.6%

7) State, which characteristics of PWM change with modulation
a) Frequency b) Amplitude c) Phase d) Duty cycle

8) In AM the I.F. amplifier are tuned circuits that select the difference frequency of _____ only.
a) 400 kHz b) 455 kHz c) 150 kHz d) 88 MHz

P.T.O.

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

1) Limiter is not essential in ratio detector.

2) PWM needs less power than PPM.

3) The guard time between pulses increases transition efficiency.

4) Square law detector are used for detecting low level modulated signals (say below 1 volt).

5) Both analog and digital signals may be transmitted by TDM.

6) Asynchronous transmission is faster than synchronous transmission.

2. Attempt the following : **14**

1) Sketch block diagram of high-level modulation in AM. **5**

2) State and explain sampling theorem. **5**

3) Explain advantages of single sideband transmission. **4**

3. a) Explain in detail generation and recovery of TDM system. **8**

b) Explain in brief generation of PPM signal. **6**

4. a) Explain in detail FM radio frequency band channels and comment on the side bands and modulation index of the FM. **8**

b) Explain the working of dual slope detector. **6**

5. a) Explain filter method of generation of SSB in AM with suitable block diagram and frequency component. **10**

b) Explain in brief AM detector. **4**

6. a) Explain amplitude shift keying, why it is called on-off keying. **8**

b) Define half duplex, full duplex and simplex. **6**

7. a) Explain the quantization of signal with suitable example. **8**

b) Explain basic working of PAM signal. **6**

SLR-MM – 496

Seat No.	

M.Sc. (Part – II) (Semester – III) Examination, 2015
PHYSICS (Applied Electronics) (Old – CGPA)
Paper – XII : Atomic, Molecular and Nuclear Physics

Day and Date : Monday, 23-11-2015 Total 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 non programmable calculator is **allowed**.*

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

1) Percentage probability of finding the deuteron in a $^3D_1$ state is _____
   a) Around 1% b) Around 5%
   c) Around 10% d) Around 20%

2) One of the series that do not contain a magic number is _____
   a) 2, 8, 20, 28, 50 b) 2, 8, 18, 28, 50
   c) 2, 8, 20, 28, 50, 82 d) 8, 18, 20, 28

3) The nuclear reaction $^3Li_6 + {}^1H_1 \longrightarrow {}^2He_3 + {}^2He_4$
   Is an example of _____ reaction.
   a) (p, p) b) (p, n) c) (p, α) d) (p, γ)

4) The Serber force is _____ for odd state.
   a) zero b) +1 c) –1 d) None of these

5) The Zeeman effect, the transition obeying $\Delta m = \pm 1$ are called
   a) p or π component b) d or δ component
   c) s or σ component d) none of these

6) X-rays originate because of the transition of the electrons in _____
   a) Valence shell b) Nuclei c) Inner shell d) None of these

P.T.O.

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

7) The quantum number _____ determines the energy and size of the orbital in an atom.

8) Electron having same n and *l* values are called _____

9) _____ model is successful in predicting the ground state spin of large number of nuclei.

10) Nuclear forces where exchange of spin is allowed but not of the position co-ordinate are known as _____

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

11) The $^2D_{5/2}$ term will split up in 5 components in Zeeman effect.

12) Mean life time is reciprocal of disintegration constant.

13) The Briet Wigner formula is also known as dispersion formula.

14) Stripping reaction can be explained by single particle model.

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

a) Calculate Lande g-factors for ^2F terms. **5**

b) What j value will be obtained in j-j coupling for p-p configuration ? **4**

c) Write any four properties of Deuteron. **4**

d) Explain the compound nucleus model for nuclear reaction. **5**

3. a) Explain what are the equivalent and non-equivalent electrons. In the light of Paulies principle, obtain the terms for p^2 configuration. What terms are excluded from the p-p configuration ? **10**

b) Explain the hyperfine structure in an atomic spectra. **4**

4. a) Discuss the spectrum arising due to the anharmonic oscillator. Calculate the frequencies of fundamental, first overtune and hot band. **10**

b) Explain the spectrum of non-rigid rotator. **4**

5. a) Explain the proton-proton scattering at low energies. **10**

b) Write a note on nuclear forces. **4**

6. a) What are magic numbers ? Discuss Shell model of nucleus. **8**

b) Discuss the Fermi gas model of the nucleus. **6**

7. a) Describe the Briet Wigner dispersion formula. **8**

b) Explain compound nucleus model for nuclear reaction. **6**

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SLR-MM – 497

Seat No.	

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

Day and Date : Tuesday, 17-11-2015 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 carry* ***equal*** *marks.*

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

i) For solving set of equation AX = B, in which the matrix A is transformed to diagonal matrix

A) Gauss Seidal method

B) Gauss elimination method

C) Gauss Jordan method

D) Gauss Jacobi's method

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

A) $\sum \log y = n\sum \log a + b\sum \log x$

B) $\sum y = n\sum a + b \log x$

C) $\sum \log y = n\sum a + b\sum \log x$

D) $\sum \log y = n\sum \log a + b\sum x$

P.T.O.

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

A) Singular matrix B) Non singular matrix

C) Upper triangular matrix D) Diagonally dominant

v) The positive real root of the equation f(x) = 0 lies between a and b if.

A) f(a) f(b) > 0 B) f(a) f(b) = 0

C) f(a) f(b) < 0 D) f(a) f(b) > 1

vi) Milne 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) The Principle of least square is based on minimizing the $\sum E_i^2$, where $Ei = (y_i - y)^2$.

ii) The positive real root of the equation $x^3 + 3x - 1 = 0$ lies between 0 and 1.

iii) To predict Adam's Method at least 4 values of y, prior to the desired values are required.

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

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

vi) The value of $I = \int_0^{0.5} x^2\, dx$ by Simpson's 1/3rd rule is 1.00073.

vii) Gauss Jordan method for solving the system AX = B fails if matrix A is not diagonally dominant.

viii) Gauss Elimination is an non-iterative method.

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 $x^2 + 4 \sin x = 0$ 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**

4. a) Evaluate the integral $I = \int_0^2 e^{x^2} dx$ by taking h = 0.2 and n = 10 using Simpson's three eight rule. **6**

   b) Find the value of y(1.85) and y(2.4) using for the following data : **8**

x	1.7	1.8	1.9	2.0	2.1	2.2	2.3
y	5.474	6.050	6.686	7.389	8.166	9.025	9.974

5. a) The curve $y = ab^x$ is fitted to the data : **8**

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

   Find the best values of a and b.

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

$x + 2y - 12z + 8w = 27$

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

$6x - 12y - 8z + 3w = 49$

$3x - 7y - 9z - 5w = -11$

6. a) Perform four iterations of false position method to find the positive root of the equation $x \log_{10} x - 1.2 = 0$. **8**

b) Solve the following system of equation by Gauss Seidal method. **6**

$10x + y + 2z = 44$

$2x + 10y + z = 51$

$x + 2y + 10z = 61$

7. a) Evaluate $\int_0^{0.5} \frac{x dx}{\sin x}$, using Romberg's Integration. **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**

SLR-MM – 499

Seat No.	

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

Day and Date : Saturday, 21-11-2015 Total Marks : 70
Time : 2.30 p.m. to 5.00 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) Figures to the **right** indicate **full** marks.*
*5) **Use** of non programmable calculator is **allowed**.*

1. Objective questions : **14**

a) Select correct alternatives : **6**

i) Microwave frequency range is

a) 20Hz-20KHz b) 1GHz-2GHz
c) 300MHz-300GHz d) 0.3GHz-3GHz

ii) Electric field is only transverse to the direction of propagation and Magnetic field is not transverse is indicated as

a) TEM wave b) TE wave
c) HE wave d) TM wave

iii) The frequency > 100 MHz cannot be used in conventional Microwave tubes, because

a) Loading effect b) Transit time effect
c) Load resistance effect d) Increase in bandwidth

iv) In Gunn diode, the current density decreases with increasing in electric field is called as

a) Positive differential resistivity b) Negative differential resistivity
c) Differential conductivity d) None of these

v) In a transmission line, if the line is short-circuited $Z_L = 0$ and $V_L = 0$, then

a) Z_{in} SC = Z_0 tanhγl b) Z_{in} SC = Z_0 coshγl

c) $Z_{in} = Z_0$ d) None of these

vi) In a rectangular wave guide one of the mode cannot be exist i.e.,

a) TE mode b) TEM mode

c) TM mode d) HE mode

b) State **True** or **False**/Justify/One line answer : **8**

i) Both electric and magnetic fields are Transverse in a direction of propagation is called TEM.

True/False

ii) The velocity of electron varies in microwave with RF input voltage is called Velocity modulation.

True/False

iii) Gunn diode can be used as a microwave oscillator.

True/False

iv) The quality factor Q of a microstrip line is very High which may be required for high quality resonant MIC's.

True/False

v) Useful frequency range of microstrip line is 50GHz-100GHz.

True/False

vi) The higher order mode inference is not encountered in normal operating frequency in conventional co-axial line because lower cut-off frequency is very low.

True/False

vii) The passive elements used to control the amount of microwave power transferred from one point to another on a Transmission line is called microwave isolators.

True/False

viii) The short circuit termination produces are adjustable reactive load at desired point on a microwave Transmission line.

True/False

2. Write short notes :
   i) Wave polarization **5**
   ii) TWT **5**
   iii) Mention the use of dielectric bead support in co-axial connectors. **4**

3. a) Starting from Maxwell's equation, derive wave equation. **8**
   b) Define TE, TM and TEM waves. **6**

4. a) With neat block diagram, explain the operation of two cavity Klystron amplifier. **10**
   b) Compare Reflex Klystron and TWT. **4**

5. a) Derive the expression for the voltage and current at any point along a uniform transmission line. **10**
   b) Explain the double stub impedance matching technique of a transmission line. **4**

6. a) With the help of neat sketches. Discuss the different types of wave guide attenuators. **10**
   b) Discuss the co-axial and stripline attenuators. **4**

7. a) With neat sketch explain the variable attenuators using ferrite rotators. **8**
   b) Discuss the wave guide phase shifter. **6**

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SLR-MM – 500

Seat No.	

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

Day and Date : Tuesday, 24-11-2015 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) Attempt **any three** from Q. **3** to Q. **7**.*

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

1) The interfacing chip used for data transmission between 8085 microprocessor and 8 bit ADC is
   a) 8255 b) 8253 c) 8279 d) 8259

2) Resolution of successive approximation 10 bit ADC is
   a) 256 b) 1024 c) 8239 d) 65535

3) An interrupt vector location for RST 7.5 is
   a) 0024 H b) 002 CH c) 003 CH d) 0034 H

4) IC 74L5138 is a
   a) Buffer b) Decoder c) Latch d) Counter

5) IC 8253/8254 is a
   a) PIT b) PIC c) PPI d) PKID

6) The R-2R network can be analysed by using the _____ theorem.
   a) Thevenin's b) Norton's c) KCL d) KVL

7) In 8259, the keyboard section includes _____ FIFO RAM.
   a) 8 × 8 b) 16 × 8 c) 16 × 16 d) 8 × 24

8) The _____ is a programmable interrupt controller.
   a) 8259 A b) 8279 c) 8258 d) 8255

P.T.O.

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

1) RST 5-5 is a lowest priority interrupt.

2) Address bus is bidirectional.

3) Flash ADC is the fastest type of ADC.

4) RST 4.5 interrupt acts as a TRAP.

5) Weighted resistor DAC is easy to expand.

6) HLDA is used to acknowledge HOLD request.

2. Attempt the following : **14**

1) Write interpretation of the accumulator bit pattern for SIM instruction. **5**

2) Draw and explain need of buffered system bus of 8085. **5**

3) Write a short note on 74LS373. **4**

3. a) Explain control word register and different modes of 8253 in detail. **10**

b) What is keybounce ? How is it achieved ? **4**

4. a) Draw and explain 4 bit flash type ADC in detail. **8**

b) Explain in brief R/2R DAC conversion technique. **6**

5. a) Explain control word and different modes in 8255 in detail. **8**

b) What is the need of 8255 PPI to interface with 8085 μp. **6**

6. a) Draw and explain block diagram of 8279 in detail. **10**

b) Write a short note on interrupts of 8085 microprocessor. **4**

7. a) For a 6 bit binary R-2R ladder assume '0' = 0 volt and '1' = + 10 volt. Find the output voltages for following inputs. **8**

i) 101001 ii) 110011 iii) 111000 iv) 111001

b) Compare : Binary weighted DAC and R-2R ladder DAC. **6**
