Seat No.

M.Sc. (Semester - I) (New) (NEP CBCS) Examination: March/April-2024
PHYSICS (APPLIED ELECTRONICS)
Mathematical Physics (2323101)

Day & Date: Friday, 10-05-2024   Max. Marks: 60
Time: 03:00 PM To 05:30 PM

Instructions: 1) All questions are compulsory.
                        2) Figures to the right indicate full marks.

Q.1 A) Choose correct alternative.   **08**

1) Function $f(Z) = 1 + \frac{1}{\sqrt{Z}}$ of a complex variable Z is _____.
   a) has a simple pole at $Z = 0$
   b) has a branch cut from $Z = 0$ to $Z = \infty$ along real axis
   c) is finite at all points inside a unit circle centred at origin
   d) has a branch point at $Z = 0$

2) The integral of Z along upper half of circle $|Z| = 1$ from $Z = -1$ to $Z = 1$ is _____.
   a) $-i\pi$ b) $i\pi$
   c) $2\pi i$ d) $-2\pi i$

3) What is the dimensionality of the vector space spanned by the vector $\{(1,0,0)\ (0,1,0)\ (0,0,1)\}$ _____.
   a) 1   b) 2
   c) 4   d) 3

4) What is the dimensionality of the vector space of 3×3 matrices?
   a) 6   b) 9
   c) 12   d) 3

5) If the characteristic equation $ar^2 + br + C = 0$ has complex roots, what type of solution do we expect?
   a) Real and Distinct   b) Real and repeated
   c) Complex conjugate   d) Imaginary

6) Which principle is allowed to solve non-homogeneous linear differential equation by adding the solutions of its homogeneous counterpart & particular solution?
   a) Superposition principal   b) Homogeneous principle
   c) Integration principal   d) Differential principal

7) Which theorem states that any periodic function can be represented as an infinite sum of sines and cosines of varying frequencies?
   a) Laplace's Theorem   b) Fourier's Theorem
   c) Parseval's Theorem   d) Fourier-Mellin Transform

8) The Fourier series expansion of a sawtooth wave contains _____.
   a) Only cosine terms
   b) Only sine terms
   c) Both cosine and sine terms
   d) Only complex exponential terms

B) **Write True/False.** 04
1) Parseval's theorem relates the power of a single to its frequency-domain representation.
2) Analytic functions are necessarily harmonic functions.
3) The dimensionality of a Hilbert space can be infinite.
4) A second-order homogeneous equation with constant coefficients always has exponential solutions.

Q.2 **Answer the following. (Any Six)** 12
a) Find the complex conjugate of the following equations
   i) $Z_1 = 2 + 3i$
   ii) $Z_2 = -5 - 2i$
b) Find the nth root of the following number $Z = 8i$
c) Find the general solution of the given differential equation
$$\frac{d^2y}{dt^2} - 3\frac{dy}{dt} + 2y = 5e^{2t}$$
d) Find the general solution of the given differential equation
$$\frac{d^2y}{dt^2} 4\frac{dy}{dt} = 0$$
e) Determine whether the vectors $V_1 = (1,2,3)$ and $V_2 = (2,4,6)$ are linearly independent.
f) State Fourier theorem and briefly explain its significance in signal processing.
g) Define the Laplace transform of a function $f(t)$ and explain its significance in solving the differential equations.
h) Find the inverse of the matrix $A = \begin{bmatrix} 2 & 1 \\ 1 & 2 \end{bmatrix}$

Q.3 **Answer the following. (Any Three)** 12
a) State and Explain Cauchy's residue theorem in detail.
b) Prove that $I - A$ is invertible, where I is identity matrix and a square matrix $A^2 = A$.
c) Find the Laplace transform of $f(s)$ for the given function $f(t) = e^{-t}$ for $t \geq 0$.
d) State and prove superposition principle.

Q.4 **Answer the following. (Any Two)** 12
a) Determine the general solution of given non-homogeneous differential equation $y'' + 3y' + 2y = 4x$
b) Evaluate the integral $f(z) = \oint \frac{\cos(Z)}{Z^2+4} dz$ where C is the semicircle in the upper half plane centred at origin with radius R & $R > 2$.
c) Find the eigen values and eigen vectors of the matrix $A = \begin{vmatrix} 2 & 1 & 0 \\ 1 & 2 & 1 \\ 0 & 1 & 2 \end{vmatrix}$

Q.5 Answer the following. (Any Two)   **12**

a) Evaluate the integral $f(z) = \oint \frac{\sin(Z)}{Z^2+4} dz$ where, C is the circle $|Z| = 3$
traversed counterclockwise.

b) i)   Compute the Fourier series of the function $f(x) = x$ over the interval
$-\pi \leq x \leq \pi$.

ii) Determine the first three nonzero terms of the Fourier series for the
sawtooth wave $g(x)$, which has period 2π and is defined as follows:

$$g(x) = \begin{cases} x & \text{for } -\pi \leq x < 0 \\ x - 2\pi & \text{for } 0 < x < \pi \end{cases}$$

c) Find the inverse of the matrix $A = \begin{vmatrix} 2 & 1 & -1 \\ 1 & 0 & 2 \\ -3 & 2 & 1 \end{vmatrix}$ and verify $A \times A^- = I$

Seat No.

M.Sc. (Semester - I) (New) (NEP CBCS) Examination: March/April-2024
PHYSICS (APPLIED ELECTRONICS)
Solid State Physics (2323102)

Day & Date: Monday, 13-05-2024   Max. Marks: 60
Time: 03:00 PM To 05:30 PM

Instructions: 1) All questions are compulsory.
2) The figure to right indicate full marks.

Q.1 A) Choose the correct alternative.   **08**

1) Which of the following is a property of a superconductor?
   a) Perfect diamagnetism   b) High electrical resistance
   c) Low electrical conductivity   d) non-zero resistivity

2) What happens to the free electrons when an electric field is applied?
   a) They move randomly and collide with each other
   b) They move in the direction of the field
   c) They remain stable
   d) They move in the direction opposite to that of the field

3) Dielectrics which show spontaneous polarization are called as _____.
   a) Pyroelectric   b) Piezoelectric
   c) Ferroelectric   d) Centrosymmetric

4) According to Curie-Wiess's law _____.
   a) $\chi = C/(T - \theta)$ b) $\chi = C/(T + \theta)$
   c) $\chi = C/(\theta - T)$ d) $\chi = C/T\theta$

5) The magnetic lines of force cannot penetrate the body of a superconductor, a phenomenon known as _____.
   a) Isotopic effect   b) BCS theory
   c) Meissner's effect   d) London theory

6) In which of the following the magnetic moments align themselves parallel to each other?
   a) Paramagnetic material   b) Ferromagnetic material
   c) Ferrimagnetic material   d) Diamagnetic material

7) The amount of energy required to raise the substance of 1 kg by 1°C is called _____.
   a) specific entropy   b) specific heat capacity
   c) sensible heat   d) latent heat

8) Polarization that possess positive and negative ions when an electric field is not applied is termed as _____.
   a) Electrical   b) Magnetic
   c) Ionic   d) orientation

B) Fill in the blanks OR write true / false.   **04**

1) The fermi energy level for extrinsic 'n' type semiconductors lies _____.
2) The temperature at which the conductivity of a material becomes infinite is called _____.
3) Weber is the unit of magnetic flux.
4) In a good conductor, the energy gap between the conduction band and the balance band is wide.

Q.2 **Answer the following. (Any Six).** 12
  a) What is heat capacity?
  b) Define diamagnetic materials.
  c) Write a short note on the Bloch wall.
  d) Define Neel temperature.
  e) What is the isotope effect?
  f) What is ionic polarization?
  g) State the concept of ferroelectricity.
  h) State Curie-Wiess's law?

Q.3 **Answer the following (Any Three)** 12
  a) Write a note on BCS theory.
  b) Difference between diamagnetic and paramagnetic.
  c) Explain in Brillouin zones in 2-D.
  d) Write a note on the orientation polarization.

Q.4 **Answer the following (Any Two)** 12
  a) Explain the Clausius - Mossotti equation.
  b) Explain the motion of electrons in 1-D.
  c) Explain Meissner's effect.

Q.5 **Answer the following (Any Two)** 12
  a) Explain the Kronig-Penny model.
  b) Write a note on London penetration depth.
  c) Explain Weiss's theory in detail.

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M.Sc. (Semester - I) (New) (NEP CBCS) Examination: March/April-2024
PHYSICS (APPLIED ELECTRONICS)
Analog and Digital Electronics (2323106)

Day & Date: Wednesday, 15-05-2024 Max. Marks: 60
Time: 03:00 PM To 05:30 PM

Instructions: 1) All Questions are compulsory.
2) Figure to right indicate full marks.

Q.1 A) Choose correct alternative. (MCQ) 08

1) The basic SR flip-flop can be constructed by cross coupling by using which of the gates _____.
 a) AND or OR gate b) XOR or XNOR gate
 c) NOR or NAND gate d) AND or NOR gate

2) In JK flip-flop "no change" condition appear when _____.
 a) J = 1, K = 1 b) J = 0, K = 0
 c) J = 1, K = 0 d) None of these

3) Which is the 16-bit register for 8085 microprocessors _____.
 a) Stack pointer b) Accumulator
 c) Register B d) Register C

4) The feedback path in an op-amp integrator consists of _____.
 a) A resistor
 b) A capacitor
 c) A resistor and capacitor in series
 d) A resistor and capacitor in parallel

5) Multiplexure has _____.
 a) Many Input and one output
 b) One input many output
 c) Many Input and many out put
 d) One input and one output

6) The op-amp comparator circuit uses _____.
 a) Positive feedback b) Negative feedback
 c) Regenerative feedback d) No feedback

7) Op- amp is a _____ type of amplifier.
 a) Current b) Voltage
 c) Power d) Resistance

8) An XOR gate can be used for _____.
 a) Inverter and non-inverter b) Only inverter
 c) Only non-inverter d) None of the above

B) Fill in the blanks OR Write True /False. 04

1) In an instrumentation amplifier, the output voltage is based on the _____ times a scale Factor.
2) The output voltage of a voltage buffer is _____ with the input voltage.
3) The voltage gain of a voltage buffer is _____.
4) The data in stack is called _____.

Q.2   Answer the following. (Any Six)   **12**
   a)   List the allowed register pairs of 8085.
   b)   Define CMRR frequency response.
   c)   What is microprocessor? Give the power supply & clock frequency of 8085.
   d)   Draw AND gate with truth table.
   e)   Define Input offset voltage.
   f)   Define Multiplexer.
   g)   State the principle of phase shift oscillator.
   h)   Define Voltage follower.

Q.3   Answer the following. (Any Three)   **12**
   a)   Explain Multiplexers and Demultiplexers.
   b)   Explain Inverting and Non inverting amplifier.
   c)   Write a note on Demorgan's Theorem.
   d)   Write in details of Integrator and Differentiator.

Q.4   Answer the following. (Any Two)   **12**
   a)   Draw and explain Integrator using 741 Op Amp.
   b)   What is multivibrator? Explain the difference between the three types of multivibrators.
   c)   Draw and explain 8:1 Multiplexers.

Q.5   Answer the following. (Any Two)   **12**
   a)   Draw and explain memory write cycle of 8085 microprocessor.
   b)   Explain in details of instrumentation amplifier.
   c)   Define Oscillators? Explain their types.

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M.Sc. (Semester - I) (New) (NEP CBCS) Examination: March/April-2024
PHYSICS (APPLIED ELECTRONICS)
Research Methodology in Physics (2323105)

Day & Date: Friday, 17-05-2024   Max. Marks: 60
Time: 03:00 PM To 05:30 PM

Instructions: 1) All questions are compulsory.
2) Figure to right indicate full marks.

Q.1 A) Choose the correct alternatives from the options.   **08**

1) Research is _____.
   a) Searching again and again
   b) Finding solution to any problem
   c) Working in a scientific way to search for truth of any problem
   d) None of above

2) Electronic interview can be conducted by _____.
   a) Telephonic   b) Fax
   c) Personal   d) All of the above

3) In DC sputtering, _____ bias is applied to the target material.
   a) Negative   b) Positive
   c) No   d) All of the above

4) E-beam evaporation transfers _____ and precise metal coatings.
   a) Non-uniform   b) Pure
   c) Impure   d) All of the above

5) Qualitative methods are probably the oldest of all the scientific techniques, the method of Qualitative research is _____.
   a) Questionnaire   b) Attitude Scales
   c) Depth Interview   d) Observation

6) Resistive thermal deposition can deposit materials with low _____ points.
   a) boiling   b) decimal
   c) melting   d) None of the above

7) The most common scales used in research are _____.
   a) Nominal   b) Ratio
   c) Ordinal   d) All of the above

8) HRTEM provides _____ images.
   a) medium resolution   b) poor resolution
   c) low resolution   d) high resolution

B) Fill in the blanks OR Write True or False: 04
1) In _____ sputtering, magnets behind cathode trap electrons.
2) In PLD, kinetic energies of ablated particles are high enough to promote surface diffusion. (True/False)
3) _____ sampling is a probability sampling method.
4) Hypothesis must be conceptually clear. (True/False)

Q.2 Answer the following. (Any Six) 12
a) State the physical conditions of Ion beam sputtering.
b) What is the necessity of defining the research problem?
c) Write the significance of HRTEM over SEM and TEM techniques.
d) What is empirical research method?
e) State the parameters affecting the deposition by chemical bath method.
f) State the various tools for data analysis.
g) Draw the neat labeled diagram of electrodeposition method.
h) What are secondary sources of literature review?

Q.3 Answer the following. (Any Three) 12
a) Write a note on Applied Vs. Fundamental research methods.
b) Draw the neat labeled diagram of HRTEM instrument.
c) Write a note on Patents.
d) Write in brief about Sol-gel technique.

Q.4 Answer the following. (Any Two) 12
a) Elaborate the mechanism of Magnetron Sputtering.
b) Explain steps/process in scientific Research.
c) Write in detail about the construction and working of SEM.

Q.5 Answer the following. (Any Two) 12
a) What is sampling? Explain essentials of good Sampling?
b) Explain the construction and working of Fourier Transform Infrared Spectroscopy.
c) What is Research Methodology? What are the requisites for Good Scientific Research?

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M.Sc. (Semester - I) (Old) (CBCS) Examination: March/April-2024
PHYSICS (APPLIED ELECTRONICS)
Mathematical Physics (MSC5101)

Day & Date: Friday, 10-05-2024 Max. Marks: 80
Time: 03:00 AM To 06:00 PM

Instructions: 1) Q. No. 1 and 2 are compulsory.
2) Attempt any three questions from Q. No. 3 to Q. No. 7
3) Figures to the right indicate full marks.

Q.1 A) Choose correct alternative. 10

1) Function $f(Z) = 1 + \frac{1}{\sqrt{Z}}$ of a complex variable Z is _____.
   a) has a simple pole at $Z = 0$
   b) has a branch cut from $Z = 0$ to $Z = \infty$ along real axis
   c) is finite at all points inside a unit circle centred at origin
   d) has a branch point at $Z = 0$

2) The integral of Z along upper half of circle $|Z| = 1$ from $Z = -1$ to $Z = 1$ is _____.
   a) $-i\pi$ b) $i\pi$
   c) $2\pi i$ d) $-2\pi i$

3) What is the dimensionality of the vector space spanned by the vector $\{(1,0,0)\ (0,1,0)\ (0,0,1)\}$ _____.
   a) 1   b) 2
   c) 4   d) 3

4) What is the dimensionality of the vector space of 3×3 matrices?
   a) 6   b) 9
   c) 12   d) 3

5) If the characteristic equation $ar^2 + br + C = 0$ has complex roots, what type of solution do we expect?
   a) Real and Distinct   b) Real and repeated
   c) Complex conjugate   d) Imaginary

6) Which principle is allowed to solve non-homogeneous linear differential equation by adding the solutions of its homogeneous counterpart & particular solution?
   a) Superposition principal   b) Homogeneous principle
   c) Integration principal   d) Differential principal

7) Which theorem states that any periodic function can be represented as an infinite sum of sines and cosines of varying frequencies?
   a) Laplace's Theorem   b) Fourier's Theorem
   c) Parseval's Theorem   d) Fourier-Mellin Transform

8) The Fourier series expansion of a sawtooth wave contains _____.
   a) Only cosine terms
   b) Only sine terms
   c) Both cosine and sine terms
   d) Only complex exponential terms

9) Determinant of orthogonal matrix is _____.
   a) 0   b) 1
   c) −1   d) It can be real or Imaginary

10) Which function's Fourier transform results in a constant function?
   a) Box function   b) Exponential function
   c) Delta function   d) Rectangular function

B) Write True/False.   **06**
1) Parseval's theorem relates the power of a single to its frequency-domain representation.
2) Analytic functions are necessarily harmonic functions.
3) The dimensionality of a Hilbert space can be infinite.
4) A second-order homogeneous equation with constant coefficients always has exponential solutions.
5) In the Argand diagram, the real part of a complex number is represented along the y-axis.
6) In a first-order homogeneous equation with variable coefficients, the superposition principle holds.

Q.2 Answer the following.   **16**
a) State and Explain Cauchy's residue theorem in detail.
b) Prove that $I = A$ is invertible, where I is identity matrix and a square matrix $A^2 = A$.
c) Find the Laplace transform of $f(s)$ for the given function $f(t) = e^{-t}$ for $t \geq 0$.
d) State and prove superposition principle.

Q.3 Answer the following.   **16**
a) Determine the general solution of given non-homogeneous differential equation $Y'' + 3y' + 2y = 4x$
b) Evaluate the integral $f(z) = \oint \frac{\cos(Z)}{Z^2+4} dz$ where C is the semicircle in the upper half plane centred at origin with radius R & $R > 2$.

Q.4 Answer the following.   **16**
a) Find the eigen values and eigen vectors of the matrix $A = \begin{vmatrix} 2 & 1 & 0 \\ 1 & 2 & 1 \\ 0 & 1 & 2 \end{vmatrix}$

b) Find the inverse of the matrix $A = \begin{vmatrix} 2 & 1 & -1 \\ 1 & 0 & 2 \\ -3 & 2 & 1 \end{vmatrix}$ and verify $A \times A^- = I$.

Q.5 Answer the following. 16

a) Evaluate the integral $(z) = \oint \frac{\sin(Z)}{Z^2+4} dz$ where, C is the circle $|Z| = 3$ traversed counterclockwise.

b) 1) Compute the Fourier series of the function $f(x) = x$ over the interval $-\pi \leq x \leq \pi$.

2) Determine the first three nonzero terms of the Fourier series for the sawtooth wave $g(x)$, which has period 2π and is defined as follows:

$$g(x) = \begin{cases} x & \text{for } -\pi \leq x < 0 \\ x - 2\pi & \text{for } 0 \leq x < \pi \end{cases}$$

Q.6 Answer the following. 16

a) Solve $\frac{d^2y}{dx^2} - 2\frac{dy}{dx} + y = 2\cos x$ using successive integration method.

b) Discuss the second order non-homogeneous linear differential equation with constant coefficient.

Q.7 Answer the following. 16

a) Expand the Fourier series for full wave rectifier
$$f(x) = \sin x; \qquad (0 \leq x < \pi)$$
$$= -\sin x; \qquad (-\pi \leq x \leq 0)$$

b) Find the Laplace transform of
$$f(t) \begin{cases} \sin t & 0 < t < \pi \\ 0 & t > \pi \end{cases}$$

| Seat No. | | | **Set** | **P** |

Day & Date: Monday, 13-05-2024   Max. Marks: 80
Time: 03:00 PM To 06:00 PM

Instructions: 1) Q. Nos. 1 and. 2 are compulsory.
             2) Attempt any three questions from Q. No. 3 to Q. No. 7
             3) Figure to right indicate full marks.

Q.1 A) Choose the correct alternative.   **10**

1) In the case of a superconductor, at Tc conductance becomes _____.
   a) Zero   b) Finite
   c) Infinite   d) None of the above

2) Induced electric dipole moment is directly proportional to _____.
   a) E b) E^2
   c) E^3 d) $E^{1/2}$

3) Number of tetrad axis in simple cubic system are _____.
   a) 2   b) 3
   c) 4   d) 8

4) According to mass action law, product of hole and electron concentration is equal to _____ of intrinsic concentration.
   a) Square   b) 1/2
   c) 1/3   d) 1/4

5) Miller indices of crystal plane which intercepts at (2a, 3b, c) are _____.
   a) (3,3,6)   b) (1,2,3)
   c) (2,1,6)   d) (3,2,1)

6) _____ metals are generally not superconductors.
   a) Divalent   b) Monovalent
   c) Trivalent   d) A and b

7) Reciprocal lattice vector G = _____.
   a) K'-K   b) K - K'
   c) K'+ K   d) $(K'+K)^2$

8) The electronic polarizability αe of a monoatomic gas is _____.
   a) $4\pi\varepsilon_0$ b) $4\pi\varepsilon_0 R$
   c) $4\pi\varepsilon_0 R^3$ d) $4\pi\varepsilon_0^2$

9) The effective mass of localized electrons depends on _____.
   a) (d^2E/dK) b) (dE/dK)
   c) $(d^2E/d^2K)^{-2}$ d) $(d^2E/dK^2)^{-1}$

10) The coordination number of HCP is _____.
   a) Two   b) Four
   c) Six   d) Twelve

B) **Fill in the blanks OR Write True or False.** 06
   1) The coordination number of the body-centered cubic crystal structure is _____.
   2) At _____ temperature materials show transition from normal to superconducting state.
   3) Induced electric dipole moment is inversely proportional to electric field E. (T/F)
   4) Crystalline solids are anisotropic. (T/F)
   5) The relation between electronic polarizability and induced electric dipole moment is given by $\mu e = \alpha e \cdot E$. (T/F)
   6) Brillouin zones are represented on the EK curve. (T/F)

Q.2 Answer the following (Any Four) 16
   a) Define packing fraction.
   b) Concept of Cooper pair
   c) What is electronic polarization?
   d) What is penetration depth?
   e) Calculate the electronic polarization of isolated Se atom of atomic radius 0.18nm. Given $\varepsilon_0 = 8.854 \times 10^{-12} F/m$

Q.3 Answer the following.
   a) Discuss the Meissner effect in detail. 10
   b) Distinguish direct and indirect band gap semiconductors. 06

Q.4 Answer the following.
   a) Give the expression for interplanar spacing (d). 10
   b) For simple cubic structure, calculate the number of atoms per square mm for the atomic planes (010), (110) and (111). 06

Q.5 Answer the following.
   a) Explain the Kronig-Penney model. 08
   b) Write about Ionic polarization. 08

Q.6 Answer the following.
   a) Give the expression for the concentration of electrons in the conduction band of Intrinsic semiconductors. 10
   b) Explain the concept of Brillouin zones. 06

Q.7 Answer the following.
   a) Explain BCC and FCC Crystal structures. 10
   b) Explain the defects in solids. 06

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M.Sc. (Semester - I) (Old) (CBCS) Examination: March/April-2024
PHYSICS (APPLIED ELECTRONICS)
Analog and Digital Electronics (MSC5103)

Day & Date: Wednesday, 15-05-2024 | Max. Marks: 80
Time: 03:00 PM To 06:00 PM

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

Q.1 A) Choose correct alternative. (MCQ) 10

1) Output impedance of ideal op-amp is _____.
   a) infinite b) zero
   c) 75Ω d) $1M\Omega$

2) _____ is used for Mod-2 addition.
   a) XOR-gate b) OR-gate
   c) Full adder d) Half adder

3) The device which changes from serial data to parallel data is _____.
   a) Multiplexer b) Demultiplexer
   c) Flip-Flop d) Counter

4) In J-K flip-flop, when J=1 and K=1, it is possible to _____ the flip-flop,
   a) set b) reset
   c) toggle d) forbidden

5) Stack pointer holds _____.
   a) 16 bit address b) 16 bit data
   c) 8 bit address d) 8 bit data

6) Calculate the output voltage of a non-inverting amplifier with $Ri = 200k\Omega$, $Rf = 2M\Omega$ and $Vi = 10mV$.
   a) $110mV$ b) $120mV$
   c) $200mV$ d) $210mV$

7) Unity gain voltage follower is also called as _____.
   a) Comparator b) Schmitt trigger
   c) Buffer d) Zero crossing detector

8) What is the word length of an 8-bit microprocessor?
   a) 8 bits-64 bits b) 4 bits -32 bits
   c) 8 bits-16 bits d) 8 bit-32 bits

9) A decoder converts _____.
   a) noncoded information into coded form
   b) coded information into noncoded form
   c) highs to lows
   d) lows to highs

10) What will be the output from a D flip-flop if the clock is low and D = 0?
    a) 0 b) 1
    c) No change d) Toggle between 0 and 1

B) **Fill in the blanks OR Write true/false** **06**
1) A phase shift oscillator uses LC network. (True/False)
2) The output stage of an op-amp usually a _____.
3) In _____ microprocessor, accumulator register used as a working area in CPU
4) Master slave flip is also referred to as Pulse -triggered flip-flop. (True/False)
5) Can an encoder be called a multiplexer? (True/False)
6) Voltage when applied at two inputs of Op-amp to get 0 V of output is called Output offset voltage. (True/False)

Q.2 **Answer the following** **16**
a) Explain the concept of virtual ground in op. amp.
b) State De Morgan's theorems with logical diagrams.
c) Explain dual input balance output differential amplifier.
d) Explain why open loop op-amp configurations are not used in linear applications.

Q.3 **Answer the following.**
a) Write the features of 8085 microprocessor. **06**
b) Explain with neat circuit diagram Wein bridge oscillator. **10**

Q.4 **Answer the following.**
a) Draw and explain functional block diagram of 8085 microprocessor. **08**
b) What is Demultiplexer? Explain 1:8 Demultiplexer. **08**

Q.5 **Answer the following.**
a) Draw logic diagram and truth table of RS flip flop and explain its working. **08**
b) Draw and explain the block diagram of op.amp. **08**

Q.6 **Answer the following.**
a) Explain summing amplifier using differential configuration. **08**
b) Describe 4 bit D flip-flop with timing diagram. **08**

Q.7 **Answer the following.**
a) Draw and explain Phase shift Oscillator using op. amp. Obtain an expression for its frequency. **08**
b) Write an assembly language program to add two 8bit numbers. **08**

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M.Sc. (Semester - I) (Old) (CBCS) Examination: March/April-2024
PHYSICS (APPLIED ELECTRONICS)
Classical Mechanics (MSC5108)

Day & Date: Friday, 17-05-2024   Max. Marks: 80
Time: 03:00 PM To 06:00 PM

Instructions: 1) Q. Nos. 1 and. 2 are compulsory.
                 2) Attempt any three questions from Q. No. 3 to Q. No. 7
                 3) Figure to right indicate full marks.

Q.1 A) Choose correct alternative.   **10**

1) A particle moving with constant velocity along a straight path parallel to +X axis is said to possess _____.
   a) linear momentum and angular momentum about given origin
   b) angular acceleration
   c) only linear momentum but not angular momentum about given origin
   d) nothing

2) In Galilean transformation, time in both the frames under consideration is treated as _____.
   a) absolute
   b) relative
   c) some times absolute and some times relative
   d) variant

3) If the condition of the constraint is expressed as $f(r_1, r_2, r_3, r_4 \dots, t) = 0$ then it is known as _____.
   a) Holonomic, Rheonomous constraint
   b) Holonomic, Scaleronomous constraint
   c) Non-holonomic, Rheonomous constraint
   d) Non-holonomic, Scaleronomous constraint

4) As per Kepler's third law of planetary motion, square of a time period is directly proportional to cube of a _____.
   a) semi-minor axis   b) semi-major axis
   c) diameter of a orbit   d) average diameter of a orbit

5) The Rutherford scattering cross section $\sigma(\theta)$ varies_____ with _____ where θ is the scattering angle
   a) directly, $cosec^4(\frac{\theta}{2})$ b) inversely, $cosec^4(\frac{\theta}{2})$
   c) directly, $cosec^2(\frac{\theta}{2})$ d) inversely, $cosec^2(\frac{\theta}{2})$

6) Action is the integral product of _____.
   a) generalized momentum and velocity
   b) generalized momentum and force
   c) generalized momentum and co-ordinate
   d) none of these

7) Identify the correct equation for Jacobi's Identity _____.
   a) $[[p,q],r] + [[p,r],q] + [[q,r],p] = 0$
   b) $[[q,q],r] + [[p,r],q] + [[q,r],p] = 0$
   c) $[[p,q],r] + [[p,r],q] + [[r,q],p] = 0$
   d) $[[p,q],r] + [[r,p],q] + [[q,r],p] = 0$

8) Choose the correct equation for Hamiltonian _____.
   a) $H = p_i q' i - L$ b) $H = p_i q' i + L$
   c) $H = piqi + L$ d) $H = piqi - L$

9) The Lagrangian of the system gives _____ of the system.
   a) difference in kinetic and potential energy
   b) addition of kinetic and potential energy
   c) power
   d) rate of change of energy

10) The phase space is _____ dimensional space.
    a) 3N   b) 2N
    c) N   d) 6N

B) Fill in the blanks or write true /false.   **06**
1) The transformation is canonical if pdq-PdQ ia an exact differential. (True/False)
2) In a simple pendulum (θ) is the generalized co-ordinate. (True/False)
3) Under Galilean transformation the inertial mass remains invariant. (True/False)
4) Hamiltonian; H is the function of _____.
5) Kepler's second law tells about _____.
6) A rigid body moving freely in space has the degrees of freedom _____.

Q.2 Answer the following questions.   **16**
a) Explain in detail about the constraints and their classification.
b) Check whether the transformation defined as Q=1/p, P=qp^2 is canonical or not.
c) Write a note on Poisson brackets and their properties.
d) State Hamilton's variational principle and drive the Lagrange's equation of motion from it

Q.3 Answer the following.
a) Prove the laws of linear and angular momentum for a system of particles.   **08**
b) Explain   **08**
   i) Symmetries and laws of conservation
   ii) Jacobi integral

Q.4 Answer the following.
a) What are generalized co-ordinates? Express the D'Alembert's principle.   **08**
b) What are the Kepler's laws of planetary motion? Derive the equation for Kepler's first law.   **08**

Q.5 Answer the following.
a) Express the Hamilton's canonical equations of motion and deduce them from variational principle.   **08**
b) Apply the Hamilton's equations to derive the equations of motion for simple pendulum and linear harmonic oscillator.   **08**

Q.6 Answer the following.
    a) What is canonical transformation? Discuss the exact differential condition to show that the transformation is to be canonical.   **08**
    b) Write about invariance under Galileon Transformation.   **08**

Q.7 Answer the following.
    a) i) Derive the equations of motion for a particle moving near surface of earth.   **08**
       ii) Show that the shortest distance between two points is a straight line.
    b) Explain and prove the principle of least action.   **08**

Seat No.

M.Sc. (Semester - II) (New) (NEP CBCS) Examination: March/April-2024
PHYSICS (APPLIED ELECTRONICS)
Quantum Mechanics (2323201)

Day & Date: Thursday, 09-05-2024   Max. Marks: 60
Time: 11:00 AM To 01:30 PM

Instructions: 1) All Question are compulsory.
2) Figure to right indicate full marks.
3) Draw neat labelled diagrams wherever necessary.

Q.1 A) Choose the correct alternatives from the options.   **08**

1) Kets are represented by _____.
   a) row vectors   b) column vectors
   c) square matrices   d) both row and column vectors

2) For commutativity of, $|\alpha\rangle$ and $|\beta\rangle$, $|\alpha\rangle + |\beta\rangle = $ _____.
   a) $|\alpha\rangle - |\beta\rangle$ b) $|\alpha\rangle / |\beta\rangle$
   c) $|\alpha\rangle * |\beta\rangle$ d) $|\beta\rangle + |\alpha\rangle$

3) The product of a scalar with a vector gives _____.
   a) another vector   b) scalar
   c) pseudo scalar   d) null vector

4) The uncertainty relation cannot hold for the following pairs _____.
   a) position and momentum
   b) energy and time
   c) linear momentum and angle
   d) angular momentum and angle

5) The minimum energy of particle confined to one dimensional rigid box is obtained by substituting n equal to _____.
   a) one   b) zero
   c) half   d) two

6) The Momentum operator is given by _____.
   a) $\dfrac{\hbar}{i}\dfrac{d^2}{dx^2}$ b) $\dfrac{\hbar}{i}\dfrac{d}{dx}$
   c) $i\hbar\dfrac{d}{dx}$ d) $-i\hbar\dfrac{d}{dt}$

7) In operator equation $H\psi = E\psi$ the eigen function is _____.
   a) H b) ψ
   c) E d) $H \& E$

8) Which of the following is adjoint of matrix $\begin{bmatrix} 2 & 3 \\ 1 & 4 \end{bmatrix}$?
   a) $\begin{bmatrix} -2 & 3 \\ -1 & 4 \end{bmatrix}$ b) $\begin{bmatrix} 2 & -3 \\ -1 & 4 \end{bmatrix}$
   c) $\begin{bmatrix} -2 & 3 \\ 1 & -4 \end{bmatrix}$ d) $\begin{bmatrix} 4 & -3 \\ -1 & 2 \end{bmatrix}$

B) Fill in the blanks OR Write True/False.   **04**
1) If Ψ_a and Ψ_b are orthogonal to each other, then $\langle \Psi_a | \Psi_b \rangle = $ _____.
2) The operator $\frac{\partial^2}{\partial x^2}$ has the eigen value corresponding to an eigen function $\psi = \sin \alpha x$ as _____.
3) The value of $[L_y, L_z] = $ _____.
4) Hermitian operators are represented by matrices that are equal to their _____.

Q.2 Answer the following. (Any Six)   **12**
a) Define is a linear vector space.
b) What is Schwartz Inequality?
c) Compute eigen values of the square matrix, $A = \begin{bmatrix} 2 & 1 \\ 4 & 5 \end{bmatrix}$
d) What is a Wave function (ψ)?
e) Write boundary conditions for infinite potential well.
f) What is a harmonic oscillator?
g) Compute $\psi^\dagger \cdot \psi$; if $\psi^\dagger = [c_\alpha^* \ c_\beta^*]$ and $\psi = \begin{bmatrix} c_\alpha \\ c_\beta \end{bmatrix}$
h) What is Spinor or spin matrix?

Q.3 Answer the following. (Any Three)   **12**
a) Discuss operator algebra.
b) Give physical interpretation of wave function.
c) Prove that $[L^2, L_z] = 0$
d) Write a note on Pauli Spin matrices.

Q.4 Answer the following. (Any Two)   **12**
a) Derive time dependent Schrödinger's wave equation.
b) Discuss motion of a particle in square well potential.
c) Describe Algebra of Spin angular momenta.

Q.5 Answer the following. (Any Two)   **12**
a) Describe Paul Dirac's bra-ket notations.
b) State and prove Ehrenfest's theorem.
c) Discuss Clebich Gordon Coefficient.

Seat No.		Set	P

M.Sc. (Semester - II) (New) (NEP CBCS) Examination: March/April-2024
PHYSICS (APPLIED ELECTRONICS)
Electrodynamics (2323202)

Day & Date: Saturday, 11-05-2024   Max. Marks: 60
Time: 11:00 AM To 01:30 PM

Instructions: 1) All Questions are compulsory.
              2) Figures to the right indicate full marks.

Q.1 A) **Choose the correct alternatives from the options.**   08

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

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

3) The total power radiated by an oscillating dipole is _____ to the _____ of frequency.
   a) Proportional, fourth
   b) Inversely proportional, fourth
   c) Inversely proportional, third
   d) proportional, third

4) In an electromagnetic wave, the direction of magnetic field induction $\vec{B}$ is _____.
   a) parallel to electric field $\vec{E}$
   b) perpendicular to electric field $\vec{E}$
   c) random
   d) None of the above

5) The Poynting's vector S of an electromagnetic wave is _____.
   a) $\vec{S} = \vec{E} \times \vec{H}$ b) $\vec{S} = \vec{E} \times \vec{B}$
   c) $\vec{S} = \vec{E}/\vec{B}$ d) $\vec{S} = \vec{E}/\vec{H}$

6) The sum of coefficient of reflection and transmission in absorption free case is _____.
   a) 1   b) 2
   c) 0.66   d) 0

7) Poynting's vector S gives _____.
   a) Energy transported per unit area per second
   b) Energy stored per unit volume
   c) Flux of fields
   d) Electromagnetic Momentum contained per unit volume

8) Which of the Maxwell's following equations is corrected based on equation of continuity _____.
   a) $\nabla . \vec{E} = \rho/\epsilon_0$
   b) $\nabla . \vec{B} = 0$
   c) $\nabla \times \vec{E} = -\partial \vec{E}/\partial t$
   d) $\nabla \times \vec{B} = \mu_0 J + \mu_0 \epsilon_0 \, \partial \vec{E}/\partial t$

B) Write True/False. 04
   1) In equipotential surface, potential is different everywhere. (True/ False)
   2) One of the Maxwell's equations (in free space) in differential form is as follows $\nabla . B = 0$
   3) The direction of propagation of electromagnetic wave is $(\vec{E} \times \vec{B})$. (True/ False)
   4) The equation of continuity is $\nabla . \vec{J} - \frac{\partial \rho}{\partial t} = 0$. (True/False)

Q.2 Answer the following. (Any Six) 12
   a) Write Poisson's and Laplace's equations.
   b) State Ampere's law.
   c) State Faraday's law and write expression for it.
   d) What are the scalar and vector potentials?
   e) Write electromagnetic wave equations in terms of electric and magnetic fields.
   f) Define skin depth.
   g) What is an electric dipole?
   h) What is radiation damping?

Q.3 Answer the following. (Any Three) 12
   a) State and prove Gauss's law.
   b) Write a note on Maxwell's displacement current.
   c) Explain the concepts: Lorentz's and Coulomb's gauges.
   d) Explain magnetic dipole radiation.

Q.4 Answer the following. (Any Two) 12
   a) Derive an expression for differential form of Ampere's law.
   b) Derive an expression for magnetic interaction between two current loops.
   c) Derive the expressions for reflection and refraction of electromagnetic waves at plane boundaries for normal incidence.

Q.5 Answer the following. (Any Two) 12
   a) Derive Larmor's formula.
   b) Derive an expression for differential form of Gauss's law.
   c) Describe electromagnetic plane waves in stationary medium.

Seat No.		Set	P

M.Sc. (Semester - II) (New) (NEP CBCS) Examination: March/April-2024
PHYSICS (APPLIED ELECTRONICS)
Classical Mechanics (2323206)

Day & Date: Tuesday, 14-05-2024   Max. Marks: 60
Time: 11:00 AM To 01:30 PM

Instructions: 1) All Questions are compulsory.
2) Figures to the right indicate full marks.

Q.1 A) Choose the correct alternatives from the options.   **08**

1) The gyroscopic forces are _____ in nature.
   a) conservative   b) non-conservative
   c) pseudo   d) not exist

2) If the total force is zero, then _____ is conserved.
   a) angular momentum   b) force
   c) linear momentum   d) torque

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

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) If coordinates q_j in Lagrangian are cyclic, then $\frac{\partial H}{\partial q_j}$ is equal to _____.

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

6) The configuration space involves _____.
   a) 2N dimensions   b) 3N dimensions
   c) 6N dimensions   d) 4N dimensions

7) The Poisson's bracket, [q, q] = _____.
   a) p   b) q
   c) 0   d) Q

8) The Kronecker delta, $\delta_{ik} = 1$ for _____.
   a) $i = k$ b) $i \neq k$
   c) not depends on i and k d) depends on i and k

B) Write True/False. 04
   1) The equations of constraints containing the time as an explicit variable are called rheonomous constraints. (True/ False)
   2) In δ variation, both position and time coordinates at the end points, are not fixed. (True/ False)
   3) The fundamental Poisson's brackets are invariant under canonical transformation. (True/ False)
   4) An angular momentum is conserved in the absence of external torque. (True/ False)

Q.2 Answer the following. (Any Six) 12
   a) What are the gyroscopic forces?
   b) Prove linear momentum is conserved for a particle.
   c) What are the degrees of freedom?
   d) What are the generalized coordinates?
   e) State Hamilton's principle and write its expression.
   f) What is configuration space?
   g) How many forms of generating function? Write it.
   h) Define Poisson's bracket and write its expression.

Q.3 Answer the following (Any Three) 12
   a) State and prove work-energy theorem.
   b) Derive an expression for reduction of two body problem in to equivalent one body problem.
   c) Deduce Lagrange's equation of motion from Hamilton's principle.
   d) Explain any four properties of Poisson's brackets.

Q.4 Answer the following (Any Two) 12
   a) Derive the equation of motion for the system with variable mass.
   b) Explain general features of the orbit with effective potential energy curve.
   c) Deduce Euler-Lagrange's differential equation using variational technique.

Q.5 Answer the following (Any Two) 12
   a) Derive an expression for Kepler's first law of planetary motion.
   b) Explain the principle of least action and prove it.
   c) Derive Hamilton's canonical equations of motion in terms of Poisson's brackets.

Seat No.		Set P

M.Sc. (Semester - II) (Old) (CBCS) Examination: March/April-2024
PHYSICS (APPLIED ELECTRONICS)
Quantum Mechanics (MSC5201)

Day & Date: Thursday, 09-05-2024 Max. Marks: 80
Time: 11:00 AM To 02:00 PM

Instructions: 1) Q. Nos. 1 and. 2 are compulsory.
2) Attempt any three questions from Q. No. 3 to Q. No. 7
3) Figure to right indicate full marks.

Q.1 A) Choose the correct alternative from the options. **10**

1) An electron, a neutron, an alpha particle and tennis ball are, moving at the same speed. Which one of them has the greatest de Broglie Wavelength?
   a) Neutron   b) Electron
   c) Tennis ball   d) Alpha particle

2) Consider an electron in a ring of constant potential energy. Let C be the length of circumference of the ring. Since wave functions must be single valued, then $\psi(x) = $ _____.
   a) $\psi\left(x + \dfrac{c}{4}\right)$ b) $\psi\left(x + \dfrac{c}{2}\right)$
   c) $\psi(x + C)$ d) $\psi\left(x + \dfrac{3c}{4}\right)$

3) Which of the following relation is true for wavelength of De Broglie waves?
   a) $\lambda = \dfrac{h}{p}$ b) $\lambda = \dfrac{p}{h}$
   c) $\lambda = \dfrac{1}{\sqrt{ph}}$ d) $\lambda = \dfrac{p}{m}$

4) The number of electrons circulating about the positively charged nucleus in hydrogen like atom is _____.
   a) negligible
   b) equal to the number of protons in the nucleus
   c) equal to mass number
   d) one

5) The zero-point energy of a particle in 3-dimensional box is _____.
   a) equal to that for a one-dimensional box.
   b) double that for a one-dimensional box.
   c) three times that for a one-dimensional box.
   d) nine times that for a one-dimensional box.

6) If electron 1 is placed at definite point in space, then the potential energy of electron 1 in the field of electron 2 is given by _____.
   a) $V_1 = \displaystyle\int \dfrac{\phi_1^2(1)}{r_{12}} d\tau_1$ b) $V_1 = \displaystyle\int \dfrac{\phi_1^2(1)}{r_{12}} d\tau_2$
   c) $V_1 = \displaystyle\int \dfrac{\phi_2^2(2)}{r_{12}} d\tau_1$ d) $V_1 = \displaystyle\int \dfrac{\phi_2^2(2)}{r_{12}} d\tau_2$

7) In atoms having many electrons, the electron repulsion term _____.
    a) can be ignored
    b) can be included in the momentum operator
    c) has to be included in the potential energy term of wave equation
    d) none of the above

8) The shell K, L, M, N, O, P, Q can accommodate _____ number of electrons.
    a) $2n^2$ b) $2(2l + 1)$
    c) $2l + 1$ d) $2n + 1$

9) A system is in a state described by the function,
    $\Psi(\phi, Q) = \frac{1}{\sqrt{45}}[2Y_3^1 + 4Y_2^1 + 5Y_2^0]$ where Y_1^m are spherical harmonics.
    The probability of finding the system in a state with $m = 1$ is _____.
    a) $\frac{4}{9}$ b) $\frac{29}{45}$
    c) $\frac{41}{45}$ d) 1

10) The electrons in K shell have _____ spins.
    a) parallel   b) antiparallel
    c) no   d) perpendicular

B) Fill in the blanks OR Write True/False.   **06**
1) To every physically measurable quantity of a system there corresponds _____ in quantum mechanics.
2) Free electron moving without any restriction has a _____ energy spectrum.
3) The s- type orbitals are _____ shaped.
4) The exact solution of a _____ is not obtained.
5) The M shell can accommodate _____ electrons.
6) Separation of electronic and nuclear function describes the _____ principle.

Q.2 Answer the following.   **16**
a) The wave function for a particle moving in x direction is $\Psi(x) = A\,e^{ikx}$, where $0 < x < L$. Calculate the value of normalization constant A.
b) Explain wave and particle nature of radiation.
c) The lowest kinetic energy of an electron (E) confined in one dimensional box is $5\ eV$. Calculate its energy in the second excited state.
(Given: Planck's constant, $h = 6.626 \times 10^{-34} J/s$ and mass of electron, $m = 9.1 \times 10^{-31}$ kg).
d) Write a note on shape of atomic orbital.

Q.3 Answer the following.   **16**
a) Write a note on helium atom. Obtain expression for ground state energy of helium atom.
b) Discuss molecular orbital theory.

Q.4 Answer the following.   **16**
a) State and explain 'Heisenberg's uncertainty principle.'
b) Write a note on hydrogen molecule ion.

Q.5 Answer the following.   **16**
a) State and explain the postulates of quantum mechanics.
b) Explain physical interpretation of hydrogenic orbital.

Q.6 Answer the following. 16
   a) Obtain Total wave function of hydrogen- like atom.
   b) Discuss wave function of many electron systems.

Q.7 Answer the following. 16
   a) Write a note on Slater's rules.
   b) Give the formulation of Valence-Bond method for the Hydrogen molecule.

Seat No.

M.Sc. (Semester - II) (Old) (CBCS) Examination: March/April-2024
PHYSICS (APPLIED ELECTRONICS)
Electrodynamics (MSC5202)

Day & Date: Saturday, 11-05-2024   Max. Marks: 80
Time: 11:00 AM To 02:00 PM

Instructions: 1) Q. No. 1 and 2 are compulsory.
                        2) Attempt any Three questions from Q.No.3 to Q.No.7.
                        3) Figures to the right indicates full marks.

Q.1 A) Choose the correct alternatives from the options.   10

1) If magnetic monopole existed, then which of the following Maxwell's equations will be modified _____.
   a) $\nabla . \vec{E} = \rho/\in_0$
   b) $\nabla . \vec{B} = 0$
   c) $\nabla \times \vec{E} = -\partial\vec{B}/\partial t$
   d) $\nabla \times \vec{B} = \mu_0 J + \mu_0 \in_0 \partial\vec{E}/\partial t$

2) The power radiated by an electric dipole is proportional to _____.
   a) ω
   b) ω^2
   c) ω^3
   d) ω^4

3) Poynting's vector S gives _____.
   a) Energy transported per unit area per second
   b) Energy stored per unit volume
   c) Flux of fields
   d) Electromagnetic Momentum contained per unit volume

4) The sum of coefficient of reflection and transmission in absorption free case is _____.
   a) 1
   b) 2
   c) 0.66
   d) 0

5) The vectors of the electromagnetic wave propagation can be expressed in _____.
   a) dot product
   b) cross product
   c) unit vector
   d) perpendicular vector

6) The Poynting's vector S of an electromagnetic wave is _____.
   a) $\vec{S} = \vec{E} \times \vec{H}$
   b) $\vec{S} = \vec{E} \times \vec{B}$
   c) $\vec{S} = \vec{E}/\vec{B}$
   d) $\vec{S} = \vec{E}/\vec{H}$

7) Faraday's laws are consequence of the conservation of _____.
   a) charge
   b) energy
   c) magnetic field
   d) both (b) and (c)

8) The expression for the continuity equation is _____.
   a) $\rho + J = 0$
   b) $d\rho/dt + \nabla.J = 0$
   c) $d\rho/dt + J = 0$
   d) $\rho + \nabla J = 0$

9) SI unit of magnetic induction is _____.
   a) NC^{-1}
   b) tesla
   c) weber
   d) NmA^{-1}

10) The Maxwell's equation derived from Ampere's law is _____.
    a) $\nabla . I = H$ b) $\nabla . H = J$
    c) $\nabla \times B = J$ d) $\nabla \times B = D$

B) Write Ture /False.   06
1) The complete theory of electromagnetic waves is contained in Maxwell's equations. (True/False)
2) In equipotential surface, potential is different everywhere. (True/False)
3) Total four Maxwell's equations in electrodynamics. (True/False)
4) The direction of propagation of electromagnetic wave is $(\vec{E} \times \vec{B})$. (True/False)
5) The equation of continuity is the consequence of conservation of charge. (True/False)
6) Planck's law gives third Maxwell's equation. (True/False)

Q.2 Answer the following.   16
  a) State and explain the Faraday's law.
  b) Explain the concepts: skin effect and skin depth.
  c) Derive the expression for the inhomogeneous wave equations.
  d) Derive the expression for Thomson cross-section.

Q.3 Answer the following.
  a) Write a detailed note on differential and integral forms of Maxwell's equations.   10
  b) Give detailed account on Maxwell's displacement current.   06

Q.4 Answer the following.
  a) Describe the reflection and refraction of electromagnetic waves at plane boundaries.   10
  b) Derive the expression for magnetic interaction between two current loops.   06

Q.5 Answer the following.
  a) What are the Gauge transformations? Derive the expressions for the wave equations in terms of electromagnetic potentials.   10
  b) Explain the Lorentz's and Coulomb's gauges with their gauge conditions.   06

Q.6 Answer the following.
  a) Derive the expression for the radiation from an oscillating electric dipole.   10
  b) Explain the concept radiation damping.   06

Q.7 Answer the following.
  a) Derive the Maxwell's equations for moving medium.   10
  b) State and prove the Poynting's theorem.   06

| Seat No. | | Set | P |

M.Sc. (Semester - II) (Old) (CBCS) Examination: March/April-2024
PHYSICS (APPLIED ELECTRONICS)
Statistical Physics (MSC5206)

Day & Date: Tuesday, 14-05-2024　　　　　　　　　　　　Max. Marks: 80
Time: 11:00 AM To 02:00 PM

Instructions: 1) Question no. 1 and 2 are compulsory.
　　　　　　　　2) Attempt any three questions from Q. No. 3 to Q. No. 7.
　　　　　　　　3) Figure to right indicate full marks.

Q.1　A)　Choose correct alternatives.　　　　　　　　　　　　　　　**10**

1) In Bose Einstein Condensation all the particle accumulates in _____.
   a) excited state　　　　　　　b) meta state
   c) ground state　　　　　　　d) all exited state

2) In Fermi Dirac statistics, particles are _____.
   a) indistinguishable　　　　　b) distinguishable
   c) dimensionless　　　　　　　d) weightless

3) The Boltzmann limit of Bosons and fermions is _____.
   a) $e^{\beta\mu} \ll 1$　　　　　　　b) $e^{\beta\mu} \gg 1$
   c) $e^{\beta\mu} = 0$　　　　　　　d) $e^{\beta\mu} = 1$

4) If r is the ratio of the probability that two particles are found in the same state to the probability that two particles belong to different states, then the ratio $r_{MB} : r_{BD} : r_{FD}$ is _____.
   a) $1/2 : 1 : 0$　　　　　　　b) $1 : 0 : 2$
   c) $1 : 1 : 2$　　　　　　　　d) $1 : 1/2 : 0$

5) In grand canonical ensemble, the system exchange _____.
   a) only matter　　　　　　　　b) only energy
   c) both matter and energy　　d) neither matter nor energy

6) In Maxwell Boltzmann statistics, particles are _____.
   a) indistinguishable　　　　　b) distinguishable
   c) dimensionless　　　　　　　d) weightless

7) Entropy in thermodynamics is measure of _____.
   a) order of system　　　　　　b) pressure of system
   c) volume of system　　　　　d) disorder of system

8) Phase equilibrium curve terminates at _____.
   a) Boiling point　　　　　　　b) Sublimation point
   c) Triple point　　　　　　　　d) Critical point

9) At a critical point, $\frac{dp}{dv} =$
   a) 1　　　　　　　　　　　　　b) 0
   c) ∞　　　　　　　　　　　　　d) -1

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

B) **State true or false.** **06**
1) Photons in black body radiation obeys Bose Einstein Statistics.
2) The quantitative explanation of Brownian motion was given by Einstein.
3) Second law of thermodynamics deals with phase transition.
4) During first order transition of a matter from one phase to another, entropy remains constant.
5) The point at which the vapor pressure curve abruptly terminates is called transition point.
6) The transition from liquid He I to He II is called second order phase transition.

Q.2 **Answer the following.** **16**
a) Explain microstates and macrostates.
b) Distinguish between Fermi Dirac Statistics and Bose Einstein Statistics.
c) Derive the conditions for phase equilibrium.
d) Explain Law of corresponding states.

Q.3 **Answer the following.**
a) Explain the second order phase transition with an example of $BaTiO_3$. **08**
b) Define energy fluctuation. Derive energy fluctuation in Canonical ensemble. **08**

Q.4 **Answer the following.**
a) State and prove Liouville's theorem. **08**
b) Derive the expression for Bose Einstein distribution law. **08**

Q.5 **Answer the following.**
a) Derive Ehrenfest's equation for second order phase transition. **08**
b) Using Vander Waal's equation of reduced state, calculate the values of critical constants. **08**

Q.6 **Answer the following.**
a) Derive Clausius- Clapeyron equation for first order phase transition. **08**
b) Discuss the condition of ideal Bose gas. **08**

Q.7 **Answer the following.**
a) Define and explain types of ensemble. State their importance in statistical mechanics. **08**
b) Derive Sackur-Tetrode equation for entropy of a gas. **08**

Seat No.	

M.Sc. (Semester - III) (New) (CBCS) Examination: March/April-2024
PHYSICS (APPLIED ELECTRONICS)
Semiconductor Physics (MSC5301)

Day & Date: Friday, 10-05-2024   Max. Marks: 80
Time: 11:00 AM To 02:00 PM

Instructions: 1) Q. No. 1 & 2 are compulsory.
               2) Attempt any three questions from Q. 3 to 7.
               3) Figures to the right indicate full marks.

Q.1 A) Choose correct alternatives.   **10**

1) Epitaxial growth is best suited for growing _____.
    a) Polycrystalline silicon
    b) very thin single crystal layer on a substrate
    c) single crystals several inches in size
    d) single crystal of several mm in size

2) In a semiconductor, the energy gap between the valence band and conduction band is about _____.
    a) 5 eV   b) 10 eV
    c) 15 eV   d) 1 eV

3) A semiconductor has _____ temperature coefficient of resistance.
    a) Negative   b) Positive
    c) Zero   d) One

4) Electron-hole pairs are produced by _____.
    a) Recombination   b) Thermal energy
    c) Ionization   d) Doping

5) At the absolute zero temperature (-273° C), an intrinsic semiconductor has _____.
    a) A few free electrons   b) Many Holes
    c) Many free electrons   d) No holes or free electrons

6) The drift velocity of the conductor _____.
    a) Increase with an increase in temperature
    b) Decrease with decrease in temperature
    c) Increase with decrease in the temperature
    d) Decrease with the increase in temperature

7) Ohm's law is not obeyed by _____.
    a) conductor   b) semiconductor
    c) insulator   d) dielectrics

8) In Schottky barrier, barrier height depends on _____.
    a) Amount of doping material   b) Type of doping material
    c) Temperature   d) None of the above

9) In electroluminescence, the EHPs are generated by _____.
   a) Light absorption
   b) Electron bombardment
   c) Applying electric field
   d) none of above

10) The probability that an electron in a metal occupies the fermi level, at any temperature (> 0K) is _____.
   a) 0
   b) 1
   c) 0.5
   d) 1.0

B) Fill in the blanks OR write True /False.   **06**
   1) The current density (J) of semiconductor is _____.
   2) In MBE evaporation of material that produces flux of atoms is _____ dependent.
   3) A vacant partially filled band is called _____.
   4) The random motion of holes and free electrons due to thermal agitation is called diffusion. (True/False)
   5) The particle flux is inversely proportional to particle velocity. (True/False)
   6) The strength of a semiconductor crystal comes from Electron-pair bonds. (True/False)

Q.2 Answer the following.   **16**
   a) Diffusion and recombination
   b) Optical absorption in semiconductors
   c) Chemical vapor deposition
   d) Nucleation & crystal growth

Q.3 a) Define Luminescence? Explain different types of Luminescence with example.   **10**
   b) Elucidate Direct and Indirect semiconductors.   **06**

Q.4 a) Describe growth of multiple crystals from Molecular Beam Epitaxy.   **10**
   b) Explain Vapor phase epitaxy.   **06**

Q.5 a) Deduce an expression of electron and hole concentration at equilibrium.   **10**
   b) Write a note on Indirect recombination (trapping).   **06**

Q.6 a) Describe crystal growth by Czochralski method.   **10**
   b) Elucidate gel method with suitable example.   **06**

Q.7 a) Give an account of Metal-Semiconductor Interface with band diagrams.   **10**
   b) Draw equilibrium energy band diagram for a metal to an p-type semiconductor where   **06**
   1) $\Phi_M < \Phi_S$
   2) $\Phi_M > \Phi_S$

Seat No.

M.Sc. (Semester -III) (New) (CBCS) Examination: March/April - 2024
PHYSICS (APPLIED ELECTRONICS)
Atomic, Molecular Physics (MSC5302)

Day & Date: Monday, 13-05-2024   Max. Marks: 80
Time: 11:00 AM To 02:00 PM

Instructions: 1) Question no. 1 and 2 are compulsory.
          2) Attempt any three questions from Q. No. 3 to Q. No. 7.
          3) Figure to right indicate full marks.

Q.1 A) Multiple choice questions.   **10**

1) What is the fundamental principle underlying the Bohr model of the atom?
   a) Wave-particle duality
   b) Uncertainty principle
   c) Quantization of angular momentum
   d) Special relativity

2) Which phenomenon describes the emission of light by excited atoms returning to lower energy states?
   a) Absorption   b) Scattering
   c) Fluorescence   d) Diffraction

3) What is the term for the minimum amount of energy required to remove an electron from an atom in its ground state?
   a) Ionization energy   b) Excitation energy
   c) Photon energy   d) Binding energy

4) What is the name given to the process where an atom or molecule gains an electron?
   a) Ionization   b) Excitation
   c) Emission   d) Electron capture

5) Which of the following quantum numbers describes the shape of an atomic orbital?
   a) Principal quantum number (n)
   b) Azimuthal quantum number (l)
   c) Magnetic quantum number (m_l)
   d) Spin quantum number (m_s)

6) What does the Pauli Exclusion Principle state?
   a) Electrons repel each other
   b) Two electrons in the same orbital must have opposite spins
   c) Electrons can occupy the same quantum state simultaneously
   d) Electrons are quantized in discrete energy levels

7) Which of the following molecules has a linear geometry?
   a) Water (H_2O)   b) Carbon dioxide (CO_2)
   c) Methane (CH_4)   d) Ammonia (NH_3)

8) What type of bond is formed when atoms share electrons unequally?
   a) Ionic bond   b) Covalent bond
   c) Metallic bond   d) Van der Waals bond

9) What is the term for the process where a molecule absorbs energy and transitions to a higher energy state?
   a) Excitation
   b) Ionization
   c) Emission
   d) Dissociation

10) Which of the following is NOT a type of molecular spectroscopy technique?
   a) Infrared spectroscopy
   b) Nuclear magnetic resonance (NMR) spectroscopy
   c) Mass spectrometry
   d) Optical spectroscopy

B) Write true/false. 06
1) In an atom, electrons in the same subshell have the same energy.
2) Hund's rule states that electrons will occupy different orbitals within the same subshell before pairing up in the same orbital.
3) The Pauli exclusion principle states that no two electrons in an atom can have the same set of quantum numbers.
4) An atomic orbital can hold a maximum of two electrons with opposite spins.
5) Quantum mechanics predicts that electrons in an atom follow predictable paths around the nucleus, similar to planets orbiting the sun.
6) The ionization energy of an atom is the energy required to remove an electron from the atom in its ground state.

Q.2 Answer the following. 16
a) State intensity rule for Zeeman effect.
b) Give the selection rules for L-S and J-J coupling.
c) Discuss Pauli's exclusion principle and hund's rules.
d) Explain absorption and emission in a spectral line.

Q.3 Answer the following.
a) Derive an expression for Lands g factor for L-S coupling. 10
b) Distinguish between normal and anomalous Zeeman effect. 06

Q.4 Answer the following.
a) Discuss the condition under which the pure rotational spectrum of a diatomic molecules is observable. 10
b) Distinguish between spherical top and asymmetric top molecules. 06

Q.5 Answer the following.
a) Explain bind elasticity for diatomic molecule as a non-rigid rotator. 10
b) Write a note on Born -Oppenheimer approximation. 06

Q.6 Answer the following.
a) Classify molecules based on moment of inertia. 10
b) State and explain frank Condon principle. 06

Q.7 Answer the following.
a) Explain harmonic oscillator model of a diatomic molecules. 10
b) Discuss the hyperfine structure of spectral lines. 06

Seat No.

M.Sc. (Semester - III) (New) (CBCS) Examination: March/April - 2024
PHYSICS (APPLIED ELECTRONICS)
Communication System (MSC5306)

Day & Date: Wednesday, 15-05-2024 Max. Marks: 80
Time: 11:00 AM To 02:00 PM

Instructions: 1) Q. Nos. 1 and 2 are compulsory.
2) Attempt any Three questions from Q.No.3 to Q.No.7.
3) Figures to the right indicate full marks.

Q.1 A) Multiple Choice Questions 10

1) The full-duplex is a _____ communication system.
   a) unidirectional b) bidirectional
   c) multidirectional d) none of the above

2) The amplitude modulation is the process in which amplitude of the carrier signal changes with respect to _____ signal.
   a) modulating b) modulated
   c) carrier d) all of the above

3) The antenna height is equal to _____.
   a) $h = \lambda/2$ b) $h = \lambda/4$
   c) $h = \lambda/6$ d) $h = \lambda/3$

4) The frequency range of 300 kHz to 3000 kHz is known as _____ frequency.
   a) medium b) low
   c) high d) small

5) The bandwidth of AM wave is _____.
   a) 2fm b) fm
   c) 3fm d) 2

6) FM operates normally between _____ to _____ Megahertz.
   a) 10, 88 b) 88, 108
   c) 80, 108 d) 90, 100

7) _____ example of analog modulation.
   a) PAM b) PPM
   c) PWM d) All of the above

8) The lower and upper sideband frequencies for 2KHz AM with a 40KHz carrier frequency will be _____ KHz.
   a) 38 and 42 b) 42 and 38
   c) 30 and 45 d) 80 and 20

9) The full form of FSK is _____.
   a) Fuse shift keying b) Frequency shift keying
   c) Frequency shift kode d) Frequency soft key

10) The value of modulation index m, for perfect modulation is _____.
   a) >1 b) =0
   c) <1 d) =1

B) State True or False: **06**
1) Antenna can only be used as a transmitter.
2) The simplex system is a unidirectional system.
3) Sampling signals less than Nyquist Rate, aliasing will take place.
4) For low level amplitude modulation all RF amplifiers can be linear.
5) The standard form of PAM is Pulse amplitude modulation.
6) Detection is same as modulation.

Q.2 Answer the following. **16**
a) Compare TDM and FDM.
b) What is the need for modulation in communication systems?
c) Compare between PAM and PWM.
d) Write a short note on different data formats in communication system.

Q.3 Answer the following.
a) What is Transmission Mode? Explain simplex, half duplex and full duplex transmission modes in detail. **10**
b) Explain the natural and flattop sampling techniques. **06**

Q.4 Answer the following.
a) Draw block diagram of Super-heterodyne FM receiver and explain function of each block. **10**
b) Explain the cross talk in TDM. **06**

Q.5 Answer the following.
a) Explain generation of DSB-SC signal with the help of balanced modulator. **10**
b) Explain about Frequency Division Multiplexing. **06**

Q.6 Answer the following.
a) Write the different multiple access techniques. Explain the CDMA in detail. **10**
b) Compare between ASK and FSK techniques. **06**

Q.7 Answer the following.
a) Explain the modulation and demodulation of PPM signals in short. **10**
b) An AM transmitter radiates 9 kW when the carrier is unmodulated, and 10,125 kW when the amplitude of the carrier is modulated by a sinusoidal message signal, if another sinusoidal message signal is simultaneously transmitted with an individual modulation index of 0.4, then the total radiated power is equal to. **06**

Seat No. [ ]

M.Sc. (Semester - IV) (New) (CBCS) Examination: March/April-2024
PHYSICS (APPLIED ELECTRONICS)
Semiconductor Devices (MSC5401)

Day & Date: Thursday, 09-05-2024   Max. Marks: 80
Time: 03:00 PM To 06:00 PM

Instructions: 1) Question No.1 and 2 are compulsory.
      2) Attempt any three from Q. No. 3 to Q. No. 7.
      3) Figures to the right indicate full marks.

Q.1 A) Choose correct alternatives.   **10**

1) In MOS controlled Thyristor, n-channel is used to _____ the FET.
  a) switch off   b) switch on
  c) both (a) and (b)   d) None of these

2) The _____ is the minimum energy necessary for an electron to escape into vacuum from an initial energy at the Fermi level.
  a) mobility   b) diffusion
  c) electron affinity   d) work function

3) RWH theory is a _____ valley model.
  a) Ten   b) Two
  c) Three   d) One

4) DIAC is a _____ terminal device.
  a) 5   b) 3
  c) 2   d) 1

5) Spontaneous emission in LASER occurs due to _____ forward voltage.
  a) high   b) very high
  c) low   d) zero

6) In _____ case, due to thermal generation-recombination, addition of minority carriers occurs.
  a) Depletion   b) Inversion
  c) Accumulation   d) All of the above

7) LEDs work only under _____ biased condition.
  a) zero   b) reverse
  c) forward   d) all of the above

8) The anode voltage required to turn the PUT on is the _____ voltage.
  a) break   b) cut-in
  c) peak point   d) cut-off

9) In a solar cell, the n-region is much _____ than the p-region to permit light penetration.
  a) thicker   b) thinner
  c) both (a) and (b)   d) None of these

10) In Gunn effect, there are _____ fluctuations in current.
   a) Non-periodic
   b) Floating
   c) periodic
   d) Both (a) and (b)

B) Fill in the blanks / State true or false: 06
   1) TEDs are bulk devices having no _____.
   2) In order to generate photocurrent, free _____ pairs must be created.
   3) The forward voltage drop of Schottky diode is low between _____ to _____ volts.
   4) Thermal diffusion is a fast process. (True/False)
   5) Photoconductor's conductivity rises after light falls on it. (True/False)
   6) The reverse leakage current in Programmable UJT is much lower. (True/False)

Q.2 Answer the following. 16
   a) Draw a neat labelled diagram showing construction of Buried Channel CCD.
   b) Write a note on LASCR.
   c) Write in brief about flat band voltage in MOSFETs.
   d) Explain in brief Semiconductor Laser.

Q.3 Answer the following.
   a) Elaborate in detail about the construction and working of two-phase CCD. 10
   b) Write in brief about LSA mode of operation of a Gunn device. 06

Q.4 Answer the following.
   a) Write in brief about Transferred Electron Effect and Negative Differential Resistivity. 10
   b) Elaborate the formation of Gunn domains. 06

Q.5 Answer the following.
   a) Elaborate in detail about the construction and characteristics of DIACs. 10
   b) Write in brief about gate trigger characteristics of Silicon Controlled Rectifier. 06

Q.6 Answer the following.
   a) Explain the construction and working principle of Solar Cell. 10
   b) What is meant by quantum efficiency and response speed of a photodiode? 06

Q.7 Answer the following.
   a) Explain in detail about MIS structures for n-type semiconductor case. 10
   b) Explain in brief about MIS capacitances. 06

Seat No.

M.Sc. (Semester - IV) (New) (CBCS) Examination: March/April-2024
PHYSICS (APPLIED ELECTRONICS)
Nuclear and Particle Physics (MSC5402)

Day & Date: Saturday, 11-05-2024 　　　　　　　　　　　Max. Marks: 80
Time: 03:00 PM To 06:00 PM

Instructions: 1) Q. Nos. 1 and 2 are compulsory.
　　　　　　　　2) Attempt any Three questions from Q.No.3 to Q.No.7.
　　　　　　　　3) Figures to the right indicate full marks.

Q.1 A) Choose the correct alternatives from the options. 　　　　　**10**

1) The nuclear force between the nucleons is _____.
   a) central force 　　　　　　　　b) non central forces
   c) columbic forces 　　　　　　　d) cohesive forces

2) The conservation laws of energy of momentum _____.
   a) Are valid for all the situations at all level
   b) Are always obeyed at the microscopic level but always violated at the atomic level
   c) May be violated at the atomic level if the violation does not lost too long
   d) Are no longer valid at any level

3) The radius R of the nucleus is given by _____.
   a) $R = r_o A^{-1/3}$ 　　　　　　b) $R = r_o A^{1/3}$
   c) $R = r_o A^{-3}$ 　　　　　　　d) $R = r_o A^3$

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

5) The shell model explains _____.
   a) Even Number of nuclei 　　　　b) magic number
   c) Odd number 　　　　　　　　　d) All of these

6) The _____ Can explain magic number.
   a) Liquid drop model 　　　　　　b) Fermi gas model
   c) shell model 　　　　　　　　　d) All of these

7) Semi empirical mass formula for the binding energy of nucleus contains a surface correction term this term depends on the mass number A of the nucleus.
   a) $A^{-1/3}$ 　　　　　　　　　　b) $A^{2/3}$
   c) $A^{1/3}$ 　　　　　　　　　　d) A

8) The compound nucleus ha life time is of the order of _____.
   a) $10^{-8} Sec$ 　　　　　　　　b) $10^{-11} Sec$
   c) $10^{-14} Sec$ 　　　　　　　d) $10^{-21} Sec$

9) The height of potential barrier faced by an alpha particle inside the nucleus is _____.
   a) 31.2MeV 　　　　　　　　　　b) 31.2KeV
   c) 31.2GeV 　　　　　　　　　　d) 31.2eV

10) The range of energy _____ eV is called as epithermal reaction.
   a) 1eV
   b) 0.025eV
   c) 1KeV
   d) 0.1-1MeV

B) Write True/False OR Fill in the blanks. **06**
   1) Nucleons are bosons. (True/False)
   2) Cross sectional area of n-p scattering is $4\pi a^2$. (True/False)
   3) In a deuteron, the force between neutron and proton is short range and repulsive. (True/False)
   4) The velocity of charged particle in cyclotron is _____.
   5) If Q value of nuclear reaction is negative the reaction is _____.
   6) The binding energy of the deuteron is _____.

Q.2 Answer the following. **16**
   a) Discuss shape and size, mass and relative abundances of nucleus.
   b) Discuss the importance of the particle accelerators.
   c) Write a note on direct reaction.
   d) Write a note on liquid drop model.

Q.3 Answer the following.
   a) Give the account of meson octet and find out charge, Isospin, I_3, Baryon number, strangeness and hypercharge with the schematic diagram. **10**
   b) Write a note on nuclear fusion and fission with the help of binding energy curve. **06**

Q.4 Answer the following.
   a) Derive an explain bethe- Weizsacker formula. **10**
   b) Explain radioactive dating and define alpha, beta and gamma decay. **06**

Q.5 Answer the following.
   a) The uncertainty relation to estimate the K.E of the nucleon, the nuclear radius is about 8×10-3 cm and mass of the nucleus is about $940MeV/C^2$. **10**
   b) Write a note on Yukawa hypothesis. **06**

Q.6 Answer the following.
   a) Derive and explain breit-wigner dispersion formula. **10**
   b) Discuss properties of nuclear forces. **06**

Q.7 Answer the following.
   a) Derive an expression for scattering cross section of two nucleon system and write a note on scattering length. **10**
   b) Comment on compound nuclear disintegration. **06**

Seat No.

M.Sc. (Semester - IV) (New) (CBCS) Examination: March/April-2024
PHYSICS (APPLIED ELECTRONICS)
Microwave Devices and Circuits (MSC5403)

Day & Date: Tuesday, 14-05-2024   Max. Marks: 80
Time: 03:00 PM To 06:00 PM

Instructions: 1) Question no. 1 and 2 are compulsory.
         2) Attempt any three questions from Q. No. 3 to Q. No. 7.
         3) Figure to right indicate full marks.

Q.1 A) Multiple choice questions.   **10**

1) _____modes of propagation supported by a rectangular wave guide.
   a) TM, TEM, TE   b) TM, TE
   c) TM, TEM   d) TE, TEM

2) _____ can be used as oscillators and amplifiers.
   a) Klystron   b) Magnetron
   c) Both a & b   d) None of the above

3) A _____device uses a helix.
   a) TWT   b) MOSFET
   c) Gunn diode   d) Klystron oscillator

4) The frequency range from 2 to 4 GHz is designated as _____band.
   a) L   b) S
   c) C   d) X

5) A major disadvantage of klystron amplifier is _____.
   a) Low power gain   b) Low bandwidth
   c) High source power   d) Design complexity

6) The klystron tube used in a klystron amplifier is a _____ type beam amplifier.
   a) Linear beam   b) Crossed field
   c) Parallel field   d) None of the above

7) The lowest mode of TM wave propagation is _____mode.
   a) TM10   b) TM01
   c) TM11   d) TM12

8) A reflex klystron functions as a microwave _____.
   a) oscillator   b) amplifier
   c) both a and b   d) high gain cavity

9) Coupling into and out of a Travelling-Wave Tube can be accompanied by a _____.
   a) waveguide match   b) cavity match
   c) direct helix match   d) All of the above

10) Microwave frequencies are used for communication with deep space probes primarily because they do not suffer _____.
   a) attenuation   b) fading
   c) phase distortion   d) None of the above

B) **State true or false.** 06
1) The production of power at higher frequencies is much simpler than production of power at low frequencies.
2) Fields of TEM mode on strip line must satisfy Laplace's equation.
3) The frequency range from 4 to 8 GHz is designated as C band.
4) TE, TM, TEM are the modes of propagation that a co axial line supports.
5) The Gunn diodes are made with GaAs semiconducting materials.
6) LED is a microwave device.

Q.2 **Answer the following.** 16
a) Write any two limitations of conventional tubes at Microwave frequencies.
b) Write a note on TWT microwave tube.
c) What are the 4 Maxwell's equations?
d) Differentiate between strip line and micro strip line.

Q.3 **Answer the following.**
a) What is Gunn Effect? Explain it in details with the help of neat diagram. 10
b) Describe in short about Maxwell's Boundary conditions. 06

Q.4 **Answer the following.**
a) With neat labelled diagram explain in briefly the coaxial transmission line. 10
b) Write a short note on open two wire transmission line. 06

Q.5 **Answer the following.**
a) Discuss how the microwave spectrum is categorized into different bands. 08
b) What are the modes generally used in a reflex klystron? Explain each mode in short. 08

Q.6 **Answer the following.**
a) Explain following terms (a) E-plane Tee (b) H-plane Tee (c) Magic Tee. 10
b) Show that TM01 and TM10 modes in a rectangular waveguide do not exist. 06

Q.7 **Answer the following.**
a) Derive the expressions for the field components due to TE waves in rectangular wave guide. 10
b) Explain in short about the TE$_{10}$ mode. 06

Seat No.

Set **P**

M.Sc. (Semester - IV) (New) (CBCS) Examination: March/April - 2024
PHYSICS (APPLIED ELECTRONICS)
Microcontrollers & Interfacing (MSC5406)

Day & Date: Thursday, 16-05-2024   Max. Marks: 80
Time: 03:00 PM To 06:00 PM

Instructions: 1) Q. Nos. 1 and 2 are compulsory.
                 2) Attempt any Three questions from Q.No.3 to Q.No.7.
                 3) Figures to the right indicate full marks.

Q.1 A) Choose the correct alternatives from the options.   **10**

1) The internet RAM memory of the 8051 is _____ bytes.
   a) 8   b) 128
   c) 256   d) 16

2) The 8051 has _____ 16-bit counter/timers.
   a) 1   b) 2
   c) 3   d) 4

3) The 8051 can handle _____ interrupt sources.
   a) 5   b) 4
   c) 2   d) 6

4) Microcontrollers often have _____.
   a) CPU   b) ROM
   c) RAM   d) All of above

5) The 8051 has _____ parallel I/O ports.
   a) 1   b) 2
   c) 3   d) 4

6) The total external data memory that can be interfaced to the 8051 is _____.
   a) 32K   b) 4K
   c) 64K   d) 128K

7) _____ instruction will load the value 35H immediate into the high byte of timer 0.
   a) MOV TH0, #35H   b) MOV TL0, #35H
   c) MOV TH0, 35H   d) MOV T0, #35H

8) Bit-addressable memory locations are _____.
   a) 10H to 1FH   b) 20H to 2FH
   c) 30H to 3FH   d) 40H to 4FH

9) The 8-bit address bus allows access to an address range of _____.
   a) 000 to FFFH   b) 00 to FFH
   c) 0000 to FFFFH   d) 0 to FH

10) The I/O port that does not have a dual-purpose role is _____.
   a) P0   b) P1
   c) P2   d) P3

B) Write the True or false. **06**

1) Data transfer from I/O to external data memory can only be done with the MOVX command.
2) SETB 01H will set the address of the bit to 1.
3) Device pins XTAL1 and XTAL2 for the 8051 are used for connections to an external oscillator or crystal.
4) The Timer 1 module can be configured as 16 bit timer/counter.
5) 8051 has internal ROM of 8K.
6) The data bus of 8051 is 16-bit wide.

Q.2 Answer the following. **16**
a) What are the features of 8051 microcontroller?
b) Write a short note on PC and SP register.
c) Draw 40- pin diagram of 8051 Microcontroller.
d) Write a short note on PSW register of 8051 Microcontroller.

Q.3 Answer the following.
a) Write an Embedded C code for 7-segment interfacing with 8051 Microcontroller to display 0 to 9 with neat interface diagram. **10**
b) Write a short note SFR of 8051 Microcontroller. **06**

Q.4 Answer the following.
a) List the interrupts available in the 8051 microcontroller. Explain IE and IP SFR. **10**
b) Explain TCON and TMOD SFR for 8051 Microcontroller. **06**

Q.5 Answer the following.
a) Write an Embedded C code and interface diagram for DC motor with 8051. **08**
b) Explain the different logical and Branch instructions of 8051 with example. **08**

Q.6 Answer the following.
a) Draw and explain architecture of intel-8051, 8-bit Microcontroller. **10**
b) Explain different Addressing Modes of 8051 Microcontroller with examples. **06**

Q.7 Answer the following.
a) Explain in detail about the Embedded C general program structure. **08**
b) Describe in details the different data types supported in Embedded C. **08**