# M.Sc. (Semester - I) (New) (NEP CBCS) Examination: Oct/Nov-2023 PHYSICS (APPLIED ELECTRONICS) <br> Mathematical Physics (2323101) 

Day \& Date: Friday, 05-01-2024
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.

1) The value of $\int_{-\pi}^{\pi} \cos (m x) \sin (n x) d x=$ $\qquad$ .
a) 1
b) $a-1$
c) 0
d) $\pi$
2) If $\left|z^{2}-1\right|=\left|z^{2}\right|+1$ then $z$ lies on $\qquad$ .
a) the real axis
b) the imaginary axis
c) a circle
d) on ellipse
3) A point at which a function $f(z)$ is not analytic is known as a $\qquad$ or singularity of the function.
a) Scalar point
b) Singular point
c) Non-singular
d) None of these
4) Find the pole of $f(z)=\sin \frac{1}{(z-a)}=$ $\qquad$ -
a) $z=a$
b) $z=0$
c) $z=1$
d) $z=4$
5) Laplace transform of $f(t)$ is defined for $\qquad$ .
a) +ve value of $t$
b) -ve value of $t$
c) both + ve \& $-v e$ value of $t$
d) None of these
6) Legendre polynomial is a set of $\qquad$ function.
a) orthogonal
b) odd
c) even
d) real
7) If $f(z)=e^{2 z}$ then the imaginary part of $f(z)$ is $\qquad$ .
a) $e^{y} \sin x$
b) $e^{x} \cos y$
c) $e^{2 x} \cos 2 y$
d) $e^{2 x} \sin 2 y$
8) What are the eigen values of $\left(\begin{array}{cc}1 & -i \\ i & 1\end{array}\right)$ ?
a) Both are 0
b) 0 and 1
c) 0 and -1
d) 0 and 2
B) Fill in the blanks OR write true/false.
9) Fourier transform is a linear operator. (True/ False)
10) Inverse of unitary matrix is unitary matrix. (True/ False)
11) A square matrix is called orthogonal if $A=A^{-1}$. (True/ False)
12) $x \frac{\partial u}{\partial x}+t \frac{\partial u}{\partial t}=2 u$ is on ordinary differential equation. (True/ False)
Q. 2 Answer the following. (Any Six)
a) Find the pole $f(z)=\sin \left(\frac{1}{z-a}\right)$
b) What are the conditions for a matrix to be orthogonal matrix?
c) Solve $\frac{d^{2} y}{d x^{2}}-6 \frac{d y}{d x}=9 y=0$
d) Find the Laplace transform of the function

$$
f(t)=t e^{-t} \sin 2 t
$$

e) Find the pole of $f(z)=\frac{\sin (z-a)}{(z-a)^{4}}$
f) Show that inverse of an orthogonal matrix is orthogonal.
g) Solve $\frac{d^{2} y}{d x^{2}}-5 \frac{d y}{d x}+6 y=0$
h) Define singular point, explain in details its types with example.
Q. 3 Answer the following. (Any Three)
a) Discuss in details Cauchy's Integral Formula.
b) State and prove the Parseval's Theorem.
c) Show that the eigen value of Hermitian matrix are real.
d) Find the Fourier Transform of $e^{-a x^{2}}$ where $a>0$
Q. 4 Answer the following. (Any Two)
a) Write matrix $A$ gives below as the sum of symmetric \& a skew symmetric matrix.

$$
A=\left(\begin{array}{rrr}
1 & 2 & 4 \\
-2 & 5 & 3 \\
-1 & 6 & 3
\end{array}\right)
$$

b) In square wave expand the function
$f(x)=0 ;-\pi \leq x \leq 0$
$f(x)=h ; 0 \leq x \leq \pi$ fourier
c) Evaluate the following integral using residue Theorem.
$\int_{c} \frac{1+z}{z(2-z)} d z$ where $c$ is circle $|z|=1$
Q. 5 Answer the following. (Any Two)
a) Evaluate $\int_{0}^{\infty} \frac{\cos 3 \theta}{5+4 \cos \theta} d \theta$
b) Solve; $x \frac{d y}{d x}+y \log \mathrm{y}=x y e^{x}$
c) Solve the differential equation.

$$
y \log y d x+(x-\log y) d y=0
$$

# M.Sc. (Semester - I) (New) (NEP CBCS) Examination: Oct/Nov-2023 PHYSICS (APPLIED ELECTRONICS) Solid State Physics (2323102) 

Day \& Date: Sunday, 07-01-2024

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.

1) Conductivity of metals depends upon
a) The nature of the material
b) Number of free electrons
c) Resistance of the metal
d) Number of electrons
2) At what temperature does ferromagnetic material become paramagnetic?
a) Melting
b) Curie
c) Neel
d) None of these
3) Which of the following is a strong magnet?
a) Diamagnetic material
b) Paramagnetic material
c) Antiferromagnetic material
d) Ferromagnetic material
4) Electronic polarization also known as $\qquad$ .
a) molecular polarization
b) magnetic polarization
c) atomic polarization
d) orientation polarization
5) What is the phenomenon where a material exhibits zero electrical resistance below a certain critical temperature?
a) Superconductivity
b) Conductivity
c) Resistance
d) Insulation
6) For which of the following is magnetic susceptibility negative?
a) Paramagnetic Materials only
b) Ferromagnetic Materials only
c) Diamagnetic Materials
d) none of the above
7) The sprinkling of water reduces slightly the temperature of a closed room because
a) Water is a bad conductor of heat
b) Water has a large lantern heat of vaporization
c) The temperature of the water is less than the room
d) None of the above
8) 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
B) Fill in the blanks OR write true / false.
9) The SI unit of magnetic field intensity is $\qquad$ .
10) The magnetization ' M ' of a superconductor in a field is $\qquad$ .
11) When a paramagnetic material is heated above Curie temperature it becomes non-magnetic.
12) The temperature above which an antiferromagnetic material becomes paramagnetic is called the melting temperature.
Q. 2 Answer the following. (Any Six). 12
a) What is Curie Temperature?
b) Define diamagnetic materials.
c) Define specific heat.
d) What is orientational polarization?
e) What is an extrinsic semiconductor?
f) What is penetration depth?
g) State the concept of ferroelectricity.
h) Define Neel temperature.
Q. 3 Answer the following (Any Three) 12
a) Explain in Brillouin zones in 2-D.
b) Write about the direct and indirect band gap of semiconductors.
c) Explain Meissner's effect.
d) Write a note on the conductivity of solids.
Q. 4 Answer the following (Any Two)
a) Electronic polarization
b) Explain the Kronig-Penny model.
c) Explain the thermodynamics of superconductors.

## Q. 5 Answer the following (Any Two)

a) Write the difference between metal, semiconductors and insulators.
b) Write a note on Josephson's tunnelling and its theory.
c) Explain the Clausius-Mossotti equation

SLR-EQ-3
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No.
M.Sc. (Semester - I) (New) (NEP CBCS) Examination: Oct/Nov-2023 PHYSICS (APPLIED ELECTRONICS)
Analog and Digital Electronics (2323106)
Day \& Date: Tuesday, 09-01-2024
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 feedback path in an op-amp integrator consists of $\qquad$ .
a) A resistor
b) A capacitor
c) A resistor and capacitor in series
d) A resistor and capacitor in parallel
2) Multiplexer has $\qquad$ .
a) Many input and one output
b) One input many output
c) Many input and many out put
d) One input and one output
3) $\mathrm{Op}-\mathrm{amp}$ is a $\qquad$ type of amplifier.
a) Current
b) Voltage
c) Power
d) Resistance
4) The op-amp comparator circuit uses $\qquad$ .
a) Positive feedback
b) Negative feedback
c) Regenerative feedback
d) No feedback
5) Find the output of inverting amplifier?
a) $V_{0}=A V_{\text {in }}$
b) $\mathrm{V}_{0}=-\mathrm{A} \mathrm{V}_{\text {in }}$
c) $V_{0}=-A\left(V_{\text {in } 1}-V_{\text {in } 2}\right)$
d) None of the mentioned
6) What happen if any positive input signal is applied to open-loop configuration?
a) Output reaches saturation level
b) Output voltage swing's peak to peak
c) Output will be a sine waveform
d) Output will be a non-sinusoidal waveform
7) In 8085 microprocessor, how many interrupts are maskable $\qquad$ .
a) Two
b) Three
c) Four
d) Five
8) In how many different modes a universal shift register operates $\qquad$ .
a) 2
b) 3
c) 4
d) 5
B) Fill in the blanks OR Write True /False.
9) The data in stack is called $\qquad$ .
10) Circuit is used as signal source in all sort of application.
11) $\qquad$ bit program counter is available in 8085.
12) The voltage gain of a voltage buffer is $\qquad$ .
Q. 2 Answer the following. (Any Six) ..... 12a) Define Input offset voltage.b) Draw AND gate with truth table.
c) What is the function of $\mathrm{IO} / \mathrm{M}$ signal in the 8085 ?
d) What is differential amplifier.
e) What is dynamic shift register.
f) Why op-amp called direct coupled high differential circuit.
g) What is microprocessor? Give the power supply \& clock frequency of 8085.
h) Define CMRR frequency response.
Q. 3 Answer the following. (Any Three) ..... 12
a) Explain the timing diagram of 8085.
b) Explain Multiplexers and Demultiplexers.
c) Write a note on RS flip flop and JK flip flop.
d) Explain Inverting and Non inverting amplifier.
Q. 4 Answer the following. (Any Two) ..... 12
a) Define Oscillators? Explain their types.
b) Write a note on 8085 instruction set.
c) Explain in details of instrumentation amplifier.
Q. 5 Answer the following. (Any Two) ..... 12
a) Discuss Synchronous and Asynchronous counter.
b) Draw and explain 8:1 Multiplexers.
c) What is multivibrator? Explain the difference between the three types of multivibrators.

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## M.Sc. (Semester - I) (New) (NEP CBCS) Examination: Oct/Nov-2023 PHYSICS (APPLIED ELECTRONICS) Research Methodology in Physics (2323105)

Day \& Date: Thursday, 11-01-2024
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.

1) A researcher is generally expected to $\qquad$ .
a) Study of existing literature in afield
b) Generate new principle and theories
c) Synthesis the ideas given by others
d) Evaluate the finding of a study
2) Oxides and Nitrides can be applied by $\qquad$ evaporation.
a) E-beam
b) Thermal
c) Magnetron
d) DC
3) Tuning of the refractive index with the density of the films is possible by sputtering.
a) Magnetron
b) DC
c) Ion beam
d) $R F$
4) The main problem in questionnaire is $\qquad$ .
a) Accessible to Diverse Respondent
b) Greater Anonymity
c) Shows an inability of respondent to provide information
d) None of these
5) UV-Vis spectroscopy cannot analyze compounds that $\qquad$ with light.
a) don't interact
b) interact
c) merge
d) none of the above
6) Technique that allow several members of a hiring company to interview a job candidate at the same time is $\qquad$ .
a) Panel Interview
b) Self-administered interview
c) Mail Interview
d) Electronic Interview
7) The most common scales used in research are $\qquad$ .
a) Nominal
b) Ratio
c) Ordinal
d) All of the above
8) By selecting laser operating conditions, control over microstructure is $\qquad$ .
a) possible
b) impossible
c) not defined
d) both a) and b)
B) Fill in the blanks OR Write True or False:
9) In E-beam evaporation, only the target is heated and not the crucible. (True/False)
10) In thermal evaporation, films in the thickness range of angstroms to microns are obtained. (True/False)
11) Applied research is conducted to solve practical problems. (True/False)
12) The basic research is also called as fundamental research. (True/False)
Q. 2 Answer the following. (Any Six)
a) State the various sampling methods.
b) Write the applications of Pulsed Laser Deposition.
c) What are the applications of UV-Vis Spectroscopy?
d) What are patents?
e) Define Quantitative research method.
f) Define physical and chemical vapour deposition.
g) Write primary literature review sources.
h) What are the applications of FTIR Spectroscopy.
Q. 3 Answer the following. (Any three)
a) Write a note on Descriptive Vs Analytical research methods.
b) Differentiate between SEM and TEM techniques.
c) Write a note on web as source.
d) Write the basic mechanism of sputtering technique.
Q. 4 Answer the following. (Any two)
a) Define Research? What are characteristics of Research.
b) Discuss different type of Research.
c) Write a note on Review of Literature.
Q. 5 Answer the following. (Any two)
a) What is Research Design? What are its essentials
b) Write in detail about the concept of Chemical Bath Deposition.
c) Explain in detail about Spray Pyrolysis.

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# M.Sc. (Semester - I) (OId) (CBCS) Examination: Oct/Nov-2023 PHYSICS (APPLIED ELECTRONICS) Mathematical Physics (MSC5101) 

Day \& Date: Friday, 05-01-2024
Max. Marks: 80
Time: 03:00 AM To 06:00 PM
Instructions: 1) All questions are compulsory.
2) Figures to the right indicate full marks.

## Q. 1 A) Choose correct alternative.

1) The product of a singular matrix with its adjoint is $\qquad$ .
a) a unit matrix
b) a null matrix
c) an orthogonal matrix
d) Square matrix
2) What is the value of $a_{0}$ in the Fourier series of $t^{2}$ in the interval $-\pi<t<\pi$ ?
a) 0
b) $\pi^{2} / 3$
c) $\pi^{2} / 8$
d) $\pi^{2} / 4$
3) If $A$ and $B$ are orthogonal matrices, then the product $A B$ is $\qquad$ .
a) symmetric
b) antisymmetric
c) orthogonal
d) unitary
4) Evaluate the integral $\int_{0}^{2 \pi} \frac{\sin ^{2} \theta}{5+4 \cos \theta} d \theta$
a) $2 \pi$
b) $\pi$
c) $\pi / 2$
d) $\pi / 4$
5) The value of $\int_{-\pi}^{\pi} \cos (m x) \sin (n x) d x=$
a) 1
b) -1
c) 0
d) $\pi$
6) If $\left|z^{2}-1\right|=\left|z^{2}\right|+1$ then $z$ lies on $\qquad$ .
a) the real axis
b) the imaginary axis
c) a circle
d) on ellipse
7) Find the pole of $f(z)=\sin \frac{1}{(z-a)}=$ $\qquad$ .
a) $z=a$
b) $z=0$
c) $z=1$
d) $z=4$
8) In Cauchy's Residues theorem $\oint_{\Gamma} f(z) d z=$ $\qquad$ .
a) $2 \pi i \sum_{j=1}^{n} a_{-1} z j$
b) $2 \pi i$
c) $2 \pi i \sum_{j=1}^{n} a_{+1} z j$
d) $2 \pi i \sum_{j=1}^{n}$

## SLR-EQ-6

9) $\qquad$ is the real part $(\operatorname{Re} \mathrm{Z})$ \& $\qquad$ is the imaginary ( $\operatorname{Im} \mathrm{Z}$ ), of the given $z=(1+i) /(2-3 i)$.
a) $-\frac{1}{13} \& \frac{5}{13}$
b) $\quad-\frac{1}{11} \& \frac{4}{13}$
c) $\frac{1}{3} \&-\frac{5}{13}$
d) $\frac{1}{09} \& \frac{5}{13}$
10) Legendre polynomial is a set of $\qquad$ function.
a) orthogonal
b) odd
c) even
d) real
B) Fill in the blanks OR write true/false.
a) A necessary and sufficient condition that solution $y_{1}$ and $y_{2}$ of $y^{\prime \prime}+p(x) y^{\prime}+q(x) y=0$ is linearly independent is that the Wronskian is zero. (True/False)
b) Fourier series can be used to represent discontinuous where all orders of derivatives need not exist. (True/False)
c) The Fourier transform operator is unitary.
d) The first order ODE can never be linear separable and exact at the same time. (True/False)
e) A Fourier transform is a linear operator. (True/False)
f) A square matrix is called orthogonal if $A=A^{-1}$. (True/False)

## Q. 2 Answer the following.

a) If A and B are two orthogonal matrices, show that AB is also orthogonal matrix.
b) Find the Laplace transform of $\frac{s^{2}-a^{2}}{\left(s^{2}+a^{2}\right)^{2}}$
c) Find the residue of $\frac{1}{\left(z^{2}+1\right)^{3}}$ at $z=i$
d) Solve $y e^{y} d x=\left(y^{3}+2 x e^{y}\right) d y$

## Q. 3 Answer the following.

a) Solve $x \frac{d y}{d x}+y \log y=x y e^{x}$
b)

Find the eigen value of a matrix $\left[\begin{array}{lll}2 & 1 & 1 \\ 1 & 2 & 1 \\ 0 & 0 & 1\end{array}\right]$

## Q. 4 Answer the following.

a)

Determine the value of $\alpha, \beta, r$ when $\left[\begin{array}{ccc}0 & 2 \beta & r \\ \alpha & \beta & -r \\ \alpha & -\beta & r\end{array}\right]$ is orthogonal.
b) Determine the poles of the function $z, \quad f(z)=\frac{1}{z^{4}+1}$

## Q. 5 Answer the following.

a) Solve $\sin x \frac{d y}{d x}+2 y=\tan ^{3}\left(\frac{x}{2}\right)$
b) Verify Cayley - Hamilton Theorem for the following matrix. 08
$A=\left[\begin{array}{ccc}2 & -1 & 1 \\ -1 & 2 & -1 \\ 1 & -1 & 2\end{array}\right]$ and use the theorem to find $A^{-1}$

## Q. 6 Answer the following.

$\begin{array}{ll}\text { a) Find the order of each pole and residue of } \frac{1-2 z}{z(z-1)(z-2)} & 08 \\ \text { b) Show that the eigen value of Hermitian matrix are real. } & 08\end{array}$
Q. 7 Answer the following.
a) In square wave expand the function.
$f(x)=0 ;-\pi \leq x \leq 0$
$f(x)=4 ;-0 \leq x \leq \pi$ Fourier.
b) Explain Laplace transform of Derivatives. 08

# M.Sc. (Semester - I) (Old) (CBCS) Examination: Oct/Nov-2023 PHYSICS (APPLIED ELECTRONICS) Solid State Physics (MSC5102) 

Day \& Date: Sunday, 07-01-2024<br>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

1) Effective mass is equal to $\qquad$ mass for free electron.
a) Mean
b) real
c) Residual
d) zero
2) Elemental solid dielectric has only $\qquad$ polarization.
a) Electronic
b) ionic
c) orientational
d) all
3) In the case of p-type semiconductors, the Fermi level lies at $\qquad$ .
a) Below near to conductor band
b) Above near to valence band
c) Below near to valence band
d) At the middle of the valence and conduction band
4) In the case of superconductor, at Tc conductance becomes $\qquad$ .
a) Zero
b) Finite
c) Infinite
d) None of the above
5) 

a) Metal
b) Semiconductor
c) Insulator
d) Dielectric
6) The coordination number of HCP is $\qquad$ .
a) Two
b) Four
c) Six
d) Twelve
7) Plane cut to negative $x$-axis have the miller indices $\qquad$ .
a) (011)
b) (001)
c) (110)
d) $(-100)$
8) The zone lies in between $+\pi / 2$ to $-\pi / 2$ is the $\qquad$ Brillion zone.
a) $1^{\text {st }}$
b) $2^{\text {nd }}$
c) 3 rd
d) $0^{\text {th }}$
9) Relative permittivity $\left(\varepsilon_{r}\right)$ of the air is $\qquad$ .
a) 2
b) 0.5
c) 1
d) 0
10) Intrinsic concentration of charge carriers in a semiconductor varies as
a) $\quad \mathrm{T}$
b) $T^{2}$
c) $T^{3}$
d) $1 / T$
B) Fill in the blanks OR Write True or False 06

1) Some conductors are $\qquad$ below critical temperature.
2) FCC structure contains the contribution of $\qquad$ atoms.
3) The packing fraction of the BCC structure is $74 \%$. (T/F)
4) NaCl shows orientation polarization. (T/F)
5) Diamond is a conductor. (T/F)
6) The addition of pentavalent impurity creates an n-type semiconductor. (T/F)
Q. 2 Answer the following (any four) ..... 16a) Write about orientational polarization.b) Explain Meissner's effect.c) Derive the rectifier equationd) Show that in the case of an intrinsic semiconductor $E_{f}=\left(E_{c}+E_{v}\right) / 2$e) Write a note on dielectric Breakdown.
Q. 3 Answer the following
a) What is meant by imperfections in crystals? Explain the various defects in ..... 10the crystal.
b) Explain BCC and FCC Crystal structures. ..... 06
Q. 4 Answer the following
a) Discuss the BCS theory in detail. ..... 10
b) Write a note on the types of superconductors ..... 06
Q. 5 Answer the following
a) Write about the London equation. ..... 08
b) Write the expression for penetration depth. ..... 08
Q. 6 Answer the following
a) Write about Reciprocal Lattice. ..... 10
b) Explain DC Josephson's effect. ..... 06
Q. 7 Answer the following
a) Explain the Kronig-Penney model. ..... 10
b) Give the expression for electronic polarizability. ..... 06

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# M.Sc. (Semester - I) (Old) (CBCS) Examination: Oct/Nov-2023 PHYSICS (APPLIED ELECTRONICS) Analog and Digital Electronics (MSC5103) 

Day \& Date: Tuesday, 09-01-2024<br>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)

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 $\qquad$
a) $J=1, K=1$
b) $\mathrm{J}=0, \mathrm{~K}=0$
c) $\mathrm{J}=1, \mathrm{~K}=0$
d) $J=0, K=1$
3) Which is the 16 -bit register for 8085 microprocessor?
a) Stack pointer
b) Accumulator
c) Register B
d) Register C
4) The feedback path in an op-amp integrator consists of $\qquad$ .
a) A resistor
b) A capacitor
c) A resistor and capacitor in series
d) A resistor and capacitor in parallel
5) Multiplexer has $\qquad$ -
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 $\qquad$
a) Positive feedback
b) Negative feedback
c) Regenerative feedback
d) No feedback
7) Op- amp is a type of amplifier $\qquad$
a) Current
b) Voltage
c) Power
d) Resistance
8) An XOR gate can be used for $\qquad$
a) Inverter and non-inverter
b) Only inverter
c) Only non-inverter
d) None of the above
9) Which of the following addressing method does the instruction, MOV AX,[BX] represent?
a) register indirect addressing mode
b) direct addressing mode
c) register addressing mode
d) register relative addressing mode
10) Which of the following is a property of RST 7.5 interrupt?
a) It is a non-maskable interrupt
b) It has $3^{\text {rd }}$ highest priority
c) It uses level-triggered signal
d) Its vectored address is 003 CH
B) Fill in the blanks 06
11) In an instrumentation amplifier, the output voltage is based on the
$\qquad$ times a scale factor.
12) The output voltage of a voltage buffer is $\qquad$ with the input voltage.
13) The voltage gain of a voltage buffer is $\qquad$ .
14) The data in stack is called $\qquad$ _.
15) The sequential circuit is also called $\qquad$ .
16) There are $\qquad$ general purpose registers in 8085 microprocessor.
Q. 2 Answer the following ..... 16

a) Define
i) Input offset voltage
ii) Voltage follower
b) Draw AND gate and NOT gate with truth table.
c) What is microprocessor? Give the power supply \& clock frequency of 8085 and List the allowed register pairs of 8085.
d) Write a note on Demorgan's Theorem.

## Q. 3 Answer the following.

a) Draw and explain architecture of 8085 microprocessor.
b) Explain Multiplexers and Demultiplexers.
Q. 4 Answer the following.
a) What is multivibrator? Explain the difference between the three types of multivibrators.
b) Draw and explain 8:1 Multiplexers.

## Q. 5 Answer the following.

a) Explain the operation of three op-amp instrumentation amplifier. 10
b) Define Oscillators? Explain their types. 06
Q. 6 Answer the following.
a) Explain inverting configuration of Op amp as a summing, scaling and 10 averaging Amplifier.
b) Explain Inverting and Non inverting amplifier. 06

## Q. 7 Answer the following.

a) Explain the instruction set of 8085 microprocessor. 10
b) Draw and explain memory read cycle of 8085 microprocessor.

06

# M.Sc. (Semester - I) (OId) (CBCS) Examination: Oct/Nov-2023 PHYSICS (APPLIED ELECTRONICS) <br> Classical Mechanics (MSC5108) 

Day \& Date: Thursday, 11-01-2024
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.

1) The position of a particle at any time $t$ subjected to resistive force is $\qquad$ .
a) $x=k \cdot\left(1+e^{-k t}\right) / v_{o}$
b) $x=k v_{o}\left(1-e^{-k t}\right)$
c) $x=v_{o}\left(1-e^{-k t}\right) / k$
d) $x=k v_{o}\left(1+e^{-k t}\right)$
2) The rate of momentum change of an open system is equal to $\qquad$ .
a) $T+M U$
b) $F-M V$
c) $W-M V$
d) $F+M U$
3) The reduced mass of two bodies into equivalent one body is $\qquad$ .
a) $\left(m_{1}+m_{2}\right) /\left(m_{1} \cdot m_{2}\right)$
b) $\left(m_{1} \cdot m_{2}\right) /\left(m_{1}-m_{2}\right)$
c) $m_{2} /\left(1+m_{2} / m_{1}\right)$
d) $m_{1} /\left(1+m_{2} / m_{1}\right)$
4) The time derivative of generalized co-ordinate is $\qquad$ .
a) Generalized force
b) Generalized velocity
c) Generalized momentum
d) None of these
5) For $E>0$ and $\varepsilon>1$, the nature of the orbit is $\qquad$ .
a) Circle
b) Parabola
c) Ellipse
d) Hyperbola
6) The generalized momentum is equal to $\qquad$ .
a) $\partial L / \partial q_{j}$
b) $\partial L / \partial \dot{p}_{j}$
c) $\partial L / \partial \dot{q}_{j}$
d) $\partial L / \partial p_{j}$
7) Which of the following defines a conservative force $F$ ?
a) $d F / d t=0$
b) $\nabla . F=0$
c) $\nabla \times F=0$
d) $\oint$ F. $d r=0$
8) Poisson brackets are $\qquad$ under canonical transformation.
a) Variant
b) nullified
c) anti-symmetric
d) invariant
9) Generalized coordinated $\qquad$ .
a) are independent of each other
b) depend on each other
c) are always cartesian coordinates
d) are always spherical polar coordinates
10) The $F_{2}=\sum q_{k} P_{k}$ transformation defined as $\qquad$ .
a) generates exchange transformation
b) generates identity transformation
c) is not canonical transformation
d) None of the above
B) Fill in the blanks or write true /false.
11) Scleronomic constraint do not explicitly depends on time. (True/False)
12) $q_{j}$ 's which are absent in $L$ are cyclic coordinates. (True/False)
13) Rutherford's differentia scattering cross section has dimensions of solid angle. (True/False)
14) The Euler-Lagrangian differential equations is $\qquad$ .
15) Lagrangian is equal to $\qquad$ .
16) $\left[L_{x}, L_{y}\right]=$ $\qquad$ .
Q. 2 Answer the following questions.
a) Which conditions are used to verify that the transformation is canonical? Prove any one condition.
b) Prove that forces acting on a particle are conservative then the total energy $E$ of a particle is conserved.
c) Distinguish between the configuration space and phase space.
d) Define Hamiltonian. Give its physical significance.

## Q. 3 Answer the following.

a) Derive the equation of motion of a particle and deduce the acceleration of Atwood machine under constant force.
b) Obtain the equation of motion of

1) a particle subjected to a resistive force
2) a projectile (no resistance)
Q. 4 Answer the following.
a) Derive the formula for Rutherford scattering cross-section.
b) Derive an equivalent equation for reduction to one body problem from two 06 body problem.
Q. 5 Answer the following.
a) State the Kepler's laws of planetary motion and prove the Kepler's third law.
b) Deduce the Lagrange's equation of motion from Hamilton's principle and 06 using derive the generalized momentum.
Q. 6 Answer the following.
a) Derive canonical equations of Hamilton. Also write the procedure for
constructing Hamiltonian.
b) Obtain Hamilton's equation for one dimensional harmonic oscillator.

## Q. 7 Answer the following.

a) State and prove Poisson's theorem. 10
b) Prove the Jacobi identity $[V,[V, W]]+[V,[W, U]]+[W,[U, V]]=0 \quad 06$

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# M.Sc. (Semester - II) (New) (CBCS) Examination: Oct/Nov-2023 PHYSICS (APPLIED ELECTRONICS) Quantum Mechanics (MSC5201) 

Day \& Date: Monday, 18-12-2023
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) Choose the correct alternatives from the options.

10

1) The wavelength is the distance between the $\qquad$ .
a) Successive crests
b) Successive troughs
c) Either successive crests or Successive troughs
d) None of the above
2) Which of the following provide the strong evidence in favour of the particle nature of radiations?
a) Diffraction
b) Interference
c) Both Diffraction and interference of radiation
d) Photoelectric effect and Compton scattering
3) Who explained the photoelectric effect using Planks quantum hypothesis that the energy of radiation is not distributed through waves, but is concentrated into corpuscles of photons of energy hv?
a) Einstein
b) Plank
c) Heisenberg
d) Newton
4) According to Max Plank, the energy of photon is given by $\qquad$ .
a) $E=h v$
b) $E=h v / 2$
c) $E=2 h v$
d) $E=v$
5) The solution to the Schrodinger's wave equation gives $\qquad$ .
a) Wave function
b) Wavelength
c) Frequency
d) Momentum
6) The condition for wave functions to be normalized is $\qquad$ .
a) $\int \psi(r) * \psi(r) d r=-1$
b) $\int \psi(r) * \psi(r) d r=0$
c) $\int \psi(r) * \psi(r) d r=1$
d) $\int \psi(r) d r=1$

## SLR-EQ-11

7) The time development of a wave function is given by
a) $\frac{i \hbar}{2 \pi} \frac{\partial \psi}{\partial t}=-\widehat{H} \psi$
b) $\frac{i \hbar}{2 \pi} \frac{\partial \psi}{\partial x}=\widehat{H} \psi$
c) $\frac{i \hbar}{2 \pi} \frac{\partial \psi}{\partial t}=\widehat{H} \psi$
d) $\frac{i \hbar}{\pi} \frac{\partial \psi}{\partial x}=\widehat{H} \psi$
Where H is Hamiltonian operator.
8) The Hooke's law is given by $\qquad$ .
a) $f=-k^{2} x$
b) $f=-k x^{2}$
c) $f=-k x$
d) $f=k x$
9) Which of the following are the powerful methods for the calculation of the ground state energy of and wave functions of many electron atoms or ions?
a) Hartree and Hartree-Fock self-consistent field methods
b) Heisenberg methods
c) Heisenberg and Hartree-Fock self-consistent field methods
d) Hartree and Heisenberg self-consistent field methods
10) For Dirac delta function $\delta(x-a)$
a) $\int_{-\infty}^{\infty} \delta(x-a) d x=1$
b) $\int_{-\infty}^{\infty} \delta(x+a) d x=1$
c) $\int_{-\infty}^{\infty} \delta(x-a) d x=-1$
d) $\int_{-\infty}^{\infty} \delta(x-a) d x=0$
$\qquad$ -
B) Fill in the blanks or State True/False:
11) The only possible values that can be observed of a physical property like angular momentum, energy, etc of system are the eigenvalues $\lambda$, in the operator equation $\qquad$ Where A is the operator for the physical quantity and $\psi$ is the well behaved Eigen function.
12) The atomic unit of magnetic moment is known as $\qquad$ .
13) The helium atom has two electrons moving in a field of a nucleus of charge $\qquad$ -.
14) Write whether following statement is True or False

The eigenvalues of a unitary operator have modulus of one.
5) Write whether following statement is True or False Adding or subtracting operators cannot construct new operators.
6) Write whether following statement is True or False

The operation of taking square root is non linear
$\sqrt{f+g} \neq \sqrt{f}+\sqrt{g}$
Q. 2 Answer the following questions.
a) Discuss the breakdown of Born- Oppenheimer approximation.
b) Explain the Eigen functions of position operator.
c) Write a note on Normalization and orthogonality of particle in one dimensional box.
d) Write a note on space quantization.

## Q. 3 Answer the following.

a) Describe the operators in quantum mechanics with their properties. 10
b) Explain the Heisenberg uncertainty principle.
Q. 4 Answer the following.
a) Discuss of the factors influencing colour for an electron in a box. 10
b) Examine the Prob. Density of 1 s atomic orbital.
Q. 5 Answer the following.
a) Describe the theory of Wave function of many electron systems. 10
b) Discuss the electronic structure of many electron atoms.
Q. 6 Answer the following.
a) Describe the quantum mechanical theory for valence bond methods.10
b) Describe the Molecular orbital theory with the LCAO approximation. 06
Q. 7 Answer the following.
a) Describe the physical interpretation of Hydrogenic orbitals. 10
b) Discuss the important postulates of quantum mechanics. 06

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M.Sc. (Semester - II) (New) (CBCS) Examination: Oct/Nov-2023 PHYSICS (APPLIEDEL ECTRONICS) Electrodynamics (MSC5202)

Day \& Date: Tuesday, 19-12-2023
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 indicate full marks.
Q. 1 A) Choose the correct alternatives from the options.

1) Divergence of the curl of any vector field is always $\qquad$ .
a) 0
b) 1
c) Infinite
d) cant possible
2) Which one of the fundamental equation was modified by Maxwell to form the basis of electromagnetic theory?
a) Faraday law
b) Ampere law
c) Gauss law of electrostatic
d) Gauss law of magnetostatic
3) Lorentz electric force has direction $\qquad$ .
a) Similar to electric field
b) Opposite to electric field
c) Scalar quantity
d) None
4) The Poynting vector $P$ is equal to $\qquad$ .
a) E.H
b) $\mathrm{E} \times \mathrm{H}$
c) $\mathrm{E} / \mathrm{H}$
d) $\mathrm{H} / \mathrm{E}$
5) Which property of an electromagnetic wave, depends on the medium in which it is travelling?
a) Velocity
b) Frequency
c) Time period
d) Wave length
6) In the skin definition of skin depth, it is distance over which field amplitude reduces to $\qquad$ .
a) Nearly one fifth
b) $1 / e$
c) One half
d) One fourth
7) In Maxwell equation $\nabla \times H=J+\partial D / \partial t, J$ is $\qquad$ .
a) Electric flux density
b) magnetic flux density
c) Surface current density
d) No physical quantity

## SLR-EQ-12

8) Law which governs the interaction of the electromagnetic field with charge matter $\qquad$ .
a) Gauss law
b) Faradays law
c) Amperes law
d) Lorentz force law
9) Magnetic vector potential due to magnetic dipole is proportional to $\qquad$ .
a) $r$
b) $1 / r$
C) $1 / r^{2}$
d) $1 / r^{3}$
10) Electric Potential ( $\Phi$ ) of a quadrupole varies with distance ' $r$ ' on its axis as $\qquad$ .
a) $\Phi: r^{-1}$
b) $\Phi: r^{-2}$
c) $\Phi: r^{-3}$
d) $\Phi: r^{3 / 2}$
B) Fill in the blanks OR Write Ture/False
11) The charge density of electrostatic field is given by $\qquad$ .
12) In dipole, the gauss theorem value will be $\qquad$ .
13) The Ampere law is based on $\qquad$ Theorem
14) The electric field over the gaussian surface remains continuous and uniform at every point.
15) In Biot-Savart's law, the magnetic intensity is product of the current.
16) The direction of a propagation of electromagnetic wave is $\bar{E} \cdot \bar{B}$.
Q. 2 Answer the following.
a) Explain Maxwell's displacement current?
b) Write a note on Skin effect and skin depth?
c) Explain the concept of Thomson cross section?
d) State the boundary condition for an electrostatic field $\bar{E}$.
Q. 3 Answer the following.
a) Discuss the "Reflection and refraction" of electromagnetic waves at
oblique incidence.
b) Elaborate the concept of displacement current. 06
Q. 4 Answer the following.
a) Explain in details of boundary condition between conductor and free space.
b) Obtained the expression for the resistance for uniform field \&non-uniform fields.

## Q. 5 Answer the following.

a) Derive an expression for energy stored in electric and magnetic field.
b) Explain the concept of Radiation damping.

## SLR-EQ-12

## Q. 6 Answer the following.

a) Derive the general expression for electromagnetic energy.
b) Discuss Electromagnetic plane waves in stationary medium?

06

## Q. 7 Answer the following.

a) Explain the concept of radiation from a half wave antenna. 10
b) What is Gauss law? Explain differential form of its. 06

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# M.Sc. (Semester - II) (New) (CBCS) Examination: Oct/Nov-2023 PHYSICS (APPLIED ELECTRONICS) Statistical Physics(MSC5206) 

Day \& Date: Wednesday, 20-12-2023
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 the correct alternatives from the options.

10

1) Which law of thermodynamics is the law of conservation of energy?
a) First
b) Second
c) Zero
d) Third
2) The phase space is $\qquad$ dimensional space.
a) 3 N
b) 6 N
c) N
d) 2 N
3) The statistics followed by half spin particles is $\qquad$ .
a) Maxwell-Boltzmann Statistics
b) Fermi-Dirac Statistics
c) Bose-Einstein Statistics
d) None of the above
4) Maxwell-Boltzmann statistics cannot be applied to $\qquad$ .
a) Atoms
b) Molecules
c) Photons
d) Lattice
5) The equation of state for an ideal gas is represented as $\qquad$ .
a) $P V=R / T$
b) $P V=n R T$
c) $P / V=R / T$
d) $P V=R T$
6) The entropy of an ideal gas at absolute zero is $\qquad$ .
a) $\infty$
b) 0
c) $N k B$
d) Cannot be calculated
7) For which gas mutual interaction between the molecules is zero.
a) real
b) Fermi
c) Ideal
d) Bose
8) Total heat of the substance is also known as $\qquad$ .
a) Internal energy
b) Entropy
c) Thermal Capacity
d) Enthalpy
9) Pressure at the critical point is $\qquad$ .
a) $3 b$
b) $8 / 27 R$
c) $3 b / 27 R b$
d) $8 a / 27 R b$
10) In microcanonical ensembles following parameters remain constant.
a) $T V N$
b) $E V N$
c) $E V T$
d) $E V \mu$
B) Fill in the blanks OR write true/ false.
11) The ratio of the universal gas constant and Avogadro's number is called the velocity constant.
12) The transition in $\beta$-brass is an example of a second-order phase transition.
13) Photon, Phonon, etc. obeys the Fermi Dirac distribution function.
14) Entropy in thermodynamics is a measure of the disorder of the system.
15) The value of the universal gas constant is 8.3143
16) A phase space is a six-dimensional space.
Q. 2 Answer the following.
a) State the types of ensembles and point out the difference between canonical and Grand Canonical Ensemble.
b) Discuss the conditions for phase equilibrium.
c) Show that during the second order phase transition $\partial^{2} G_{1} / \partial T^{2} \neq \partial^{2} G_{2} / \partial T^{2}$.
d) What is a partition function? Derive it for Canonical Ensemble.
e) Explain the P-T diagram of the phase transaction.

## Q. 3 Answer the following.

$\begin{array}{ll}\text { a) Show that Gibb's function is continuous during the first-order phase } & 10 \\ \text { transition, but the first derivative of Gibb's function changes } \\ \text { discontinuously. }\end{array}$
b) What is a triple point? Explain it with the help of a phase diagram.
Q. 4 Answer the following.
a) Write a note on Critical Indices 10
b) Write about Liouville's theorem in a classical presentation. 06
Q. 5 Answer the following.
a) Write about Second order phase transition. 08
b) Write a note on microcanonical, canonical and grand canonical 08 ensembles.

## Q. 6 Answer the following.

a) Show that the average energy of a single particle of ideal fermi gas is 10
b) Explain the law of corresponding states. 06
Q. 7 Answer the following.
a) Derive the expression for Fermi energy at strongly degenerate ideal 10
Fermi gas.
b) Write about black body radiation. 06
3) Figure to right indicate full marks.
Q. 1 A) Choose the correct alternative.

1) In a semiconductor, the energy gap between the valence band and conduction band is about $\qquad$ .
a) 5 eV
b) 10 eV
c) 15 eV
d) 1 eV
2) Electron-hole pairs are produced by $\qquad$ .
a) Recombination
b) Thermal energy
c) Ionization
d) Doping
3) The drift velocity of the conductor $\qquad$ .
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
4) In Schottky barrier, barrier height depends on $\qquad$ .
a) Amount of doping material
b) Type of doping material
c) Temperature
d) None of the above
5) The probability that an electron in a metal occupies the fermi level, at any temperature ( $>\mathrm{OK} \mathrm{)} \mathrm{is}$ $\qquad$ -.
a) 0
b) 1
c) 0.5
d) 1.0
6) If $\sigma$ is the conductivity, what is the relation between the electric field E and the current density J in a conducting medium?
a) $\sigma=J / E$
b) $\quad \sigma=1 / J E$
c) $\sigma=E / J$
d) $\sigma=E J$
7) The equilibrium number of EHP in pure Si at room temperature is about $\qquad$ .
a) $10^{10} \mathrm{EHP} / \mathrm{cm}^{3}$
b) $10^{12} \mathrm{EHP} / \mathrm{cm}^{3}$
c) $10^{10} \mathrm{EHP} / \mathrm{m}^{3}$
d) $10^{12} \mathrm{EHP} / \mathrm{m}^{3}$
8) The atoms of solid are held together by $\qquad$ .
a) Van der Waals forces
b) Hydrogen bonds
c) Ionic bonds
d) Hydrophobic forces
9) What is the role of seed crystal in crystal growth?
a) Nucleation center
b) Catalyst
c) Solvent
d) Solution
10) Charge carriers can move in semiconductor via:
a) Diffusion mechanism
b) Floating mechanism
c) Drift mechanism
d) Both drift and diffusion mechanism
B) Fill in the blanks OR Write true/ false.

06

1) The mean lifetime of electron-hole pair (EHP) is less than $\qquad$ seconds.
2) LED is an example of $\qquad$ luminescence.
3) $\qquad$ nuclei often redissolve.
4) Nucleation poses large energy barrier. (True/False)
5) Mobility cannot be determined from Haynes-Shockley experiment. (True/False)
6) Debye temperature is associated with the highest allowed mode of vibration. (True/False)
Q. 2 Answer the following ..... 16
a) Write a note on optical absorption.
b) Explain fermi level pinning.
c) Write a short note on group velocity of electrons.
d) Explain in short direct bandgap semiconductors.

## Q. 3 Answer the following

a) Elaborate in detail about the ohmic contacts. 10
b) Explain in short about Nucleation process. 06
Q. 4 Answer the following
a) Explain the concept of vibrational specific heat and derive its expression. 10
b) Write in brief about inverse effective mass tensor. 06
Q. 5 Answer the following
a) Elaborate in detail about the growth of bulk semiconductors by Zone 10

Melting.
b) Explain in brief about surface and interface states. 06
Q. 6 Answer the following
a) Explain the concept of steady state carrier generation. 10
b) Write in brief about vapour phase epitaxy. 06
Q. 7 Answer the following
a) Explain in detail about rectifying contacts with the necessary band 10 diagrams.
b) Explain the bonding forces in solids. 06

# M.Sc. (Semester - III) (New) (CBCS) Examination: Oct/Nov-2023 PHYSICS (APPLIED ELECTRONICS) Atomic, Molecular Physics (MSC5302) 

Day \& Date: Sunday, 07-01-2024

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.

1) In computing the splitting of spectral lines in a weak magnetic field the lande g-factor arises because of $\qquad$ .
a) Pauli Exclusion Principle
b) spin-orbit coupling
c) larmor precession
d) relativistic correction
2) Laser cooling of atoms is produced due to $\qquad$ .
a) Absorption of photons by atoms
b) scattering of photons by atoms
c) Transfer of momentum from photon to atoms
d) transfer of energy from photons to atoms.
3) First raman shifted line observed at $218 \mathrm{Cm}-1$ for CCl 4 excited by 632.8 nm of HE-Ne laser, will correspond to scattered wavelength at (given $\mathrm{h}=6.6^{*} 10^{-34} \mathrm{Js} \mathrm{C}=3^{*} 10^{8} \mathrm{~m}$ )
a) 128.5 nm
b) 621.8 nm
c) 5000.0 nm
d) 641.6 nm
4) The outermost shell of an atom of an element is 3d3. The spectral symbol for the ground state
a) ${ }^{4} \mathrm{~F}_{3 / 2}$
b) ${ }^{4} \mathrm{~F}_{9 / 2}$
c) ${ }^{4} \mathrm{D}_{7 / 2}$
d) ${ }^{4} D_{1 / 2}$
5) A negative muon, which has a mass nearly 200 times that of an electron, replaces an electron in a Li atom. The lowest ionization energy for the muonic LI atom is approximately.
a) The same as that of He
b) The same as that of normal LI
c) The same as that of normal Be
d) 200 time larger than that of normal LI
6) Which of the following molecules does not exibit a rotational spectrum.
a) HCl
b) CO
c) H 2
d) HBr
7) JJ coupling is the $\qquad$ Coupling.
a) Weak
b) strong
c) less weak
d) none of these
8) One electron in P orbit and a other in a D orbit, in case of II coupling, the atom may be in a $\qquad$ state.
a) SPD
b) PDF
c) DFG
d) Only D
9) Which of the following molecule will not show the microwave spectra.
a) $\mathrm{CH}_{2} \mathrm{Cl}_{2}$
b) $\mathrm{SF}_{6}$
c) $\mathrm{H}_{2} \mathrm{O}$
d) $\mathrm{CH}_{3} \mathrm{Cl}$
10) The lowest vibrational energy is given by $\qquad$ .
a) $1 / 2 \omega$
b) $\omega$
c) $1 / 2 \omega^{2}$
d) $\omega^{2}$
B) Fill in the blanks or True false from give parenthesis
11) _Detector is an IR detector (crystal / Pyroelectric)
12) At $\mathrm{J}=0$ i.e ground rotational state, in which the $\qquad$ (rotation / no rotation)
13) Intensity rule for the Zeeman effect of the atomic systems containing more than one valance electron is $\qquad$ of type of coupling (dependent /Independent)
14) When $L$ is greater than or equal to $S$, all integral Value of $J$ between L-S and L+S are allowed.
15) Hyperfine structures arises in tungsten due to presence there even isotopes tungsten.
16) The spherical top molecule have dipole moment owing to their symmetry.

## Q. 2 Answer the following.

a) Give selection rule for LS and JJ coupling
b) State and explain the intensity rule for Zeeman Effect.
c) Distinguish between normal and anomalous Zeeman Effect.
d) Find the spectroscopic term for npl, np2, np4,np5.

## Q. 3 Answer the following.

a) With the schematic diagram, write the construction and working of stern gerlach experiment.
b) The spin orbit coupling constant for the upper state of Na atom which emits04 D lines for weak numbers $16959 \mathrm{~cm}-1$ and $1697.4 \mathrm{~cm}-1$ is?
Q. 4 Answer the following.
a) What are the assumption made for the deriving an expression for Lande ' $g$ '
factor? Obtain the expression for the Lande ' $g$ ' factor for LS coupling.
b) In a hydrogen atom the accidental or coulomb degeneracy for the $\mathrm{n}=4$ state is? \{111\}.

## Q. 5 Answer the following.

a) Write the consequences for bond elasticity for diatomic molecule as a nonrigid rotator.
b) The number of Zeeman component for 2D3/2 --> 2P3/2 transition in one 04 electron atom will be?\{124\}

## Q. 6 Answer the following.

a) Discuss the techniques and instrumentation of microwave spectrometer andits use in chemical analysis
b) The land's $g$ factor for the ${ }^{3} \mathrm{P}_{1}$ level of an atom is? $\{91\}$.

## Q. 7 Answer the following.

a) Draw the vibrational energy levels and some transition between them for a 12 diatomic molecules undergoing anharmonic oscillations
b) Consider a state in which $\mathrm{I}=4, \mathrm{~s}=1 / 2$ the orientation of total angular moment w.r.t Cos 45 the state with largest possible J, mj is? $\{55\}$

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## M.Sc. (Semester - III) (New) (CBCS) Examination: Oct/Nov-2023

## PHYSICS (APPLIED ELECTRONICS)

Communication System (MSC5306)
Day \& Date: Tuesday, 09-01-2024
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

1) FM radio receiver which is tuned to a 91.6 MHz broadcast station may receive an image frequency of $\qquad$ MHz .
a) 102.3
b) 113
c) 70
d) 80.9
2) PAM stands for $\qquad$ .
a) Pulse Analogue Modulation
b) Pulse Amplitude Modulation
c) Phase Analogue Modulation
d) Phase Amplitude Modulation
3) For AM receivers the standard IF frequency is $\qquad$ KHz.
a) 420
b) 455
c) 945
d) 10.7
4) Power of carrier wave is 500 W and modulation index is 0.25 , its total power is $\qquad$ W.
a) 500
b) 470
c) 516
d) 600
5) Commercial frequency deviation is $\qquad$
a) 75
b) 80
c) 90
d) 65
6) Detection is same as $\qquad$ .
a) Modulation
b) Mixing
c) Demodulation
d) filtering
7) A line having maximum 120 mV and minimum 40 mV value VSWR is $\qquad$ .
a) 1
b) 2
c) 3
d) 4
8) The value of modulation index $m$, for over-modulation is $\qquad$ .
a) $>1$
b) $=1$
c) $<1$
d) $=0$
9) The full form of CDMA is $\qquad$ .
a) Code division multiple access
b) Code diode multiple access
c) Cross division multiple access
d) Current division multiple access
10) $\qquad$ devices is used to generate AM waves.
a) Square-law modulator
b) Reactance modulator
c) Transmitter
d) Receiver
B) State true or false
11) Communication consists of electrical means of sending information only.
12) SSB is a standard form for radio communication.
13) Half duplex is a bidirectional communication.
14) For High level amplitude modulation all RF amplifiers can be nonlinear.
15) The standard form of PSK is Pulse shift keying.
16) FM operates normally between 88 to 108 Megahertz.
Q. 2 Answer the following. ..... 16
a) What are the benefits of modulation in communication system?
b) What do you mean by AM, FM and PM signals?
c) What is aliasing? What is the effect of aliasing?
d) Write a short note on unipolar and bipolar coding scheme.

## Q. 3 Answer the following.

a) Explain the working of AM receiver with the help of neat block diagram.
b) Explain in short Class C modulated power amplifier circuits.

## Q. 4 Answer the following.

a) Draw and explain the each block of FM Transmitter.
b) With a neat block diagram explain the working of VCO.

## Q. 5 Answer the following.

a) Describe the Phase locked loop (PLL) FM demodulator with help of neat 10
b) Find the modulation index and percentage modulation of the signal given 06 below.
(Given: $\mathrm{V}_{\text {max }}=50 \mathrm{v}$ and $\mathrm{V}_{\mathrm{min}}=15 \mathrm{v}$ )

## Q. 6 Answer the following.

a) What is multiplexing? Explain the TDMA in detail with suitable diagram. 10
b) Explain radio frequency bands \& its application used in communication 06 system.

## Q. 7 Answer the following.

a) Explain the modulation and demodulation of PAM signals in short. 10
b) Compare between TDM and FDM techniques.

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M.Sc. (Semester - IV) (New) (CBCS) Examination: Oct/Nov-2023 PHYSICS (APPLIED ELECTRONICS) Semiconductor Devices (MSC5401)
Day \& Date: Monday, 18-12-2023
Max. Marks: 80
Time: 03:00 PM To 06:00 PM
Instructions: 1) Attempt five questions.
2) Question No. 1 and 2 are compulsory.
3) Attempt any three from Q. No. 3 to Q. No. 7.
Q. 1 A) Choose correct alternatives.

1) A CCD involves $\qquad$ actions.
a) charge storage and transfer
b) only charge transfer
c) only storage
d) charge storage and loss
2) Two valley model of TEDs based on GaAs is proposed by $\qquad$ .
a) BCS
b) BBS
c) RWH
d) NWH
3) LEDs fabricated with GaAs emit $\qquad$ wavelength.
a) far ultra violet
b) ultraviolet
c) visible
d) infrared
4) An overlapping gate structure is used for improving $\qquad$ performance.
a) CCD
b) LED
c) LASER
d) SCR
5) Photodetector $\qquad$ optical signal.
a) reflects
b) detects
c) modulate
d) amplify
6) The M - S structure forms $\qquad$ barrier.
a) schottky
b) read
c) ohmic
d) non-ohmic
7) $\left(\alpha_{1}+\alpha_{2}\right)$ approaches $\qquad$ when the SCR devices are at forward breakdown.
a) 100
b) 1000
c) $\infty$
d) 1
8) A Triacs is used where the transfer of large $\qquad$ is involved.
a) Power
b) voltage transfer
c) electron transfer
d) charge transfer
9) In a CCD operation the thermal relaxation time is $\qquad$ than the charge storage time.
a) longer
b) much longer
c) shorter
d) much shorter
10) Light emission is not possible in Si due to its $\qquad$ .
a) direct band gap
b) high mobility
c) indirect band gap
d) doping
B) Fill in gaps/State True or False

06

1) Refreshing circuit is incorporated in CCD memory as it provides $\qquad$ .
2) Pulsed laser can deliver very $\qquad$ power.
3) The M-S structure forms $\qquad$ barrier.
4) The CCD devices are static.
5) The forward characteristic of a Shockley diode is useful for switching.
6) PUT requires 2 V if gate is biased at 0.8 V .
Q. 2 Answer the following.
a) Programable UJT.
b) Enhancement type MOSFET.
c) Dynamic effect in CCD.
d) Radiative and non-radiative transitions.
Q. 3 a) Describe the operating principle of photodiode based on PN junctions, pin ..... 10
configuration and multilayer hetrojunction with. band diagrams and IV
characteristics.

b) Draw block diagram, doping profile, electric field distribution in p-i-n diode. 06
Q. 4 a) Give an account of DIAC and TRIAC with suitable diagrams and IV ..... 10 characteristics.
b) Explain di/dt protection. ..... 06
Q. 5 a) Describe MS structure with band diagram. ..... 10
b) Charge trapping in MOSFET. ..... 06
Q. 6 a) Describe GaAs Gun Oscillator modes in terms of ..... 10i) Space charge accumulationii) Quenched domain modeiii) Delayed domain mode
b) Explain current flow mechanism in MS junction. ..... 06
Q. 7 a) Describe IV characteristics of solar cell. Derive an expression for ..... 10 quantum efficiency of solar cell.
b) How performance of CCD is improved. ..... 06
M.Sc. (Semester - IV) (New) (CBCS) Examination: Oct/Nov-2023 PHYSICS (APPLIED ELECTRONICS) Nuclear and Particle Physics (MSC5402)
Day \& Date: Tuesday, 19-12-2023
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.

1) The binding energy of deuteron is $\qquad$
a) 13.6 eV
b) 36 MeV
c) 2.225 MeV
d) 13.6 MeV

Max. Marks: 80
2) The range of energy $\qquad$ eV is called as epithermal reaction.
a) 1 eV
b) 0.025 eV
c) 1 KeV
d) $\quad 0.1-1 \mathrm{MeV}$
3) The simplest two nucleon system exist in nature is of $\qquad$
a) $n-n$
b) $n-p$
c) $\quad \mathrm{p}-\mathrm{p}$
d) dose not exist
4) the height of potential barrier faced by an alpha particle inside the nucleus is $\qquad$
a) $31.2 \overline{\mathrm{MeV}}$
b) 31.2 KeV
c) 31.2 GeV
d) 31.2 eV
5) The energy equivalent to 1 a mu is $\qquad$ .
a) 931 eV
b) 931 KeV
c) 931 MeV
d) 93 BeV
6) The compound nucleus ha life time is of the order of $\qquad$ .
a) $10^{-8} \mathrm{Sec}$
b) $10^{-11} \mathrm{Sec}$
c) $\quad 10^{-14} \mathrm{Sec}$
d) $10^{-21} \mathrm{Sec}$
7) Unit of cross section is $\qquad$ .
a) Fermi
b) barn
c) MeV
d) nucleon per cm3
8) 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) $\mathrm{A}^{-1 / 3}$
b) $A^{2 / 3}$
c) $A^{1 / 3}$
d) A
9) The electric quadruple moment is negative, shape of the nuclei is $\qquad$ .
a) Oblate
b) Prolate
c) Spherical
d) All of these
10) The $\qquad$ Can explain magic number.
a) Liquid drop model
b) Fermi gas model
c) shell model
d) All of these
B) Fill in the blanks / True or False.

1) Nuclear binding energy usually expressed in units of $\qquad$
2) The exchange particle which holds the quarks together is called $\qquad$ .
3) In direct reaction incident particle completely have more than $\qquad$ Energy per nucleon
4) Cross sectional area of $n-p$ scattering is $4 \pi a^{2}(T / F)$
5) In a deuteron, the force between neutron and proton is short range and repulsive (T/F)
6) Nucleons are bosons (T/F)

## Q. 2 Answer in brief.

a) Discuss shape and size, mass and relative abundances of nucleus.
b) Discuss superconductivity model.
c) Write a note on conservation laws.
d) Write a note on cosmic ray.
Q. 3 Answer the following.
a) Derive an expression for scattering cross section of two nucleon system and write a note on scattering length.
b) Discuss properties of nuclear forces.
Q. 4 Answer the following.
a) Describe liquid drop model of nucleus point out its usefulness and 10 limitations in understanding the nuclear phenomenon.
b) Explain the energy levels of shell model. How this helps to explain the occurrence of magic numbers? Draw the diagram.
Q. 5 Answer the following
a) Explain the nuclear reaction kinematics Obtain an expression for $Q$ value discuss the general solution of the Q equation.
b) Comment on compound nuclear disintegration.

## Q. 6 Answer the following

a) Give the Gell-Mann-Nisijima relation and calculate the charge of baryon
family using this relation find out strangeness' and hypercharge of the
baryon octet plot the schematic diagram and table.
b) Discuss quark hypothesis and quantum chromodynamics.
Q. 7 Answer the following
a) What should be the minimum KE of the electrons to probe the size of ${ }_{20} \mathrm{Ca}^{40}$ nucleus.
b) $\mathrm{An}{ }_{8} \mathrm{O}^{16}$ nucleus is spherical and has charge radius R and volume according 06 to empirical observation of the charge radii, the volume of the ${ }_{54} \mathrm{Xe}^{128}$ nucleus assume to be spherical what is the ratio of volume of Xe to the volume of Oxygen.
M.Sc. (Semester - IV) (New) (CBCS) Examination: Oct/Nov-2023 PHYSICS (APPLIED ELECTRONICS) Microwave Devices \& Circuits (MSC5403)
Day \& Date: Wednesday, 20-12-2023
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.

1) The frequency range from 2 to 4 GHz is designated as $\qquad$ .
a) Ku-band
b) V-band
c) S-band
d) C-band
2) $\quad \mathrm{In}$ $\qquad$ many modes does Gunn diodes can operate.
a) One
b) Four
c) Six
d) Eight
3) 

a) TEM mode
b) TM mode
c) TE mode
d) None of the mentioned
4) When an electric field $E$ is applied, the force on an electron with charge -e is $\qquad$ .
a) $F=-e E$
b) $F=e E$
c) $F=-e / E$
d) $F=e / E$
5) Polarization of dielectric materials results in $\qquad$ .
a) Production of eddy currents
b) Creation of dielectric dipoles
c) Release of protons
d) Absorption of electrons
6) In vacuum or free space, what observations are made?
a) $\rho=\rho_{\circ}, J=0$
b) $\quad \rho=0, J=J$ 。
c) $\rho=0, J=0$
d) $\quad \rho=\rho_{\circ} J=J$ 。
7) The lowest mode of TE mode propagation in a circular waveguide is $\qquad$ .
a) TE10 mode
b) TE00 mode
c) TE01 mode
d) TE11 mode
8) Fields of TEM mode on strip line must satisfy $\qquad$ .
a) Laplace's equation
b) Ampere's circuital law
c) Gaussian law
d) None of the mentioned
9) Transmission line is a $\qquad$ parameter network.
a) Lumped
b) Distributed
c) Active
d) None of the mentioned
10) The wavelength of a wave in a Waveguide $\qquad$ .
a) is greater than of free space
b) depends only on the waveguide dimensions and the free-space wavelength
c) is inversely proportional to the phase velocity
d) is directly proportional to the group velocity
B) State true or false.

1) The entire theory of electromagnetic waves is contained in Maxwell's equations.
2) In a GaAs n-type specimen, the current generated is constant irrespective of the electric filed applied to the specimen.
3) The mode of propagation in a Microstrip line is Quasi TEM mode.
4) Rectangular waveguide is the best medium for handling large microwave power.
5) The attenuator is used in travelling wave tube to prevent oscillations.
6) Gunn diode is suitable for very low power oscillators only.
Q. 2 Answer the following. ..... 16
a) Write down Maxwell's equation in point and integral form?
b) What are the applications of Microwaves?
c) Explain the terms: Cut-off frequency, Dominant mode, Phase velocity, Group velocity.
d) Write a short note on Electronic and Magnetic fields.

## Q. 3 Answer the following.

$\begin{array}{ll}\text { a) Draw a neat diagram of two cavity Klystron amplifier and explain the } \\ \text { bunching process. Derive the equation of velocity modulation. } & \mathbf{1 0}\end{array}$
b) Explain wave propagation in perfect Insulators.
a) Explain waveguide attenuators with neat diagram. 10
b) Discuss briefly about Microwave spectrum. 06

## Q. 5 Answer the following.

a) Explain rectangular waveguide transmission in detail. 10
b) Describe briefly standard coaxial connectors. 06

## Q. 6 Answer the following.

a) With a neat diagram, explain coaxial and strip line attenuators. 10
b) Describe the types of strip lines in brief. 06

## Q. 7 Answer the following.

a) With neat diagrams, explain construction and working of reflex klystron. 10
b) Explain the excitation of modes in circular waveguides. 06

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# M.Sc. (Semester - IV) (New) (CBCS) Examination: Oct/Nov-2023 PHYSICS (APPLIED ELECTRONICS) <br> Microcontrollers \& Interfacing (MSC5406) 

Day \& Date: Thursday, 21-12-2023 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.

1) The addressing mode of the instruction MOV A, @RO is $\qquad$ .
a) Direct
b) Indirect
c) Immediate
d) Register
2) In the 8051, control can be transferred anywhere within the $\qquad$ K bytes of code space if using the LCALL instruction.
a) 2
b) 4
c) 32
d) 64
3) Which of the following SFR of 8051 is not addressable?
a) DPH
b) PC
c) TCON
d) B
4) How many equal intervals are present in 12 bit $D-A$ converter?
a) 1023
b) 4095
c) 65535
d) 16383
5) In microcontroller \& LCD interface, which line will instruct the LCD that microcontroller sending a data or command?
a) DB 0
b) $R / \bar{W}$
c) EN
d) $R S$
6) The time taken for the output to settle within a specified band of its final value is referred as $\qquad$ .
a) Conversion time
b) Settling time
c) Take off time
d) All of the mentioned
7) To assign the highest priority to INT1 the instruction used is $\qquad$ .
a) MOV IP, \#04H
b) SETB IP. 2
c) Both (a) and (b) are correct
d) None of these
8) The PORT3 pins used to access memory are $\qquad$ .
a) P3.0 \& P3.1
b) P3.2 \& P3.3
c) P3.4 \& P3.5
d) P3.6 \& P3.7
9) In LM35 the mapping of 1 degree centigrade to $\qquad$ mV .
a) 1
b) 5
c) 7
d) 10
10) How many SBUF physically present inside the microcontroller for the serial communication?
a) 1
b) 2
c) 3
d) 4
B) State the following statements are true or false.
11) PCON register SMOD bit decides the baud rate for serial communication.
12) LCD can't be used in the read mode.
13) MOVC A, @A+DPTR access the data from the RAM or data memory.
14) $X R L C, / b$ is a valid instruction.
15) Maximum delay will be produced by timer if it will be used in MODE-1.
16) $\overline{E A}$ pin should be connected to ground to access external memory.
Q. 2 Answer the following. ..... 16
a) Explain following instructions.
17) $X C H D A, @ R 1$
18) POP 30 H
b) Draw and explain the PSW format of 8051.
c) Why optocoupler is used in relay?
d) Explain the function of the following pins of 8051.
19) $T 0$
20) $\overline{\mathrm{PSEN}}$
Q. 3 Answer the following. 16
a) Explain the memory organization of 8051.
b) Draw and explain the power ON reset circuit of 8051.
Q. 4 Answer the following. ..... 16
a) Interface relay to 8051. Write a program to turn ON the LED connected to P1.2 whenever the relay turns ON.
b) Interface seven segment (common cathode type) display to 8051. Write a program to display the number from 0 to 9 continuously.

Q. 5 Answer the following.
a) Write a program to generate a square wave of 4 KHz on P1.3.
Use Timer 1 for delay purpose. Assume crystal frequency is 12 MHz .
b) Write a program to transfer characters "YES" with the baud rate of 4800 bits per second by using TXD pin of 8051. Assume crystal frequency is 12 MHz and $\mathrm{SMOD}=0$.
Q. 6 Answer the following. 16
a) Interface $16 \times 2$ LCD to 8051 . Write a program to display "Welcome" at the center of the first line.
b) Interface the LM35 to 8051 for the measurement of temperature. Write a program to display the measured temperature value on P1 where the seven segment displays are connected.

## Q. 7 Answer the following.

a) Implement the half adder in 8051.
b) Interface ADC0804 to 8051 . Write a program to display the converted data on P2 where LEDs are connected.

