			Mathematical Phys		,	
-			riday, 05-01-2024 M To 05:30 PM		Max.	Marks: 60
Insti	ructio		1) All questions are compulsory. 2) Figures to the right indicate full	mar	ks.	
Q.1	A)	<b>Cho</b> 1)	<b>Dose correct alternative.</b> The value of $\int_{-\pi}^{\pi} \cos(mx) \sin(nx)$	dx =	=	08
			a) 1 c) 0		a-1 $\pi$	
		2)	If $ z^2 - 1  =  z^2  + 1$ then z lies o a) the real axis c) a circle	b)	the imaginary axis on ellipse	
		3)	A point at which a function $f(z)$ i or singularity of the function. a) Scalar point c) Non-singular	b)	t analytic is known as a Singular point None of these	
		4)	Find the pole of $f(z) = \sin \frac{1}{(z-a)} =$	=		
			a) $z = a$ c) $z = 1$	b)	z = 0 $z = 4$	
		5)	Laplace transform of $f(t)$ is define a) +ve value of t c) both +ve & -ve value of t	b)	-ve value of $t$	
		6)	Legendre polynomial is a set of _ a) orthogonal c) even	b)	_ function. odd real	
		7)	If $f(z) = e^{2z}$ then the imaginary ( a) $e^{y} \sin x$ c) $e^{2x} \cos 2y$	b)	of $f(z)$ is $e^x \cos y$ $e^{2x} \sin 2y$	
		8)	What are the eigen values of $\binom{1}{i}$	-i	)?	
			<ul> <li>a) Both are 0</li> <li>c) 0 and −1</li> </ul>	b) d)	0 and 1 0 and 2	
	B)	Fill 1) 2) 3) 4)	in the blanks OR write true/false Fourier transform is a linear oper Inverse of unitary matrix is unitar A square matrix is called orthogo $x \frac{\partial u}{\partial x} + t \frac{\partial u}{\partial t} = 2u$ is on ordinary di	rator ry ma onal i	atrix. (True/ False) f $A = A^{-1}$ . (True/ False)	<b>04</b>

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No.	

SLR-EQ-1

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Page  ${\bf 1}$  of  ${\bf 2}$ 

### Page 2 of 2

## Q.2 Answer the following. (Any Six)

- Find the pole  $f(z) = \sin\left(\frac{1}{z-z}\right)$ a)
- What are the conditions for a matrix to be orthogonal matrix? b)
- Solve  $\frac{d^2y}{dx^2} 6\frac{dy}{dx} = 9y = 0$ C)
- Find the Laplace transform of the function d)

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

Find the pole of  $f(z) = \frac{\sin(z-a)}{(z-a)^4}$ e)

Show that inverse of an orthogonal matrix is orthogonal. f)

g) Solve 
$$\frac{d^2y}{dx^2} - 5\frac{dy}{dx} + 6y = 0$$

Define singular point, explain in details its types with example. h)

### Q.3 Answer the following. (Any Three)

- Discuss in details Cauchy's Integral Formula. a)
- State and prove the Parseval's Theorem. b)
- Show that the eigen value of Hermitian matrix are real. C)
- Find the Fourier Transform of  $e^{-ax^2}$  where a > 0d)

## Q.4 Answer the following. (Any Two)

Write matrix A gives below as the sum of symmetric & a skew symmetric a) matrix.

$$A = \begin{pmatrix} 1 & 2 & 4 \\ -2 & 5 & 3 \\ -1 & 6 & 3 \end{pmatrix}$$

- b) In square wave expand the function  $f(x) = 0; -\pi \le x \le 0$  $f(x) = h; 0 \le x \le \pi$  fourier
- Evaluate the following integral using residue Theorem. C)  $\int_{C} \frac{1+z}{z(2-z)} dz$  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;  $x \frac{dy}{dx} + y \log y = xy e^x$
- Solve the differential equation. C)

 $y \log y \, dx + (x - \log y) dy = 0$ 

12

12

12

12

5	,	5			
arization also known as r polarization polarization plarization on polarization					
enomenon where a ma ow a certain critical ten nductivity ce	npera b)			al	
ne following is magnetion netic Materials only gnetic Materials only etic Materials he above	c sus	ceptibility n	egative?		
of water reduces slight	tly th	e temperatı	ure of a clos	sed	
a bad conductor of hea is a large lantern heat o perature of the water is the above	of va		om		

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

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

### Q.1 A) Choose the correct alternative.

a) c)

Day & Date: Sunday, 07-01-2024 Time: 03:00 PM To 05:30 PM

Seat

No.

- Conductivity of metals depends upon 1) b)
  - The nature of the material a)
  - Resistance of the metal c)
- At what temperature does ferromagnetic material become paramagnetic? 2) Curie

d)

b)

b)

d)

- Melting Neel
  - d) None of these

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

### 3) Which of the following is a strong magnet?

- **Diamagnetic material** a)
- Antiferromagnetic material c)
- 4) Electronic pola
  - a) molecular
  - b) magnetic
  - atomic po c)
  - d) orientation
- What is the phe 5) resistance belo
  - a) Supercon
  - c) Resistanc
- 6) For which of the
  - Paramagr a)
  - b) Ferromag
  - Diamagne c)
  - none of th d)
- 7) The sprinkling room because
  - Water is a a)
  - Water has b)
  - c) The temp
  - None of the d)

## SLR-EQ-2

Max. Marks: 60

Number of free electrons

Number of electrons

Paramagnetic material

Ferromagnetic material

Set

	B)	<ul> <li>Fill in the blanks OR write true / false.</li> <li>1) The SI unit of magnetic field intensity is</li> <li>2) The magnetization 'M' of a superconductor in a field is</li> <li>3) When a paramagnetic material is heated above Curie temperature it becomes non-magnetic.</li> <li>4) The temperature above which an antiferromagnetic material becomes paramagnetic is called the melting temperature.</li> </ul>	04
Q.2	Ans a) b) c) d) e) f) g) h)	wer the following. (Any Six). What is Curie Temperature? Define diamagnetic materials. Define specific heat. What is orientational polarization? What is an extrinsic semiconductor? What is penetration depth? State the concept of ferroelectricity. Define Neel temperature.	12
Q.3	Ans a) b) c) d)	wer the following (Any Three) Explain in Brillouin zones in 2-D. Write about the direct and indirect band gap of semiconductors. Explain Meissner's effect. Write a note on the conductivity of solids.	12
Q.4	Ans a) b) c)	wer the following (Any Two) Electronic polarization Explain the Kronig-Penny model. Explain the thermodynamics of superconductors.	12
Q.5	Ans a) b)	wer the following (Any Two) Write the difference between metal, semiconductors and insulators. Write a note on Josephson's tunnelling and its theory.	12

c) Explain the Clausius-Mossotti equation

Seat No.		Set	Ρ
М.	Sc. (\$	Semester - I) (New) (NEP CBCS) Examination: Oct/Nov-2023 PHYSICS (APPLIED ELECTRONICS) Analog and Digital Electronics (2323106)	
		uesday, 09-01-2024 Max. Marks: M To 05:30 PM	60
Instruct		1) All Questions are compulsory. 2) Figure to right indicate full marks.	
Q.1 A)	<b>Ch</b> (1)	<ul> <li>oose correct alternative. (MCQ)</li> <li>The feedback path in an op-amp integrator consists of</li> <li>a) A resistor</li> <li>b) A capacitor</li> <li>c) A resistor and capacitor in series</li> <li>d) A resistor and capacitor in parallel</li> </ul>	08
	2)	Multiplexer 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	
	3)	Op- amp is a type of amplifier. a) Current b) Voltage c) Power d) Resistance	
	4)	The op-amp comparator circuit uses a) Positive feedback b) Negative feedback c) Regenerative feedback d) No feedback	
	5)	Find the output of inverting amplifier? a) $V_o = AV_{in}$ b) $V_o = -AV_{in}$ c) $V_o = -A(V_{in1}-V_{in2})$ d) None of the mentioned	
	6)	<ul> <li>What happen if any positive input signal is applied to open-loop configurat</li> <li>a) Output reaches saturation level</li> <li>b) Output voltage swing's peak to peak</li> <li>c) Output will be a sine waveform</li> <li>d) Output will be a non-sinusoidal waveform</li> </ul>	ion?
	7)	In 8085 microprocessor, how many interrupts are maskable a) Two b) Three c) Four d) Five	
	8)	In how many different modes a universal shift register operates a) 2 b) 3 c) 4 d) 5	
В)	Fill 1) 2) 3) 4)	in the blanks OR Write True /False. The data in stack is called Circuit is used as signal source in all sort of application. bit program counter is available in 8085. The voltage gain of a voltage buffer is	04

Q.2	<ul> <li>Answer the following. (Any Six)</li> <li>a) Define Input offset voltage.</li> <li>b) Draw AND gate with truth table.</li> <li>c) What is the function of IO/M signal in the 8085?</li> <li>d) What is differential amplifier.</li> <li>e) What is dynamic shift register.</li> <li>f) Why op-amp called direct coupled high differential circuit.</li> <li>g) What is microprocessor? Give the power supply &amp; clock frequency of 8085.</li> <li>h) Define CMRR frequency response.</li> </ul>	12
Q.3	<ul> <li>Answer the following. (Any Three)</li> <li>a) Explain the timing diagram of 8085.</li> <li>b) Explain Multiplexers and Demultiplexers.</li> <li>c) Write a note on RS flip flop and JK flip flop.</li> <li>d) Explain Inverting and Non inverting amplifier.</li> </ul>	12
Q.4	<ul> <li>Answer the following. (Any Two)</li> <li>a) Define Oscillators? Explain their types.</li> <li>b) Write a note on 8085 instruction set.</li> <li>c) Explain in details of instrumentation amplifier.</li> </ul>	12
Q.5	<ul> <li>Answer the following. (Any Two)</li> <li>a) Discuss Synchronous and Asynchronous counter.</li> <li>b) Draw and explain 8:1 Multiplexers.</li> <li>c) What is multivibrator? Explain the difference between the three types of multivibrators.</li> </ul>	12

## Seat No.

## 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 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
  - 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 \_\_\_\_\_ evaporation.

- a) E-beam b) Thermal
- c) Magnetron d) DC

### Tuning of the refractive index with the density of the films is possible 3) by sputtering.

- a) Magnetron b) DC
- d) RF c) lon beam

### The main problem in questionnaire is . 4)

- 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 with light.
  - a) don't interact b) interact c) merge
    - d) none of the above
- Technique that allow several members of a hiring company to 6) interview a job candidate at the same time is a) Panel Interview
  - b) Self-administered interview
  - c) Mail Interview
    - d) Electronic Interview
- 7) The most common scales used in research are .
  - a) Nominal b) Ratio
  - c) Ordinal
- 8) By selecting laser operating conditions, control over microstructure is
  - a) possible

- b) impossible
- c) not defined d) both a) and b)

Max. Marks: 60



- d) All of the above

	B)	<ul> <li>Fill in the blanks OR Write True or False:</li> <li>1) In E-beam evaporation, only the target is heated and not the crucible. (True/False)</li> <li>2) In thermal evaporation, films in the thickness range of angstroms to microns are obtained. (True/False)</li> <li>3) Applied research is conducted to solve practical problems. (True/False)</li> <li>4) The basic research is also called as fundamental research. (True/False)</li> </ul>	04
Q.2	Ans a) b) c) d) e) f) g) h)	Swer the following. (Any Six) State the various sampling methods. Write the applications of Pulsed Laser Deposition. What are the applications of UV-Vis Spectroscopy? What are patents? Define Quantitative research method. Define physical and chemical vapour deposition. Write primary literature review sources. What are the applications of FTIR Spectroscopy.	12
Q.3	Ans a) b) c) d)	<b>swer the following. (Any three)</b> Write a note on Descriptive Vs Analytical research methods. Differentiate between SEM and TEM techniques. Write a note on web as source. Write the basic mechanism of sputtering technique.	12
Q.4	Ans a) b) c)	<b>swer the following. (Any two)</b> Define Research? What are characteristics of Research. Discuss different type of Research. Write a note on Review of Literature.	12
Q.5	Ans a) b)	swer the following. (Any two) What is Research Design? What are its essentials Write in detail about the concept of Chemical Bath Deposition.	12

c) Explain in detail about Spray Pyrolysis.

Seat No.					Set	Ρ
	М.S	Pł	er - I) (Old) (Cl HYSICS (APPL Mathematical I	IED ELE	•	
		e: Friday, 05-0 00 AM To 06:00	1-2024		Max. Marks	s: 80
Instru	ictio	· ·	tions are compul to the right indica	•	ks.	
Q.1		1) The prod a) a un	-	b)	its adjoint is a null matrix Square matrix	10
	:	2) What is the $-\pi < t < a$ a) 0 c) $\pi^2/\xi$	. π?	he Fourier b) d)	series of $t^2$ in the interval $\frac{\pi^2}{_3}$ $\frac{\pi^2}{_4}$	
	:	a) symr c) ortho	netric ogonal	b) d)	nen the product AB is antisymmetric unitary	
		4) Evaluate a) 2π c) <sup>π</sup> /2	the integral $\int_0^2$	$\frac{\sin^2\theta}{5+4\cos^2\theta}$ b) d)	π	
	:	5) The value a) 1 c) 0	e of $\int_{-\pi}^{\pi} \cos(mx)$	b sin( <i>nx</i> ) <i>dx</i> b) d)		
		6) If  z <sup>2</sup> – 1 a) the r c) a cire		z lies on b) d)	the imaginary axis on ellipse	
		<ul> <li>7) Find the</li> <li>a) z = a</li> <li>c) z = 2</li> </ul>		b)	z = 0 z = 4	
		a) 2πi <u>Σ</u>	y's Residues theo $\sum_{j=1}^{n} a_{-1} z_j$ $\sum_{j=1}^{n} a_{+1} z_j$	b)		

c) 
$$\frac{1}{3} \& -\frac{5}{13}$$
 d)  $\frac{1}{09} \& \frac{5}{13}$ 

10) Legendre polynomial is a set of \_\_\_\_\_ 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'' + p(x)y' + 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  $\frac{s^2 a^2}{(s^2 + a^2)^2}$

c) Find the residue of 
$$\frac{1}{(z^2+1)^3}$$
 at  $z = i$   
d) Solve  $y e^y dx = (y^3 + 2xe^y)dy$ 

## Q.3 Answer the following.

a) Solve  $x \frac{dy}{dx} + y \log y = xye^x$ b) Find the eigen value of a matrix  $\begin{bmatrix} 2 & 1 & 1 \\ 1 & 2 & 1 \\ 0 & 0 & 1 \end{bmatrix}$ 08

## Q.4 Answer the following.

a)

Determine the value of  $\alpha, \beta, r$  when  $\begin{bmatrix} 0 & 2\beta & r \\ \alpha & \beta & -r \\ \alpha & -\beta & r \end{bmatrix}$  is orthogonal.

# **b)** Determine the poles of the function z, $f(z) = \frac{1}{z^4 + 1}$ **08**

06

## Q.5 Answer the following.

Q.6

Q.7

	Verify Cayley - Hamilton Theorem for the following matrix. $A = \begin{bmatrix} 2 & -1 & 1 \\ -1 & 2 & -1 \\ 1 & -1 & 2 \end{bmatrix}$ and use the theorem to find $A^{-1}$	08
Ans a) D)	swer the following. Find the order of each pole and residue of $\frac{1-2z}{z(z-1)(z-2)}$ Show that the eigen value of Hermitian matrix are real.	08 08
1)	In square wave expand the function. $f(x) = 0; -\pi \le x \le 0$ $f(x) = 4; -0 \le x \le \pi$ Fourier.	08 08
	) ) .n:	$A = \begin{bmatrix} 2 & -1 & 1 \\ -1 & 2 & -1 \\ 1 & -1 & 2 \end{bmatrix}$ and use the theorem to find $A^{-1}$ <b>Inswer the following.</b> Find the order of each pole and residue of $\frac{1-2z}{z(z-1)(z-2)}$ Show that the eigen value of Hermitian matrix are real. <b>Inswer the following.</b> In square wave expand the function. $f(x) = 0; -\pi \le x \le 0$ $f(x) = 4; -0 \le x \le \pi$ Fourier.

Seat No.		Set P	,
	M.Sc	(Semester - I) (Old) (CBCS) Examination: Oct/Nov-2023 PHYSICS (APPLIED ELECTRONICS) Solid State Physics (MSC5102)	
		unday, 07-01-2024 Max. Marks: 80 // To 06:00 PM	)
Instru		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	<b>A) Ch</b> 1)	Dose the correct alternative.10Effective mass is equal to mass for free electron.10a) Meanb) realc) Residuald) zero	נ
	2)	Elemental solid dielectric has only polarization. a) Electronic b) ionic c) orientational d) all	
	3)	<ul> <li>In the case of p-type semiconductors, the Fermi level lies at</li> <li>a) Below near to conductor band</li> <li>b) Above near to valence band</li> <li>c) Below near to valence band</li> <li>d) At the middle of the valence and conduction band</li> </ul>	
	4)	In the case of superconductor, at Tc conductance becomes a) Zero b) Finite c) Infinite d) None of the above	
	5)	has a positive temperature coefficient of resistance.a)Metalb)Semiconductorc)Insulatord)Dielectric	
	6)	The coordination number of HCP is a) Two b) Four c) Six d) Twelve	
	7)	Plane cut to negative x-axis have the miller indices a) (011) b) (001) c) (110) d) (-100)	
	8)	The zone lies in between $+\pi/2$ to $-\pi/2$ is the Brillion zone. a) $1^{st}$ b) $2^{nd}$ c) $3rd$ d) $0^{th}$	
	9)	Relative permittivity $(\varepsilon_r)$ of the air is a) 2 b) 0.5 c) 1 d) 0	
	10	Intrinsic concentration of charge carriers in a semiconductor varies as a)Tb) $T^2$ c) $T^3$ d) $1/T$	

Q.2Answer the following (any four) a)16a)Write about orientational polarization. b)Explain Meissner's effect. c)16b)Explain Meissner's effect. c)Derive the rectifier equation d)16d)Show that in the case of an intrinsic semiconductor $E_f = (E_c + E_v)/2$ e)10d)Show that in the case of an intrinsic semiconductor $E_f = (E_c + E_v)/2$ e)10d)Show that in the case of an intrinsic semiconductor $E_f = (E_c + E_v)/2$ e)10d)Write a note on dielectric Breakdown.10d)Answer the following a)10a)What is meant by imperfections in crystals? Explain the various defects in the crystal. b)10b)Explain BCC and FCC Crystal structures.06Q.4Answer the following a)10b)Write a note on the types of superconductors06Q.5Answer the following a)10b)Write about the London equation. b)08Q.6Answer the following a)08Q.6Answer the following a)10a)Write about Reciprocal Lattice. b)10b)Explain DC Josephson's effect.06Q.7Answer the following a)10c)Give the expression for electronic polarizability.10b)Give the expression for electronic polarizability.06		B)	<ul> <li>Fill in the blanks OR Write True or False</li> <li>Some conductors are below critical temperature.</li> <li>FCC structure contains the contribution of atoms.</li> <li>The packing fraction of the BCC structure is 74%. (T/F)</li> <li>NaCl shows orientation polarization. (T/F)</li> <li>Diamond is a conductor. (T/F)</li> <li>The addition of pentavalent impurity creates an n-type semiconductor. (T/F)</li> </ul>	06
<ul> <li>a) What is meant by imperfections in crystals? Explain the various defects in the crystal.</li> <li>b) Explain BCC and FCC Crystal structures.</li> <li>06</li> <li>Q.4 Answer the following <ul> <li>a) Discuss the BCS theory in detail.</li> <li>b) Write a note on the types of superconductors</li> <li>06</li> </ul> </li> <li>Q.5 Answer the following <ul> <li>a) Write about the London equation.</li> <li>b) Write the expression for penetration depth.</li> </ul> </li> <li>Q.6 Answer the following <ul> <li>a) Write about Reciprocal Lattice.</li> <li>b) Explain DC Josephson's effect.</li> </ul> </li> <li>Q.7 Answer the following <ul> <li>a) Explain the Kronig-Penney model.</li> </ul> </li> </ul>	Q.2	a) b) c) d)	Write about orientational polarization. Explain Meissner's effect. Derive the rectifier equation Show that in the case of an intrinsic semiconductor $E_f = (E_c + E_v)/2$	16
the crystal.06b)Explain BCC and FCC Crystal structures.06Q.4Answer the following a)10 Discuss the BCS theory in detail.10 b)b)Write a note on the types of superconductors06Q.5Answer the following a)08 Write about the London equation.08 b)Q.6Answer the following a)08Q.6Answer the following a)10Q.6Answer the following a)10Q.7Answer the following a)10Q.7Answer the following a)10Q.7Answer the following a)10Q.7Answer the following a)10	Q.3			40
Q.4       Answer the following       10         a)       Discuss the BCS theory in detail.       10         b)       Write a note on the types of superconductors       06         Q.5       Answer the following       08         a)       Write about the London equation.       08         b)       Write the expression for penetration depth.       08         Q.6       Answer the following       08         a)       Write about Reciprocal Lattice.       10         b)       Explain DC Josephson's effect.       06         Q.7       Answer the following       10         a)       Explain the Kronig-Penney model.       10			the crystal.	
<ul> <li>a) Discuss the BCS theory in detail.</li> <li>b) Write a note on the types of superconductors</li> <li>Q.5 Answer the following         <ul> <li>a) Write about the London equation.</li> <li>b) Write the expression for penetration depth.</li> </ul> </li> <li>Q.6 Answer the following         <ul> <li>a) Write about Reciprocal Lattice.</li> <li>b) Explain DC Josephson's effect.</li> </ul> </li> <li>Q.7 Answer the following         <ul> <li>a) Explain the Kronig-Penney model.</li> <li>10</li> </ul> </li> </ul>		b)	Explain BCC and FCC Crystal structures.	06
<ul> <li>a) Write about the London equation.</li> <li>b) Write the expression for penetration depth.</li> <li>C.6 Answer the following         <ul> <li>a) Write about Reciprocal Lattice.</li> <li>b) Explain DC Josephson's effect.</li> <li>C.7 Answer the following                 <ul></ul></li></ul></li></ul>	Q.4	a)	Discuss the BCS theory in detail.	
b)Write the expression for penetration depth.08Q.6Answer the following a)10b)Explain DC Josephson's effect.10b)Explain DC Josephson's effect.06Q.7Answer the following a)10b)Explain the Kronig-Penney model.10	Q.5	Ans	wer the following	
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b)Explain DC Josephson's effect.06Q.7Answer the following a)Explain the Kronig-Penney model.10	Q.6			40
a) Explain the Kronig-Penney model. 10		'		
	Q.7			
		,		

## Q.

Seat No.		Set P
I	M.Sc.	(Semester - I) (Old) (CBCS) Examination: Oct/Nov-2023 PHYSICS (APPLIED ELECTRONICS) Analog and Digital Electronics (MSC5103)
		esday, 09-01-2024 Max. Marks: 80 I To 06:00 PM
Instructi	2	) All questions are compulsory. ) Attempt any three questions from Q.3 to Q.7. ) Figure to right indicate full marks.
Q.1 A)	Cho 1)	ose correct alternative. (MCQ)10The basic SR flip-flop can be constructed by cross coupling by using which of the gates?a)a)AND or OR gateb)xOR or XNOR gatec)NOR or NAND gated)AND or NOR gated)
	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) $J = 0, K = 1$
	3)	Which is the 16-bit register for 8085 microprocessor? a) Stack pointer b) Accumulator c) Register B d) Register C
	4)	<ul> <li>The feedback path in an op-amp integrator consists of</li> <li>a) A resistor</li> <li>b) A capacitor</li> <li>c) A resistor and capacitor in series</li> <li>d) A resistor and capacitor in parallel</li> </ul>
	5)	<ul> <li>Multiplexer has</li> <li>a) Many input and one output</li> <li>b) One input many output</li> <li>c) Many input and many out put</li> <li>d) One input and one output</li> </ul>
	6)	<ul> <li>The op-amp comparator circuit uses</li> <li>a) Positive feedback</li> <li>b) Negative feedback</li> <li>c) Regenerative feedback</li> <li>d) No feedback</li> </ul>
	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

06

16

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<sup>rd</sup> highest priority
  - c) It uses level-triggered signal
  - d) Its vectored address is 003C H

### B) Fill in the blanks

- 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
- 5) The sequential circuit is also called
- 6) There are \_\_\_\_\_ general purpose registers in 8085 microprocessor.

## Q.2 Answer the following

- 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) b)	Draw and explain architecture of 8085 microprocessor. Explain Multiplexers and Demultiplexers.	10 06
Q.4	Ans	swer the following.	
	a)	What is multivibrator? Explain the difference between the three types of multivibrators.	10
	b)	Draw and explain 8:1 Multiplexers.	06
Q.5	Ans	swer the following.	
	a) b)	Explain the operation of three op-amp instrumentation amplifier. Define Oscillators? Explain their types.	10 06
Q.6	Ans	swer the following.	
	a)	Explain inverting configuration of Op amp as a summing, scaling and averaging Amplifier.	10
	b)	Explain Inverting and Non inverting amplifier.	06
Q.7	Ans	swer the following.	
	a)	Explain the instruction set of 8085 microprocessor.	10
	b)	Draw and explain memory read cycle of 8085 microprocessor.	06

Seat No.			Set P
	M.S	Sc. (Semester - I) (Old) (CBCS) Examina PHYSICS (APPLIED ELECTRO Classical Mechanics (MSC5	DNICS)
		Thursday, 11-01-2024 PM To 06:00 PM	Max. Marks: 80
Instru	iction	<ul> <li>s: 1) Q. Nos. 1 and. 2 are compulsory.</li> <li>2) Attempt any three questions from Q. No. 3 t</li> <li>3) Figure to right indicate full marks.</li> </ul>	o Q. No. 7
Q.1	,	Choose correct alternative. 1) The position of a particle at any time t subje a) $x = k \cdot (1 + e^{-kt})/v_o$ b) $x = k$ c) $x = v_o(1 - e^{-kt})/k$ d) $x = k$	$v_o(1-e^{-kt})$
	2	2) The rate of momentum change of an open s a) $T + MU$ b) $F - M$ c) $W - MV$ d) $F + M$	1V
		B) The reduced mass of two bodies into equival a) $(m_1 + m_2)/(m_1 \cdot m_2)$ b) $(m_1 \cdot m_2)$ c) $m_2/(1 + m_2/m_1)$ d) $m_1/(1)$	$(m_1 - m_2)/(m_1 - m_2)$
	2	<ul> <li>The time derivative of generalized co-ordina</li> <li>a) Generalized force</li> <li>b) Gene</li> <li>c) Generalized momentum</li> <li>d) None</li> </ul>	ralized velocity
	Ļ	<ul> <li>For E &gt; 0 and ε &gt; 1, the nature of the orbit i</li> <li>a) Circle</li> <li>b) Parat</li> <li>c) Ellipse</li> <li>d) Hyper</li> </ul>	pola
	(	b) The generalized momentum is equal to a) $\partial L/\partial q_j$ b) $\partial L/\partial q_j$ c) $\partial L/\partial \dot{q}_j$ d) $\partial L/\partial q_j$	5
	7	7) Which of the following defines a conservativ a) $dF/dt = 0$ b) $\nabla F = C$ c) $\nabla \times F = 0$ d) $\oint F dt$	= 0
	8	<ul> <li>B) Poisson brackets are under canonic</li> <li>a) Variant</li> <li>b) nullifi</li> <li>c) anti-symmetric</li> <li>d) invariant</li> </ul>	cal transformation. ed
	ę	<ul> <li>B) Generalized coordinated</li> <li>a) are independent of each other</li> <li>b) depend on each other</li> <li>c) are always cartesian coordinates</li> <li>d) are always spherical polar coordinates</li> </ul>	
		10) The $F_2 = \sum q_k P_k$ transformation defined as _ a) generates exchange transformation b) generates identity transformation c) is not canonical transformation d) None of the above	

d) None of the above

	в)	<ol> <li>Fill in the blanks or write true /faise.</li> <li>Scleronomic constraint do not explicitly depends on time. (True/False)</li> <li>q<sub>j</sub>'s which are absent in <i>L</i> are cyclic coordinates. (True/False)</li> <li>Rutherford's differentia scattering cross section has dimensions of solid angle. (True/False)</li> <li>The Euler-Lagrangian differential equations is</li> <li>Lagrangian is equal to</li> <li>[L<sub>x</sub>, L<sub>y</sub>] =</li> </ol>	06
Q.2		swer the following questions.	16
	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 <i>E</i> of a particle is conserved.	
	c) d)	Distinguish between the configuration space and phase space. Define Hamiltonian. Give its physical significance.	
Q.3	An	swer the following.	
	a)	Derive the equation of motion of a particle and deduce the acceleration of Atwood machine under constant force.	10
	b)	Obtain the equation of motion of	06
		<ol> <li>a particle subjected to a resistive force</li> <li>a projectile (no resistance)</li> </ol>	
Q.4		swer the following.	40
	a) b)	Derive the formula for Rutherford scattering cross-section. Derive an equivalent equation for reduction to one body problem from two body problem.	10 06
Q.5	An	swer the following.	
	a) b)	State the Kepler's laws of planetary motion and prove the Kepler's third law. Deduce the Lagrange's equation of motion from Hamilton's principle and using derive the generalized momentum.	10 06
Q.6	An	swer the following.	
	a)	Derive canonical equations of Hamilton. Also write the procedure for constructing Hamiltonian.	10
	b)	Obtain Hamilton's equation for one dimensional harmonic oscillator.	06
Q.7		swer the following.	
	a) b)	State and prove Poisson's theorem. Prove the Jacobi identity $[V, [V, W]] + [V, [W, U]] + [W, [U, V]] = 0$	10 06
	,		

### B) Fill in the blanks or write true /false.

M.Sc. (Semester - II) (New) (CBCS) Examination PHYSICS (APPLIED ELECTRONIC Quantum Mechanics (MSC5201	CS)
Day & Date: Monday, 18-12-2023 Time: 11:00 AM To 02:00 PM	Max. Mark
<ul> <li>Instructions: 1) Q. Nos. 1 and 2 are compulsory.</li> <li>2) Attempt any Three questions from Q.No.3 to Q.</li> <li>3) Figures to the right indicate full marks.</li> </ul>	).No.7.
<ul> <li>Q.1 A) Choose the correct alternatives from the options</li> <li>1) The wavelength is the distance between the</li> <li>a) Successive crests</li> </ul>	

- 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

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- 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
  - d) Newton c) Heisenberg
- According to Max Plank, the energy of photon is given by 4)
  - a) E = hvb) E = hv/2
  - c) E = 2hvd) E = v
- 5) The solution to the Schrodinger's wave equation gives .
  - a) Wave function b) Wavelength
  - c) Frequency d) Momentum
- 6) The condition for wave functions to be normalized is \_\_\_\_\_.
  - $\int \psi(r) * \psi(r) dr = -1$   $\int \psi(r) * \psi(r) dr = 0$   $\int \psi(r) * \psi(r) dr = 1$   $\psi(r) dr = 1$ c)

SLR-EQ-11

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Max. Marks: 80

- 7) The time development of a wave function is given by
  - a)  $\frac{i\hbar}{2\pi} \frac{\partial \psi}{\partial t} = -\hat{H}\psi$  b)  $\frac{i\hbar}{2\pi} \frac{\partial \bar{\psi}}{\partial x} = \hat{H}\psi$
  - c)  $\frac{i\hbar}{2\pi}\frac{\partial\psi}{\partial t} = \hat{H}\psi$  d)  $\frac{i\hbar}{\pi}\frac{\partial\psi}{\partial x} = \hat{H}\psi$

Where H is Hamiltonian operator.

### 8) The Hooke's law is given by \_\_\_\_\_.

a) 
$$f = -k^2 x$$
  
b)  $f = -kx^2$   
c)  $f = -kx$   
d)  $f = kx$ 

- 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)  $\int_{-\infty}^{\infty} \delta(x-a)dx = 1$  \_\_\_\_\_.  
b)  $\int_{-\infty}^{\infty} \delta(x+a)dx = 1$   
c)  $\int_{-\infty}^{\infty} \delta(x-a)dx = -1$  \_\_\_\_\_\_.  
d)  $\int_{-\infty}^{\infty} \delta(x-a)dx = 0$ 

## B) Fill in the blanks or State True/False:

- 1) 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 \_\_\_\_\_ Where  $\hat{A}$  is the operator for the physical quantity and  $\psi$  is the well behaved Eigen function.
- 2) The atomic unit of magnetic moment is known as \_\_\_\_
- The helium atom has two electrons moving in a field of a nucleus of charge \_\_\_\_\_.
- Write whether following statement is True or False The eigenvalues of a unitary operator have modulus of one.
- 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	Ans a) b) c) d)	swer the following questions. Discuss the breakdown of Born- Oppenheimer approximation. Explain the Eigen functions of position operator. Write a note on Normalization and orthogonality of particle in one dimensional box. Write a note on space quantization.	16
Q.3	Ans a) b)	swer the following. Describe the operators in quantum mechanics with their properties. Explain the Heisenberg uncertainty principle.	10 06
Q.4	Ans a) b)	swer the following. Discuss of the factors influencing colour for an electron in a box. Examine the Prob. Density of 1s atomic orbital.	10 06
Q.5	Ans a) b)	swer the following. Describe the theory of Wave function of many electron systems. Discuss the electronic structure of many electron atoms.	10 06
Q.6	Ans a) b)	swer the following. Describe the quantum mechanical theory for valence bond methods. Describe the Molecular orbital theory with the LCAO approximation.	10 06
Q.7	Ans a) b)	swer the following. Describe the physical interpretation of Hydrogenic orbitals. Discuss the important postulates of quantum mechanics.	10 06

Electrodynamics (MSC5202)								
	Day & Date: Tuesday, 19-12-2023 Max. Marks: 80 Time: 11:00 AM To 02:00 PM							
<ul> <li>Instructions: 1) Q. No. 1 and 2 are compulsory.</li> <li>2) Attempt any Three questions from Q.No.3 to Q.No.7.</li> <li>3) Figures to the right indicate full marks.</li> </ul>								
Q.1	A)	<b>Chc</b> 1)	rom the options.10vector field is alwaysb) 1d) cant possible					
		2)	Which one of the fundamental form the basis of electromagne a) Faraday law c) Gauss law of electrostatic	b) Ampere law				
		3)	Lorentz electric force has direc a) Similar to electric field c) Scalar quantity	ction b) Opposite to electric field d) None				
		4)	The Poynting vector P is equa a) E.H c) E/H	l to b) E × H d) H/E				
<ul> <li>5) Which property of an electromagr medium in which it is travelling?</li> <li>a) Velocity</li> <li>c) Time period</li> </ul>			medium in which it is travelling a) Velocity	<b>.</b>				
		6)	In the skin definition of skin amplitude reduces to a) Nearly one fifth c) One half	depth, it is distance over which field b) 1/e d) One fourth				
		7)	In Maxwell equation $\nabla \times H = J$ a) Electric flux density c) Surface current density	b) magnetic flux density				

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

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## SLR-EQ-12

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- c) Surface current density d) No physical quantity

			,	Amperes law		(d	Lorentz force law	
		9)	Ma	agnetic vector pot	ential due to m	agn	etic dipole is proportional	
			_	 r		b)	1/r	
				1/r <sup>2</sup>			1/r <sup>3</sup>	
		10)			) of a quadrup	ole	varies with distance ' $r$ ' on its	
			axi a)	is as $\Phi: r^{-1}$		b)	$\Phi: r^{-2}$	
				$\Phi: r^{-3}$		d)	$\Phi: r^{3/2}$	
	B)			he blanks OR Wr				06
		1) 2)		e charge density dipole, the gauss			d is given by I be	
		3)	The	e Ampere law is l	based on	_ Tł	neorem	
		4)		e electric field ove iform at every poi		า su	rface remains continuous and	
		5)				inte	nsity is product of the current.	
		6)	The	e direction of a p	ropagation of e	lect	romagnetic wave is $\overline{E}$ . $\overline{B}$ .	
Q.2	Ans			following.				16
	a) b)			Maxwell's displace note on Skin effect				
				the concept of Th			ion?	
	d)	State	e the	e boundary condi	ition for an elec	tros	static field $\overline{E}$ .	
Q.3	Ans	wer t	he f	following.				
	a)			the "Reflection a incidence.	nd refraction" o	of el	ectromagnetic waves at	10
	b)		•	te the concept of	displacement of	curre	ent.	06
01	۸ne	worf	ho (	following.				
Q.4				•	dary condition	betv	ween conductor and free	10
	ь)	spac			fou the uppinton		four un if owner finded One one un if owner	00
	b)	field		a the expression	for the resistan	ice	for uniform field &non-uniform	06
0 F	A			fallaudiaa				
Q.5	Ans a)			following. an expression for	energy stored	in e	lectric and magnetic field.	10
	b)			the concept of Ra	••		5	06

8) Law which governs the interaction of the electromagnetic field with charge matter \_\_\_\_\_. b) Earadays law

- )
- 3

Q.6	Ans a) b)	swer the following. Derive the general expression for electromagnetic energy. Discuss Electromagnetic plane waves in stationary medium?	10 06
Q.7	Ans a) b)	<b>swer the following.</b> Explain the concept of radiation from a half wave antenna. What is Gauss law? Explain differential form of its.	10 06

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

Day & Date: Wednesday, 20-12-2023 Time: 11:00 AM To 02:00 PM

Seat

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**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.

- Which law of thermodynamics is the law of conservation of energy? 1)
  - a) First b) Second
  - c) Zero d) Third
- 2) The phase space is \_\_\_\_\_ dimensional space.
  - a) 3N b) 6N d) c) N 2N

### The statistics followed by half spin particles is \_\_\_\_\_. 3)

- a) Maxwell-Boltzmann Statistics
- b) Fermi-Dirac Statistics
- c) Bose-Einstein Statistics
- d) None of the above

### Maxwell-Boltzmann statistics cannot be applied to \_\_\_\_\_. 4)

- a) Atoms b) Molecules
- c) Photons d) Lattice

The equation of state for an ideal gas is represented as 5)

- a) PV = R/Tb) PV = nRT
- d) PV = RTc) P/V = R/T

6) The entropy of an ideal gas at absolute zero is .

- a) ∞ b) 0 c) NkB
  - d) Cannot be calculated

For which gas mutual interaction between the molecules is zero. 7)

- a) real Fermi b) c) Ideal d) Bose
- Total heat of the substance is also known as \_\_\_\_\_. 8)
  - a) Internal energy b) Entropy
  - c) Thermal Capacity d) Enthalpy

### Pressure at the critical point is 9)

a) 3b b) 8/27R d) c) 3b/27Rb8a/27Rb

## SLR-EQ-13



Max. Marks: 80

10) In microcanonical ensembles following parameters remain constant.

			•••
a)	TVN	b)	EVN

c) EVT d)  $EV\mu$ 

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

- 1) The ratio of the universal gas constant and Avogadro's number is called the velocity constant.
- 2) The transition in  $\beta$ -brass is an example of a second-order phase transition.
- 3) Photon, Phonon, etc. obeys the Fermi Dirac distribution function.
- 4) Entropy in thermodynamics is a measure of the disorder of the system.
- 5) The value of the universal gas constant is 8.3143
- 6) A phase space is a six-dimensional space.

### Q.2 Answer the following.

16

06

- 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.

Q.0	Answer the following.							
	a)	Show that Gibb's function is continuous during the first-order phase transition, but the first derivative of Gibb's function changes discontinuously.	10					
	b)	What is a triple point? Explain it with the help of a phase diagram.	06					
Q.4	Ans	wer the following.						
	a)	Write a note on Critical Indices	10					
	b)	Write about Liouville's theorem in a classical presentation.	06					
Q.5	Ans	wer the following.						
	a)	Write about Second order phase transition.	80					
	b)	Write a note on microcanonical, canonical and grand canonical ensembles.	08					
Q.6	Ans	wer the following.						
	a)	Show that the average energy of a single particle of ideal fermi gas is 3/5 times the fermi energy of the system.	10					
	b)	Explain the law of corresponding states.	06					
Q.7	Ans	wer the following.						
	a)	Derive the expression for Fermi energy at strongly degenerate ideal Fermi gas.	10					
	b)	Write about black body radiation.	06					

	Semiconductor Physics (MSC5301)						
	Day & Date: Friday, 05-01-2024 Max. Marks: 80 Time: 11:00 AM To 02:00 PM						
Instr	Instructions: 1) Q. (1) and (2) are compulsory. 2) Attempt any three from Q. No. 3 to Q. No. 7 3) Figure to right indicate full marks.						
Q.1	A)	<ul> <li>Choose the correct alternative.</li> <li>1) In a semiconductor, the energy gap between the valence band and conduction band is about</li> </ul>					
			a) 5 eV c) 15 eV	b) d)	10 eV 1 eV		
		2)	Electron-hole pairs are produced b a) Recombination c) Ionization	y b) d)	 Thermal energy Doping		
	<ul> <li>3) The drift velocity of the conductor</li> <li>a) Increase with an increase in temperature</li> <li>b) Decrease with Decrease in temperature</li> <li>c) Increase with Decrease in the temperature</li> <li>d) Decrease with the increase in temperature</li> </ul>			rature ature perature			
		4)	In Schottky barrier, barrier height d a) Amount of doping material c) Temperature	•	ds on Type of doping material None of the above		
<ul> <li>5) The probability that an electron in a metal occupies the fermi level, at any temperature (&gt; OK) is</li> <li>a) 0 b) 1</li> <li>c) 0.5 d) 1.0</li> </ul>							
		6)	If $\sigma$ is the conductivity, what is the and the current density J in a cond a) $\sigma = J/E$ c) $\sigma = E/J$	ucting b)			
<ul> <li>7) The equilibrium number of EHP in pure Si at room temperature is about</li> <li>a) 10<sup>10</sup> EHP/cm<sup>3</sup></li> <li>b) 10<sup>12</sup> EHP/cm<sup>3</sup></li> <li>c) 10<sup>10</sup> EHP/m<sup>3</sup></li> <li>d) 10<sup>12</sup> EHP/m<sup>3</sup></li> </ul>			10 <sup>12</sup> EHP/cm <sup>3</sup>				
		8)	The atoms of solid are held togethe a) Van der Waals forces c) Ionic bonds	er by _ b) d)			
		9)	What is the role of seed crystal in c a) Nucleation center c) Solvent	rystal b) d)	-		

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

Seat No.

## SLR-EQ-15

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		<ul> <li>10) Charge carriers can move in semiconductor via:</li> <li>a) Diffusion mechanism</li> <li>b) Floating mechanism</li> <li>c) Drift mechanism</li> <li>d) Both drift and diffusion mechanism</li> </ul>	
	В)	Fill in the blanks OR Write true/ false.       06         1) The mean lifetime of electron-hole pair (EHP) is less than seconds.       2)         2) LED is an example of luminescence.       3)         3) nuclei often redissolve.       4)         4) Nucleation poses large energy barrier. (True/False)       5)         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	Ans a) b) c) d)	Ver the following16Write a note on optical absorption.16Explain fermi level pinning.16Write a short note on group velocity of electrons.16Explain in short direct bandgap semiconductors.16	;
Q.3	Ans a) b)	ver the followingElaborate in detail about the ohmic contacts.10Explain in short about Nucleation process.06	
Q.4	Ans a) b)	ver the followingExplain the concept of vibrational specific heat and derive its expression.10Write in brief about inverse effective mass tensor.06	
Q.5	Ans a) b)	ver the following Elaborate in detail about the growth of bulk semiconductors by Zone 10 Melting. Explain in brief about surface and interface states. 06	
Q.6	Ans a) b)	ver the followingExplain the concept of steady state carrier generation.10Write in brief about vapour phase epitaxy.06	
Q.7	a)	ver the following         Explain in detail about rectifying contacts with the necessary band         diagrams.         Explain the bonding ferroes in colide	
	b)	Explain the bonding forces in solids. 06	)

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No.	

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

Day & Date: Sunday, 07-01-2024 Time: 11:00 AM To 02:00 PM

Max. Marks: 80

**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 \_\_\_\_\_.
  - a) Pauli Exclusion Principle b) spin-orbit coupling
  - c) larmor precession d) relativistic correction
- 2) Laser cooling of atoms is produced due to \_\_\_\_\_.
  - 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.
- First raman shifted line observed at 218 Cm-1 for CCl4 excited by 632.8nm of HE-Ne laser, will correspond to scattered wavelength at (given h=6.6\*10<sup>-34</sup>Js C=3\*10<sup>8</sup>m)
  - a) 128.5nm b) 621.8nm
  - c) 5000.0nm d) 641.6 nm
- 4) The outermost shell of an atom of an element is 3d3. The spectral symbol for the ground state

a) <sup>4</sup> F <sub>3/2</sub>	b)	<sup>4</sup> F <sub>9/2</sub>
c) <sup>4</sup> D <sub>7/2</sub>	d)	<sup>4</sup> D <sub>1/2</sub>

- 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) HCI b) CO
  - c) H2 d) HBr
- 7) JJ coupling is the \_\_\_\_\_ 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 \_\_\_\_\_ state.
  - a) SPD b) PDF
  - c) DFG d) Only D

06

16

- 9) Which of the following molecule will not show the microwave spectra.
  - a)  $CH_2CI_2$  b)  $SF_6$
  - c) H<sub>2</sub>O d) CH<sub>3</sub>CI
- 10) The lowest vibrational energy is given by \_\_\_\_\_.
  - a)  $\frac{1}{2}\omega$  b)  $\omega$
  - c)  $\frac{1}{2}\omega^2$  d)  $\omega^2$

## B) Fill in the blanks or True false from give parenthesis

- 1) \_\_\_\_\_ Detector is an IR detector (crystal / Pyroelectric)
- 2) At J=0 i.e ground rotational state, in which the \_\_\_\_\_ (rotation / no rotation)
- Intensity rule for the Zeeman effect of the atomic systems containing more than one valance electron is \_\_\_\_\_ of type of coupling (dependent /Independent)
- 4) When L is greater than or equal to S, all integral Value of J between L-S and L+S are allowed.
- 5) Hyperfine structures arises in tungsten due to presence there even isotopes tungsten.
- 6) 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
   12 gerlach experiment.
- b) The spin orbit coupling constant for the upper state of Na atom which emits
   D lines for weak numbers 16959cm-1 and 1697.4cm-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 n=4 state **04** 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 and 12 its use in chemical analysis
- **b)** The land's g factor for the  ${}^{3}P_{1}$  level of an atom is? {91}.

## Q.7 Answer the following.

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

		SLR-EQ-1
Seat No.		Set F
M	.Sc. (\$	emester - III) (New) (CBCS) Examination: Oct/Nov-2023 PHYSICS (APPLIED ELECTRONICS) Communication System (MSC5306)
•		esday, 09-01-2024 Max. Marks: 8 1 To 02:00 PM
Instruc		) Q. Nos. 1 and 2 are compulsory. ) Attempt any Three questions from Q.No.3 to Q.No.7. ) Figures to the right indicate full marks.
Q.1 A)	) Mul 1)	iple Choice Questions1FM radio receiver which is tuned to a 91.6 MHz broadcast station102.3may receive an image frequency of MHz.b) 113a) 102.3b) 113c) 70d) 80.9
	2)	<ul> <li>PAM stands for</li> <li>a) Pulse Analogue Modulation</li> <li>b) Pulse Amplitude Modulation</li> <li>c) Phase Analogue Modulation</li> <li>d) Phase Amplitude Modulation</li> </ul>
	3)	For AM receivers the standard IF frequency is KHz.a) 420b) 455c) 945d) 10.7
	4)	Power of carrier wave is 500W and modulation index is 0.25, its total power is W. a) 500 b) 470 c) 516 d) 600
	5)	Commercial frequency deviation is KHz. a) 75 b) 80 c) 90 d) 65
	6)	Detection is same asa) Modulationb) Mixingc) Demodulationd) filtering
	7)	A line having maximum 120mV and minimum 40mV value VSWR is a) 1    b) 2 c) 3    d) 4
	8)	The value of modulation index m, for over-modulation is a) >1    b) = 1 c) <1    d) = 0
	9)	<ul> <li>The full form of CDMA is</li> <li>a) Code division multiple access</li> <li>b) Code diode multiple access</li> <li>c) Cross division multiple access</li> <li>d) Current division multiple access</li> </ul>
	10)	devices is used to generate AM waves. a) Square-law modulator b) Reactance modulator

c) Transmitter d) Receiver

## 06

		<ol> <li>For High level amplitude modulation all RF amplifiers can be nonlinear.</li> <li>The standard form of PSK is Pulse shift keying.</li> <li>FM operates normally between 88 to 108 Megahertz.</li> </ol>				
Q.2	Ans a) b) c) d)	swer the following.16What are the benefits of modulation in communication system?What are the benefits of modulation in communication system?What do you mean by AM, FM and PM signals?What is aliasing? What is the effect of aliasing?Write a short note on unipolar and bipolar coding scheme.				
Q.3	Ans a) b)		10 06			
Q.4	Ans a) b)	I	08 08			
Q.5	Ans a) b)	diagram.	10 06			
Q.6	Ans a) b)		10 06			
Q.7	Ans a) b)		10 06			

### B) State true or false

- Communication consists of electrical means of sending information 1) only.
- 2) 3) SSB is a standard form for radio communication.
- Half duplex is a bidirectional communication

Seat No.		Set P
N	I.Sc. (	Semester - IV) (New) (CBCS) Examination: Oct/Nov-2023 PHYSICS (APPLIED ELECTRONICS) Semiconductor Devices (MSC5401)
		onday, 18-12-2023 Max. Marks: 80 // To 06:00 PM
Instruc	tions:	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	.) Ch 1)	ose correct alternatives.10A CCD involves actions.a) charge storage and transferb) only charge transferc) only storaged) charge storage and loss
	2)	Two valley model of TEDs based on GaAs is proposed by a) BCS b) BBS c) RWH d) NWH
	3)	LEDs fabricated with GaAs emit wavelength. a) far ultra violet b) ultraviolet c) visible d) infrared
	4)	An overlapping gate structure is used for improving performance. a) CCD b) LED c) LASER d) SCR
	5)	Photodetector optical signal.a) reflectsb) detectsc) modulated) amplify
	6)	The M - S structure forms barrier.a) schottkyb) readc) ohmicd) non – ohmic
	7)	$(\alpha_1 + \alpha_2)$ approaches when the SCR devices are at forwardbreakdown.a) 100b) 1000c) $\infty$ d) 1
	8)	A Triacs is used where the transfer of large is involved. a) Power b) voltage transfer c) electron transfer d) charge transfer

	a) direct band gap b) high mobility c) indirect band gap d) doping	
B)	<ul> <li>Fill in gaps/State True or False</li> <li>1) Refreshing circuit is incorporated in CCD memory as it provides</li> <li>2) Pulsed laser can deliver very power.</li> <li>3) The M-S structure forms barrier.</li> <li>4) The CCD devices are static.</li> <li>5) The forward characteristic of a Shockley diode is useful for switching.</li> <li>6) PUT requires 2 V if gate is biased at 0.8 V.</li> </ul>	06
Ans a) b) c) d)	<b>wer the following.</b> Programable UJT. Enhancement type MOSFET. Dynamic effect in CCD. Radiative and non-radiative transitions.	16
a)	Describe the operating principle of photodiode based on PN junctions, pin configuration and multilayer hetrojunction with. band diagrams and IV characteristics.	10
b)	Draw block diagram, doping profile, electric field distribution in p-i-n diode.	06
a)	Give an account of DIAC and TRIAC with suitable diagrams and IV characteristics.	10
b)	Explain di/dt protection.	06
a) b)	Describe MS structure with band diagram. Charge trapping in MOSFET.	10 06
a)	Describe GaAs Gun Oscillator modes in terms of i) Space charge accumulation ii) Quenched domain mode iii) Delayed domain mode	10
b)	Explain current flow mechanism in MS junction.	06
a)	Describe IV characteristics of solar cell. Derive an expression for	10
b)	quantum efficiency of solar cell. How performance of CCD is improved.	06

In a CCD operation the thermal relaxation time is \_\_\_\_\_ than the

b) much longer

d) much shorter

# 10) Light emission is not possible in Si due to its \_\_\_\_\_. a) direct band gap b) high mobility c) indirect band gap d) doping

charge storage time.

a) longer

c) shorter

9)

Q.2

Q.3

Q.4

Q.5

Q.6

Q.7

Seat No.	t			Set	Ρ		
	M.Sc. (Semester - IV) (New) (CBCS) Examination: Oct/Nov-2023 PHYSICS (APPLIED ELECTRONICS) Nuclear and Particle Physics (MSC5402)						
			esday, 19-12-2023 To 06:00 PM	Max. Marks	: 80		
Instr	ucti	2	) Q. Nos. 1 and. 2 are compulsory. ) Attempt any three questions from Q. No. 3 to Q. No. 7 ) Figure to right indicate full marks.				
Q.1	A)	<b>Cho</b> 1)	ose the correct alternative. The binding energy of deuteron is a) 13.6 eV b) 36 MeV c) 2.225 MeV d) 13.6MeV		10		
		2)	The range of energy eV is called as epithermal reada)1eVb)0.025eVc)1KeVd)0.1-1MeV	ction.			
		3)	The simplest two nucleon system exist in nature is ofa)n-nb)n-pc)p-pd)dose not exist				
		4)	the height of potential barrier faced by an alpha particle innucleus isa) 31.2MeVb) 31.2KeVc) 31.2GeVd) 31.2eV	side the			
		5)	The energy equivalent to 1 a m u is a) 931 eV b) 931 KeV c) 931 MeV d) 93 BeV				
		6)	The compound nucleus ha life time is of the order ofa)10 <sup>-8</sup> Secb)10 <sup>-11</sup> Secc)10 <sup>-14</sup> Secd)10 <sup>-21</sup> Sec				
		7)	Unit of cross section isa) Fermib) barnc) MeVd) nucleon per cm3	3			
		8)	Semi empirical mass formula for the binding energy of nucleon contains a surface correction term this term depends on the number A of the nucleus a) $A^{-1/3}$ b) $A^{2/3}$				
			a) $A^{-1/3}$ b) $A^{2/3}$ c) $A^{1/3}$ d) $A$				
		9)	The electric quadruple moment is negative, shape of the ra)Oblateb)Prolatec)Sphericald)All of these	iuclei is			
		10)	The Can explain magic number. a) Liquid drop model b) Fermi gas mode c) shell model d) All of these	I			

	B)	<ul> <li>Fill in the blanks / True or False.</li> <li>1) Nuclear binding energy usually expressed in units of</li> <li>2) The exchange particle which holds the quarks together is called</li> <li>3) In direct reaction incident particle completely have more than</li> <li>Energy per nucleon</li> <li>4) Or non-actional error of p-p coefficient is 4-p<sup>2</sup>(T/F).</li> </ul>	06
		<ol> <li>Cross sectional area of n-p scattering is 4πa<sup>2</sup>(T/F)</li> <li>In a deuteron, the force between neutron and proton is short range and repulsive (T/F)</li> <li>Nucleons are bosons (T/F)</li> </ol>	
Q.2	Ans a) b) c) d)	swer in brief. Discuss shape and size, mass and relative abundances of nucleus. Discuss superconductivity model. Write a note on conservation laws. Write a note on cosmic ray.	16
Q.3	Ans a) b)	swer the following. Derive an expression for scattering cross section of two nucleon system and write a note on scattering length. Discuss properties of nuclear forces.	10 06
Q.4	Ans a) b)	swer the following. Describe liquid drop model of nucleus point out its usefulness and limitations in understanding the nuclear phenomenon. Explain the energy levels of shell model. How this helps to explain the occurrence of magic numbers? Draw the diagram.	10 06
Q.5	Ans a) b)	swer the following Explain the nuclear reaction kinematics Obtain an expression for Q value discuss the general solution of the Q equation. Comment on compound nuclear disintegration.	10 06
Q.6	Ans a) b)	Swer the following 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. Discuss quark hypothesis and quantum chromodynamics.	10 06
Q.7	Ans a) b)	Swer the following What should be the minimum KE of the electrons to probe the size of <sub>20</sub> Ca <sup>40</sup> nucleus. An <sub>8</sub> O <sup>16</sup> nucleus is spherical and has charge radius R and volume according to empirical observation of the charge radii, the volume of the <sub>54</sub> Xe <sup>128</sup>	10 06
		nucleus assume to be spherical what is the ratio of volume of Xe to the	

volume of Oxygen.

			SLR-EQ-	21
Seat No.			Set	Ρ
Γ	M.Sc. (	(Semester - IV) (New) (CBCS) Examination: Oct PHYSICS (APPLIED ELECTRONICS) Microwave Devices & Circuits (MSC5403)	:/Nov-2023	
		/ednesday, 20-12-2023 M To 06:00 PM	Max. Marks	: 80
Instruc		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	<b>) Mul</b> 1)	Itiple choice questions. The frequency range from 2 to 4 GHz is designated as _ a) Ku-band b) V-band c) S-band d) C-band		10
	2)	In many modes does Gunn diodes can operate a) One b) Four c) Six d) Eight	9.	
	3)	mode of propagation is supported by a strip line. a) TEM mode b) TM mode c) TE mode d) None of the mentio	oned	
	4)	When an electric field E is applied, the force on an elect charge -e is a) $F = -eE$ b) $F = eE$ c) $F = -e/E$ d) $F = e/E$	ron with	
	5)	<ul> <li>Polarization of dielectric materials results in</li> <li>a) Production of eddy currents</li> <li>b) Creation of dielectric dipoles</li> <li>c) Release of protons</li> <li>d) Absorption of electrons</li> </ul>		
	6)	In vacuum or free space, what observations are made? a) $\rho = \rho_{\circ}, J = 0$ b) $\rho = 0, J = J_{\circ}$ c) $\rho = 0, J = 0$ d) $\rho = \rho_{\circ}, J = J_{\circ}$		
	7)	The lowest mode of TE mode propagation in a circular a) TE10 mode b) TE00 mode c) TE01 mode d) TE11 mode	waveguide is	
	8)	Fields of TEM mode on strip line must satisfy a) Laplace's equation b) Ampere's circuital c) Gaussian law d) None of the mentio		
	9)	Transmission line is a parameter network.a) Lumpedb) Distributedc) Actived) None of the mention	oned	

		10)	<ul> <li>The wavelength of a wave in a Waveguide</li> <li>a) is greater than of free space</li> <li>b) depends only on the waveguide dimensions and the free-space wavelength</li> <li>c) is inversely proportional to the phase velocity</li> <li>d) is directly proportional to the group velocity</li> </ul>	
	B)	State 1) 2) 3) 4) 5) 6)	<ul> <li>true or false.</li> <li>The entire theory of electromagnetic waves is contained in Maxwell's equations.</li> <li>In a GaAs n-type specimen, the current generated is constant irrespective of the electric filed applied to the specimen.</li> <li>The mode of propagation in a Microstrip line is Quasi TEM mode.</li> <li>Rectangular waveguide is the best medium for handling large microwave power.</li> <li>The attenuator is used in travelling wave tube to prevent oscillations.</li> <li>Gunn diode is suitable for very low power oscillators only.</li> </ul>	06
Q.2	Ans a) b) c) d)	Write of What a Explain velocit	he following. down Maxwell's equation in point and integral form? are the applications of Microwaves? in the terms: Cut-off frequency, Dominant mode, Phase velocity, Group ty. a short note on Electronic and Magnetic fields.	16
Q.3	Ans a) b)	Draw a bunch	<b>he following.</b> a neat diagram of two cavity Klystron amplifier and explain the ning process. Derive the equation of velocity modulation. in wave propagation in perfect Insulators.	10 06
Q.4	Ans a) b)	Explai	<b>he following.</b> in waveguide attenuators with neat diagram. ss briefly about Microwave spectrum.	10 06
Q.5	Ans a) b)	Explai	<b>he following.</b> in rectangular waveguide transmission in detail. ibe briefly standard coaxial connectors.	10 06
Q.6	Ans a) b)	With a	<b>he following.</b> a neat diagram, explain coaxial and strip line attenuators. ibe the types of strip lines in brief.	10 06
Q.7		With n	<b>he following.</b> neat diagrams, explain construction and working of reflex klystron. in the excitation of modes in circular waveguides.	10 06

			SLR-EQ-22	)	
Sea No.	t		Set P		
M.Sc. (Semester - IV) (New) (CBCS) Examination: Oct/Nov-2023 PHYSICS (APPLIED ELECTRONICS) Microcontrollers & Interfacing (MSC5406)					
Day & Date: Thursday, 21-12-2023 Max. Marks: 8 Time: 03:00 PM To 06:00 PM					
Instr	uctio		) Q. Nos. 1 and 2 are compulsory. ) Attempt any Three questions from Q.No.3 to Q.No.7. ) Figures to the right indicate full marks.		
Q.1	A)	<b>Chc</b> 1)	ose the correct alternatives from the options.10The addressing mode of the instruction MOV A, @R0 isa)a) Directb)Indirectc)Immediated)Register	)	
		2)	In the 8051, control can be transferred anywhere within the 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) DB0 b) R/W c) EN d) RS		
		6)	The time taken for the output to settle within a specified band of itsfinal value is referred asa) Conversion timeb) Settling timec) Take off timed) All of the mentioned		
		7)	To assign the highest priority to INT1 the instruction used is 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         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 mV. a) 1		
		10)	How many SBUF physically present inside the microcontroller for the serial communication? a) 1 b) 2 c) 3 d) 4		

B)	<ul> <li>State the following statements are true or false.</li> <li>PCON register SMOD bit decides the baud rate for serial communication</li> <li>LCD can't be used in the read mode.</li> <li>MOVC A, @A+DPTR access the data from the RAM or data memory.</li> <li>XRL C, /b is a valid instruction.</li> <li>Maximum delay will be produced by timer if it will be used in MODE-1.</li> <li>EA pin should be connected to ground to access external memory.</li> </ul>
a) b) c)	<ul> <li>wer the following.</li> <li>Explain following instructions.</li> <li>1) XCHD A, @R1</li> <li>2) POP 30H</li> <li>Draw and explain the PSW format of 8051.</li> <li>Why optocoupler is used in relay?</li> <li>Explain the function of the following pins of 8051.</li> <li>1) T0</li> <li>2) PSEN</li> </ul>
Ans a) b)	<b>wer the following.</b> Explain the memory organization of 8051. Draw and explain the power ON reset circuit of 8051.
Ans a) b)	wer the following. Interface relay to 8051. Write a program to turn ON the LED connected to P1.2 whenever the relay turns ON. Interface seven segment (common cathode type) display to 8051. Write a program to display the number from 0 to 9 continuously.
Ans a) b)	wer the following. Write a program to generate a square wave of 4KHz on P1.3. Use Timer 1 for delay purpose. Assume crystal frequency is 12MHz. 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 12MHz and SMOD = 0.
Ans a) b)	wer the following. Interface 16×2 LCD to 8051. Write a program to display "Welcome" at the center of the first line. 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.
A 10 0	wartha fallowing

Q.7 Answer the following.

Q.2

Q.3

Q.4

Q.5

Q.6

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

06 ication.

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