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Total No. of Printed Pages: 02

SEAT No._____

[413]

SARDAR PATEL UNIVERSITY
M. Sc. Physics III[rd] – Semester Examination
Wednesday, Date: 01-11-2017 Time: 10:00 a.m. to 1:00 p.m.
Course No: PS03CPHY01
Subject: Quantum Mechanics -II

Note: Symbols have their usual meaning. Total Marks: 70

Q.1 Select the best possible answer from the choices given below each questions. (8)

(1) Solving an Eigen value problem for an operator is just equivalent to
(a) Determining its hermiticity
(b) Diagonalization
(c) Trace of its matrix representation
(d) Expectation values

(2) The Heisenberg picture is obtained by choosing the unitary operator as
(a) $V(t,t_0)$ (b) $V(t,t_0)V^{-1}(t,t_0)$
(c) $V^{-1}(t,t_0)$ (d) $\partial V(t,t_0)/\partial t$

(3) In the dipole approximation
(a) $e^{-ikx} \approx 0$ (b) $e^{-ikx} \approx 1$
(c) $e^{ikx} \approx 1$ (d) $e^{ikx} \approx 0$

(4) The raising operator $a^\dagger$ of the harmonic oscillator satisfy the relation
(a) $a^\dagger|n> = \sqrt{(n+1)}\,|n+1>$ (b) $a^\dagger|n> = \sqrt{n}\,|n>$
(c) $a^\dagger|n> = \sqrt{(n-1)}\,|n-1>$ (d) $a^\dagger|n> = \sqrt{(n+1)}\,|n>$

(5) The components of the angular momentum operator **J** satisfy the commutation relation
(a) $[J_z, J_x] = i\hbar J_z$ (b) $[J_z, J_x] = i\hbar m$
(c) $[J_z, J_x] = 0$ (d) $[J_z, J_x] = i\hbar J_y$

(6) The C G coefficient is represented by
(a) $\langle m_1 m_2|jm\rangle$ (b) $\langle m_1 m|jm_2\rangle$
(c) $\langle j_1 j_2|jm\rangle$ (d) $\langle m_1 m_2|j_1 j_2\rangle$

(7) The Hamiltonian assumed for relativistic particle by Dirac is
(a) $H = c\hat{\alpha}\cdot\vec{P} - \beta mc^2$ (b) $H = c\hat{\alpha}\cdot\vec{P} + \beta mc^2$
(c) $H = c\hat{\alpha}\cdot\vec{P} - \beta mc^2$ (d) $H = c\hat{\alpha}\cdot\vec{P} - \beta mc$

(8) The Pauli spin matrices satisfy the relation
(a) $\sigma_x\sigma_y\sigma_z = 0$ (b) $\sigma_x\sigma_y\sigma_z = i\hbar$
(c) $\sigma_x\sigma_y\sigma_z = i$ (d) $\sigma_x\sigma_y = 2\sigma_z$

Q.2 Answer any seven questions. All questions carry 2 marks each (7x2=14)

(1) Write all the relevant commutation relationships among the angular momentum components.
(2) Represent the Schrodinger equation in matrix form.
(3) Show that expectation values remain unchanged in Unitary transformations.
(4) Prove that $\boldsymbol{L} \times \boldsymbol{L} = i\hbar\boldsymbol{L}$
(5) Show that $(\sigma.\boldsymbol{r})(\sigma.\boldsymbol{p}) = \boldsymbol{r}.\boldsymbol{p} + i\sigma.\boldsymbol{L}$
(6) Define density matrix and state its properties.
(7) Describe the problem associated with the Klein –Gordon equation for a relativistic quantum particle.
(8) Explain the properties of Dirac matrices.
(9) Discuss the significance of the negative energy solutions of the Dirac's equation.
(9) Explain briefly the procedure for the canonical field quantization.

Q.3(a) Obtain the matrix representations of $\langle j'm'|J_{\pm}|jm\rangle$ for $j = \frac{1}{2}\hbar$. (6)

(b) Develop the Unitary transformation by rotation of co-ordinate system and show that angularmomentum operators are the generators of rotations. (6)

OR

(b) Compute the C G Coefficients for a system having $j_1 = \frac{1}{2}$ and $j_2 = 1$ (6)

Q.4(a) Describe the Schrodinger, Heisenberg and interaction pictures of quantum mechanics. (6)

(b) Develop a relativistic quantum mechanical equation for the description of a free electron and discuss its solutions. (6)

OR

(b) Discuss in detail the interaction of an atom with the electromagnetic radiation. (6)

Q.5(a) Define Clebsh-Gordan coefficients in terms of the observables like j, m, j_1 and j_2. Also show that C-G coefficient matrix has $(2j_1+1)(2j_2+1)$ elements in it. (6)

(b) Discuss in detail the case of a relativistic electron in a central potential. (6)

OR

(b) Discuss elastic scattering and derive the Born Approximation based on time dependent first order perturbation theory (6)

Q.6(a) Discuss the essential features of Lagrangian field theory. (6)

(b) In the case of a system of bosons, describe the second quantization procedure. (6)

OR

(b) Second quantize the Maxwell's electromagnetic field. (6)

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SARDAR PATEL UNIVERSITY

M.Sc. (Physics)(IIIrd Semester) Examination

Date :03/11/2017, Day : Friday, Time : 10:00a.m. to 1:00p.m.

Subject : Nanoscience and Thin film Physics, Paper No. PS03CPHY02

CBCS(choice based credit system)

Important Note : Q.1 : Multiple choice questions (MCQ) carries one mark each.
Q.2 : Short questions carries two marks each (attempt any seven out of nine)
Q.3 to Q.6 : Long questions carries 12 marks .

Total Marks : 70

Choose the appropriate options from the following in Q.1

Q.1 (8)

i) Which quantum condition must be satisfied for observation of discrete nature of the single electron charge transfer to a quantum dot ?
(a) e^2/C (b) $e^2/2C$ (c) $e^2C/2$ (d) $2e^2/C$

ii) Sputtering yield is proportional to incident ion energy if
(a) E ‹ 100eV (b) E › 100eV (c) E › 100keV
(d) E ~ 10eV

iii) The resolution obtained in a SNOM depends on
(a)size of the aperture of optical fibre (b) laser beam (c) detector
(d) sample

iv) In coalescence phenomena. when two islands merge together which of the following term decreases
(a) area (b) mass (c) length (d) breadth

v) In which lithography technique no mask is required to generate a pattern.
(a) Ion beam (b)Electron beam (c) Neutral beam (d) Laser beam

vi) The major use of ion plating technique is in
(a) Tools (b) Sensors (c) Antireflecting coatings (d) Epitaxial growth

vii) For characterizing thin films by X-ray diffraction, how the film should appear to the beam ?
(a) thin (b) thicker (c) ultrathin (d) None of these

viii) In XPS measurement which beam is used ?
(a) MgK_α (b) MoK_α (c) CuK_α (d) FeK_α

Q.2 *Answer any seven questions out of nine in Q.2* 14)

i) Which equation is used to determine particle size using particle size analyzer ? Write that equation ?

ii) Evaluate binding energy for clusters(upto four) in atomistic model.

iii) Explain photolytic and pyrolytic process.

iv) What is meant by thermal accommodation ?

v) How Auger electron generation occurs and describe how depth profiling is made possible with AES.

vi) In which microscope current is monitored to study the surface topography of a sample ? Discuss two different modes of this microscope.

vii) Mention the interactions that occur when an electron beam strikes the specimen. Which type of electrons are used in SEM ?

viii) Name the microscope which can determine accurate size of nanoparticles ? State briefly two different type of images which can be obtained by it.

ix) Define thin film and give classification for thin film deposition techniques.

Q.3(a) How one can fabricate quantum dot lasers(IR) at the laboratory ? Explain it in detail with appropriate diagrams. **(6)**

Q.3(b) Describe sol-gel technique and laser ablation method used to synthesize nanoparticles and carbon nanotubes respectively. **(6)**

OR

Q.3(b) State the principle on which AFM works and for what purpose it is used. By drawing lay out diagram explain construction and working of AFM ? **(6)**

Q.4(a) Differentiate between capillarity and atomistic model. Derive the equation for critical size nuclei, free energy and nucleation rate for capillarity model. **(6)**

Q.4(b) Mention mechanical methods by which thickness of thin films can be measured and explain each one of them. **(6)**

OR

Q.4(b) Explain four stages involved in the growth of thin films with proper figures. **(6)**

Q.5(a)	Explain high temperature CVD process and write its advantages and applications.	(6)
Q.5(b)	What is sputtering ? Explain RF sputtering process with experimental set-up .	(6)
	OR	
Q.5(b)	Describe molecular –beam epitaxy technique for depositing epitaxial semiconductors thin film.	(6)
Q.6(a)	Describe in detail about XPS technique used for elemental identification of materials .	(6)
Q.6(b)	Discuss working of LEED technique with schematic diagram.	(6)
	OR	
Q.6(b)	Describe the spectroscopy technique, which is capable to detect very low elemental concentration in a material (SIMS).	(6)

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********** THE END **********

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SARDAR PATEL UNIVERSITY

M. Sc. (Physics), 3rd Semester Examination

7th November 2017, Tuesday

Time: 10:00 AM TO 01:00 PM

Subject: Crystallography and Materials Science, Paper No. PS03EPHY01

Important Note :

Q.1 : Multiple choice questions (MCQ) carries one mark each.

Q.2 : Short questions carries two marks each (attempt any seven out of nine)

Q.3 to Q.6 : Long questions carries 12 marks each.

Max Marks: 70

Que 1 Write correct answer for each of the following MCQs. **[08]**

1 If v and v^*, volume of unit cell in direct lattice and reciprocal lattice respectively then

a) $v = v^*$ b) $v = v^*/8\pi^3$

c) $v = 8\pi^3 v^*$ d) $v = 8\pi^3 / v^*$

2 The reciprocal lattice to an fcc lattice is

a) Sc lattice b) Bcc lattice

c) Fcc lattice d) None of these.

3 Bragg's law in vector form is

a) 2K.G =0 b) 2K-G =0

c) $2K.G-G^2=0$. d) $2K.G+G^2=0$

4 Transition temperature of BaTiO3 ferroelectric Crystal is

a) 97 b) 408

c) 308 d) 197

5 The mesogens obtained by heating solids is called

a) lyotropic b) thermotrpopic

c) amorphous d) polymers

6 The T_g for composition $Fe_{80}B_{20}$ known as metglas 2605 is ---- ----- as compared with the melting temperature 1538^0C of pure iron.

a) increased b) lowered

c) constant d) increased linearly

7 Magnetic fluid is used for

a) detecting magnetic field b) inclination sensor

c) detecting electric field d) detecting electromagnetic waves

8 The combination of the electron and its strain field is known as

a) polariton b) polaron

c) photon d) phonon

(P.T.O.)

Que 2 **Write answers of any seven questions.** **[14]**

1. Prove that the direct lattice is reciprocal of its own reciprocal lattice.
2. Difference between stereographic and spherical projection?
3. Face centered cell can have only specific reflections number of 'N' present in its diffraction whereas base centered cell have no such rules. - Explain.
4. Discuss characteristics of Rochelle salt .
5. What is form factor? Mention the factors on atomic scattering factor depends and how?
6. What is elastomer ? How uncoiling takes place in polymers ?
7. Differentiate between ac and dc SQUID.
8. Calculate the number of edges and faces for C_{84} molecule ?
9. State LST relation. This relation is helpful to make comparison with inelastic neutron scattering – explain in brief.

Que 3 **[a]** Discuss Bragg's law in terms of Ewald's construction and interpret it . **[06]**

[b] Display the graphical construction of Reciprocal lattice and give its significance. Highlight the difference between direct lattice and reciprocal lattice . prove that the reciprocal lattice vector is normal to hkl plane and is of length 1/d . **[06]**

OR

[b] i. Mention the difference between Bragg and laue approaches . **[06]**
ii. obtain the laue equation of diffraction of Xrays and obtain the Bragg's law from it. .

Que 4 **[a]** Obtain the structure factor equation for ZnS type crystal with two same kind of atoms per unit cell at 000 and 1/3 2/3 1/3 , write down the conditions for reflections to be present. **[06]**

[b] What are ferroelectricity , piezoelectricity , pyroelectricity ? Explain the phenomena – polarization catastrophe observed in crystals. **[06]**

OR

[b] Give the classification of ferroelectric materials. What are ferro electric domains? Briefly discuss the thermodynamic theory of ferroelectric transition. **[06]**

Que 5 **[a]** Explain high temperature oxide superconductors along with their properties. **[06]**

[b] What is polariton ? Derive the necessary expression relating the dielectric constant with longitudinal and transverse optical phonon frequency. **[06]**

OR

[b] Explain a remarkable phenomenon observed in the conductivity versus magneticfield in a high quality two-dimensional electron system. **[06]**

Que 6 **[a]** Classify different amorphous semiconductors and discuss the band structure and electronic conduction mechanism in it.. **[06]**

[b] Differentiate between thermosetting and thermoplastic polymer and explain the effect of temperature on polymers. **[06]**

OR

[b] What are liquid crystals ? Explain the effect of magnetic field on liquid crystals. **[06]**

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SARDAR PATEL UNIVERSITY

M.Sc. (Physics) (III[rd] –Semester) Examination

Day &Date :Thursday, 09/11/2017

Time: 10:00 a.m. to 01:00 p.m.

Subject: MAGNETIC AND OPTICAL PROPERTIES OF CONDENSED MATTER

Paper No. : PS03EPHY02

Instruction:

Figure to the right indicate marks. Total Marks : 70

Q.1 Write answer of all questions by showing your choice against the question number. [8]

(i)The energy difference between _____ should be 1.5 to 3.0 eV is required for the phosphors.

(a) top of the valence band and bottom of the conduction band
(b) top of the valence band and ground state
(c) bottom of the conduction band and excited state
(d) ground state and excited state.

(ii) _____ element will not give you radiationless transition in NaI crystal.

(a) Fe (b) Ni (c) Tl (d) Co

(iii) The Mossbauer effect is observed in :

(a) Gas (b)non-viscous liquid (c) plasma (d) solid

(iv) In Mossbauer effect, there is recoiless emission of gamma rays because of :

(a) Mass of solid much larger than emitting nucleus
(b) Mass of solid much smaller than emitting nucleus
(c) Mass of solid is equal to emitting nucleus
(d) None of the above

(v) The free carrier absorption of photon occurs due to _____ transition.

(a) Intra band (b) inter band
(c) valence to conduction band (d) conduction band to valence band

(vi) In infrared frequency ($10^{11} - 10^{14}$ Hz) range, the _____ polarization contributes to permittivity.

(a) electronic (b) atomic (c) ionic (d) molecular

(vii) In antiferromagnet sample, MnO, the magnetic unit cell is _____ that of chemical unit cell.

(a) one (b) twice (c) thrice (d) equal

(viii) In magnetite, Fe_3O_4 sample which ions moments cancels out within itself;

(a) Fe^{3+} (b) Fe^{2+} (c) O^{2-} (d) none of them

(P.T.O.)

Q.2 Attempt any Seven of the followings: [14]

(i) Explain Franck – Condon principle of luminescence.
(ii) Why Ge and Si could not emit the intensity of light in the visible or near visible region of the spectrum? Give reasons.
(iii) Describe Gudden – Pohl effect in case of electroluminescence.
(iv) Mention requirements to perform Mossbauer experiment.
(v) Explain P.B. Moon's experiment attempt to observe resonance fluorescence.
(vi) Explain absorption of energy in dielectric and dielectric loss.
(vii) Write a brief on p-n junction photovoltaic cells.
(viii) With relevant equations explain Knight Shift in brief?
(ix)Taking magnetite Fe_3O_4 as sample, discuss in details the ferromagnetic order.

Q.3(a) Obtain the expression for the intensity decay exponentially for temperature dependent and temperature independent of luminescent material. [6]

Q.3(b) With help of necessary schematic diagram, discuss characteristics and non-characteristics of the phosphorous. [6]

OR

Q.3(b) What is luminescence? Describe different types of the luminescence. Discuss the various applications of the luminescent material. [6]

Q.4(a) Describe cross section of resonance process in Mossbauer effect and the mechanism of Mossbauer effect. [6]

Q.4(b) Explain natural line width and thermal line width in Mossbauer spectroscopy in detail. [6]

OR

Q.4(b) Obtain an expression of Debye-Waller factor used in Mossbauer spectroscopy also show its temperature dependence. [6]

Q.5(a) Explain complex dielectric constant. Derive the equation of energy dissipated per second in dielectric material. Show how the energy loss is proportional to loss factor [6]

Q.5(b) In absorption process explain fundamental absorption. Explain direct and indirect gap semiconductor absorption. Also discuss exciton absorption. [6]

OR

Q.5(b) What is photoconductivity? Derive the equation of response time and gain factor. Why calculated gain factor varies from the experimental gain factor? [6]

Q.6(a) Explain nuclear magnetic resonance (NMR) and derive the equation of free precession. [6]

Q.6(b) Explain ferromagnetic resonance (FMR). Derive the equation of ferromagnetic resonance (FMR) frequency for ellipsoidal specimen. [6]

OR

Q.6(b) Explain Magnons and derive the dispersion relation for a ferromagnetic cubic lattice. [6]

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SARDAR PATEL UNIVERSITY

M. Sc. (Physics) III[rd] Semester Examination

Day and Date: Tuesday, 7[th] November, 2017

Time: 10.00 am to 1.00 pm

Subject: Microwave communication: Electronics and technology

Paper No: PS03EPHY03

Total Marks: 70

Note: All questions are compulsory.

Q.1 Multiple choice Questions. (8)

(1) _____ is a lowest power microwave device.
(a) Klystron (b) Magnetron (c) Gunn diode (d) TWT

(2) _____ can be used as a microwave switch.
(a) Schottky barrier diode (b) Varactor diode (c) P - I - N diode (d) Gunn diode.

(3) _____ mode of propagation is dominant in circular waveguide.
(a) $TE_{1,0}$ (b) $TE_{1,1}$ (c) $TE_{0,1}$ (d) $TM_{0,1}$

(4) VSWR in a transmission line is always between _____.
(a) 0 and 1 (b) 1 and infinity (c) -1 and +1 (d) 0 and infinity

(5) The radio horizon is an important parameter for _____ wave propagation of e. m. waves.
(a) ground (b) space (c) tropospheric (d) ionospheric

(6) _____layers of ionosphere exist during night time.
(a) D, E, F (b) F_1, F_2 (c) D , E (d) E , F

(7) _____antenna is an example of resonant antenna.
(a) horn (b) dipole (c) dish (d) parabollic

(8) The radiation pattern of a dipole antenna having length of 2 wavelengths will contain _____ lobes.
(a) 4 (b) 8 (c) 2 (d) 6

Q.2 Short answer questions (Attempt any seven) (14)

(1) Discuss the structure and I – V characteristics of Gunn diode.

(2) With the help of Applegate diagram, explain how bunching of electrons takes place in Klystron tube.

(3) "The transmission lines behave like a low pass filter." Justify this statement.

(4) "The waveguide has a frequency response similar to a high pass filter." Explain this statement.

(5) Why the space wave propagation of e. m. waves is also known as direct wave propagation?

(6) Calculate the distance of radio horizon for transmitting antenna for space wave propagation of electromagnetic waves when the height of a transmitting antenna is 16 m.

(7) What is a difference between resonant antenna and non resonant antenna?

(8) What is the function of a radiator in parasitic dipole antenna?

(9) "The dimensions of waveguide are frequency dependent." Give reasons for this statement.

Q.3 (a) Sketch the structure and discuss the operation and limitations of varactor diode. (6)

(b) Draw the structure and explain the workingof travelling wave tube. Why is it called a slow wave structure? (6)

OR

(b) Using necessary schematic diagram showing electric and magnetic field lines, describe the construction and working of a cavity magnetron. Also, mention the frequency and power limits of this microwave device. (6)

Q.4 (a) Calculate the dimensions of a rectangular waveguide used for propagation of $TE_{1,0}$ mode of a signal having frequency 10 GHz. Also calculate the area of this waveguide. (6)

(b) Using necessary figure, describe the construction and working of a rotating join used to couple two different pieces of waveguide. (6)

OR

(b) Mention the differences between parallel wire line and co-axial line. Also write down their frequency range of operation. What are the sources of primary line constants in transmission line? (6)

Q.5 (a) Classify the wave propagation mechanism in free space. What are the differences between the ground wave propagation and space wave propagation? Describe in detail the propagation of electromagnetic waves along the earth surface. (6)

(b) Why the density of ions is quite large in ionosphere? Mention different layers of ionosphere. Represent these layers graphically with reference to their height from earth surface and their widths. Which layers are vanished during night time? Why? (6)

OR

(b) Why satellite communication is used for long distances? Discuss the process involved in satellite communication. (6)

Q.6 (a) Draw the schematic diagram representing the transmission and reception of e. m. waves in dish antenna along with its structure. Describe the working of a dish antenna. (6)

(b) What is loop antenna? What is its function? Using necessary structural diagram, explain the working of loop antenna. (6)

OR

(b) Discuss the construction and operation of driven arrays antenna. (6)

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SARDAR PATEL UNIVERSITY

M.Sc. (PHYSICS) III[rd] Semester Examination

Thursday, 9[th] November, 2017 10:00 am to 01:00 pm

Course No.: PS03EPHY04

MICROPROCESSORS: PROGRAMMING, INTERFACING AND APPLICATIONS

Note: All questions are compulsory.

Total Marks:70

Q.1 Multiple Choice Questions. **(8)**

(i) Clock frequency of INTEL-8085 microprocessor is ____.
(a) 1 MHz **(b)** 1.5 MHz **(c)** 3 MHz **(d)** 3 kHz.

(ii) In a microprocessor assembly level program, the first memory location always contains
(a) 8-bit data **(b)** 16-bit Address
(c) 8-bit Instruction code **(d)** 16-bit Data

(iii) Asynchronous data transfer scheme can be implemented by _____ approach
(a) Hardware **(b)** Software **(c)** both a and b **(d)** DMA

(iv) A programmable I/O port has
(a) Address bus **(b)** buffers **(c)** data bus **(d)** all of the above

(v) Which of the following is a non-maskable interrupt of INTEL-8085 MPU?
(a) RST 5.5 **(b)** RST 6.5 **(c)** RST 7.5 **(d)** TRAP

(vi) Handshaking signals are exchanged before real data transfer takes place
(a) When Microprocessor and I/O devices match in speed
(b) When Microprocessor and I/O devices do not match in speed
(c) When I/O devices obtain control over buses,
(d) None

(vii) The 4[th] bit D_3 of D_0 - D_7 8-bit control word of IC-8255 is used to program Port ____as an Input or Output port.
(a) A, **(b)** B, **(c)** C_{lower}, **(d)** C_{upper}

(viii) The output stage of a Sample and Hold circuit LF-398 employs Bi-FET stage in order to obtain_____for its operation.
(a) Low droop rate, **(b)** High gain, **(c)** Large bandwidth, **(d)** None.

Q.2 Short Answer Questions. (Attempt any seven) **(14)**

(a) Explain the instructions LDA and LXI.

(b) Discuss the use of instruction DAA for decimal addition of two 8-bit numbers.

(c) Which is the fastest data transfer technique in case of INTEL-8085 microprocessor? Why?

(d) What are the functions of a DMA controller?

(e) Write programming modes and their functions of Programmable counter/interval timer IC INTEL-8252.

(P.T.O.)

(f) Explain how microprocessor receives an EOC signal once the A to D conversion is initiated.

(g) Write the status of each port of INTEL-8255 when control word register content is 98H.

(h) Discuss how current and voltage be measured by microprocessor.

(i) How is a microcontroller 8051 different from the microprocessor 8085?

Q.3(a) Sketch the block diagram of INTEL-8085 microprocessor and explain functioning of any two in detail. (6)

(b) Give classification of instructions used for MPU-8085 programming. With suitable examples explain two byte and three byte instructions in detail. (6)

OR

(b) Discuss address space partitioning and explain how memory devices are interfaced with microprocessor. (6)

Q.4(a) Write a note on data transfer techniques. (6)

(b) Describe interrupts of INTEL-8085. (6)

OR

(b) Sketch the block diagram of IC 8255 and explain its working. Also discuss the structure of control word and explain meaning of each of its bit position. (6)

Q.5(a) What is the role of Sample and Hold circuit in a data acquisition system? Explain the working of IC LF-398. (6)

(b) Interface IC AM-3705, IC LF-398, IC ADC-0800 and IC-8255 to microprocessor IC-8085 to convert analog input voltage applied to any two channels of your choice in to digital out put. Write an assembly level program to store this digital output at memory locations 2501H and 2502H. (6)

OR

(b) Explain the operating principle of DAC and discuss working of DAC-0800 with the help of necessary interfacing diagram and an assembly language program. (6)

Q.6(a) With the help of suitable example explain how a desired time delay is created using a software technique. (6)

(b) Explain how alphanumeric characters are displayed by seven segment LED display units interfaced to a display driver IC and a microprocessor 8085. (6)

OR

(b) Discuss how following electrical quantities are measured using a microprocessor based scheme. (6)

(i) Frequency of a sine wave (ii) Phase difference

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