

Seat No. : _____

MA-221

May-2025

M.Sc., Sem.-II

407 : Physics

(Digital Electronics and Microprocessor – I)

(New)

Time : 2:30 Hours]

[Max. Marks : 70

1. (A) Drawing the circuit diagram of a Monostable multivibrator using IC-555, explain the working of the circuit. 7
- (B) Explain the working of Astable multivibrator using IC-555 drawing suitable circuit diagram. 7

OR

1. (A) Explain the working of IC-7490 as Mod-10 counter in (2×5) configuration, drawing necessary circuit diagram, truth table and waveforms. 7
- (B) Draw the circuit diagrams of even and odd parity generation using IC-74180 and explain its working. 7
2. (A) Explain the working of binary ladder network drawing necessary circuit diagram. 7
- (B) Discuss the working of A/D converter using counter method, drawing necessary block diagram. 7

OR

2. (A) Discuss the working of Simultaneous method of A/D conversion, drawing necessary block diagram. 7
- (B) Discuss the working of A/D converter using Successive Approximation, drawing necessary block diagram. 7
3. (A) Give classification of the 8085 Microprocessor instructions and discuss each group with examples. 7
- (B) Discuss Input/output devices and Microprocessor as CPU. Also draw relevant schematics of (i) traditional block diagram of a computer and (ii) block diagram of a computer with the Microprocessor as CPU. 7

OR

3. (A) Discuss with relevant schematic diagrams (i) 8085 Hardware model, (ii) Programming Model and (iii) Flags 7
- (B) Discuss Operating system and low level languages. 7

4. (A) Draw relevant schematics of Microprocessor 8085 pin out and signals. Also discuss various signals group. 7
- (B) Draw a schematic of 2-to-4 decoder with active low output and enable line. Draw logic diagram of 74LS138 octal-decoder and explain working function of it. Also give a functional table of 3 to 8 decoder. 7

OR

4. (A) Draw a logic symbol of 8-to-3 Encoder. Draw a logic symbol of 74LS148 and explain working of it. Also give a functional table of it. 7
- (B) Draw a block diagram of 8085 Single-Board Microcomputer system and various components of it. 7

5. Answer in brief any **seven** questions : (Each question is of **two** marks) 14

- (i) Find the output pulse width for the monostable timer using IC-555. Given $R_A = 10 \text{ K ohm}$ and $C = 4.7 \mu\text{F}$.
- (ii) What are the basic characteristics of an ideal clock ?
- (iii) The maximum clock frequency that can be used with a logic gate having a propagation delay of 100 ns, is _____.
- (iv) Write the statement of Millman's theorem.
- (v) The binary equivalent weight of 1 (one) in 8-bit system for 0100 0000 is _____.
- (vi) The A/D converter using counter method has 8 bits and is driven by a 5-MHz clock. What is the maximum conversion time ? What is the average conversion time for the conversion ?
- (vii) What is function of a buffer ?
- (viii) What is an encoder ?
- (ix) What is a decoder ?
- (x) What is a function of D-latch ?
- (xi) Explain terms : SSI, LSI, MSI and VLSI.
- (xii) Explain terms : ASCII, Extended ASCII
- (xiii) Explain instructions : CPI, MOV D,A
- (xiv) Write function of Program counter and Stack pointer registers of the 8085.

MA-221

May-2025

M.Sc., Sem.-II**407 : Physics****(Quantum Mechanics – II and Mathematical Physics – II)****(Old)****Time : 2:30 Hours]****[Max. Marks : 70**

1. (A) What is the Schrodinger picture ? In the Schrodinger picture, prove that the evolution operator \hat{U} is unitary operator. 7
- (B) Prove that the equations of motion for the expectation values in Heisenberg picture and Schrodinger picture are the same. 7
- OR**
1. (A) Discuss the Pauli Principle for a system of non-interacting indistinguishable particles. 7
- (B) Using the unitary operator \hat{U} in the Schrodinger picture, obtain an equation which is analogue of the Hamilton- Jacobi equation. 7
2. (A) Prove that the coherent states are closest to the classical states. 7
- (B) Prove the statement: The probability that there are n photons in the coherent state is given by Poisson distribution. When can the coherent states $|\alpha\rangle$ and $|\beta\rangle$ of the annihilation operator become orthogonal ? Explain. 7
- OR**
2. (A) Define the creation and annihilation operators. Hence prove that $[\hat{a}, \hat{a}^+] = 1$. 7
- (B) Explain why \hat{a} is called the annihilation operator and \hat{a}^+ is called creation operator. 7
3. (A) Evaluate integral (I) using the Residue theorem, where $I = \oint_C \frac{dz}{\sin h z}$, where C is the circle $|z| = 2$. 7
- (B) Derive first and second equations for Cauchy-Riemann's conditions. 7
- OR**
3. (A) Write statement of Residue theorem and prove that the integral 7
- $$\oint_C f(z) dz = 2\pi i (R_1 + R_2 + \dots + R_n)$$
- (B) Using Cauchy-Riemann's conditions, decide following given functions are analytic or non-analytic : 7
- (i) $F(Z) = \frac{x - iy}{x^2 + y^2}$
- (ii) $F(Z) = \frac{2z - i}{iz + 2}$

4. (A) Evaluate the following function using Neumann series method : 7

$$\phi(x) = x + \frac{1}{2} \int_{-1}^1 (t-x) \phi(t) dt$$

(B) Prove that 7

$$\phi(x) = 1 - \int_0^x (t-x) \phi(t) dt = \cos hx$$

OR

4. (A) Evaluate $\phi(x) = x + \lambda \int_0^1 xt \Phi(t) dt$ using a Neumann series method. 7

(B) Find values of $\phi_1(x)$, $\phi_2(x)$, $\phi_3(x)$ and $\phi_4(x)$ of a function 7

$$\phi(x) = (1+x) + \int_0^x (x-t) \phi(t) dt$$
 using Neumann's series method.

5. Answer in brief any **seven** questions : (Each question is of **two** mark) 14

(i) The operator $\hat{a}^+ \hat{a}$ is also called _____ operator.

- (a) Annihilation (b) Creation
 (c) Ladder (d) Number

(ii) In _____ picture the state vector Ψ is a function of time, but the dynamical variable \hat{A} is independent of time.

- (a) Schrodinger (b) Heisenberg
 (c) Interaction (d) Perturbation

(iii) The quantity $\langle \Psi | \hat{A} | \Psi \rangle$ represents

- (a) Expectation value of \hat{A} for non-normalized wave function Ψ
 (b) Eigen value of \hat{A} for normalized wave function Ψ
 (c) The norm of \hat{A}
 (d) Expectation value of \hat{A} for normalized wave function Ψ

(iv) The eigen value of $\hat{a}^+ \hat{a}$ is always _____

- (a) > 0 (b) < 0
 (c) $= 0$ (d) infinite

(v) Define indistinguishable particles.

(vi) Prove that $\hat{a} | n \rangle = (\sqrt{n}) | n-1 \rangle$.

(vii) Find out real $u(x, y)$, and imaginary $v(x, y)$ of function $f(Z) = e^{iz}$.

(viii) Find complex conjugate of $(\text{Re } Z)$.

(ix) $F(Z) = \frac{Z}{Z+1}$ is a non analytic function. (True/ False)

(x) Write a non-homogeneous integral equation.

(xi) Write a homogeneous integral equation.

(xii) If $\phi(x) = x + \lambda \int_0^1 xt \phi(t) dt$ then find out $\phi_2(x)$.