

b) State and prove Cauchy's Residue theorem in multiply connected region.

5. a) Find the Fourier transform of Gaussian distribution function $f(x) = Ne^{-\alpha x^2}$. 6

OR

b) Derive expression for Fourier sine and cosine transform of 1st derivatives.

6. a) State and prove convolution theorem for Fourier-transform. 6

OR

b) Find a solution of heat flow equation in ID using Fourier transform.

7. a) Find Laplace transform $f(t) = t^n$, $n = 0, 1, 2, \dots$ 6

OR

b) Using Laplace's transform solve the differential equation $y'' + 2y' + 5y = e^{-x} \sin x$.

L-427-1400



2022

Full Marks - 60

Time - 3 hours

The figures in the right-hand margin indicate marks

Answer all questions

Part-I

1. Answer the following : 1 × 8

a) The value of $(i)^{30} = \underline{\hspace{2cm}}$.b) The point at which a function is not analytic is called .

c) Write the complex form of Fourier integral representation.

d) The Fourier transform of $e^{-x^2/2}$ simply repeats itself. (True/false)e) If $f(k)$ is the Fourier transform of $f(t)$ then the Fourier transform of $f(t \pm a)$ is .

f) Write heat flow equation in ID.

g) $L\{t^5\} = \underline{\hspace{2cm}}$.

h) Define Laplace transform.

L-427

[Turn over

[2]

Part-II

2. Answer any *eight* of the following : $1\frac{1}{2} \times 8$
- a) Find the complex conjugate of $\frac{1+2i}{1-i}$. ✓
 - b) State Cauchy's Integral theorem. ✓
 - c) Find $\oint \frac{e^z}{z^2+9} dz$ inside C if $|z|=2$ is C. ✓
 - d) Find the Taylor's series expansion of $f(z) = \sin z$ about $z=0$. ✓
 - e) Find Fourier sine transform of a^{-at} . ✓
 - f) State convolution theorem. ✓
 - g) Prove change of scale property of Fourier-transform. ✓
 - h) Find Laplace's transform of $e^{3t} + e^{-2t}$. ✓
 - i) Find the Laplace's transform of $f(t) = t$. ✓
 - j) Write Linearity property of Inverse Laplace's transform. ✓

Part-III

3. Answer any *eight* of the following : 2×8
- a) Find the location of inverse of $4 - 3i$ in the argand diagram. ✓
 - b) State necessary and sufficient condition for a function to be analytic. ✓

[3]

- c) Find the analytic function $f(z) = u + iv$, if $v(x, y) = y^2 - x^2$. ✓
- d) Define zeroes and singular point of a complex function. ✓
- e) Find the Fourier cosine integral representation of $f(x) = \begin{cases} \sin x, & 0 \leq x \leq \pi \\ 0, & x > \pi \end{cases}$ ✓
- f) Prove shifting property of Fourier transform. ✓
- g) Write down the properties of Dirac delta function. ✓
- h) Find the value of $\int xe^{-3x} \sin x dx$. ✓
- i) Find Laplace transform of first derivative of $f(t)$. ✓
- j) Find $f(t)$ whose Laplace transform is $F(s) = \frac{1}{s(s-a)}$. ✓

Part-IV

4. a) Derive Cauchy-Reimann conditions in polar form. 6

OR

L-427

[Turn over

IV-UG-Phy(CC)-VIII (OC)

2022

Full Marks - 60

Time - 3 hours

The figures in the right-hand margin indicate marks

Answer *all* questions

1. Answer any *four* of the following : 3 × 4

a) Evaluate $\int_c ze^z dz$

b) Expand $\ln(1+z)$ using Taylor series.

c) Find Laplace transformation of t^2e^{-at} .

d) Evaluate Fourier transformation of Cosine Function.

e) Evaluate $f(i)$ when $f(z)$ be the principal branch of z^{-i} .

f) Find $F(t)$ whose Laplace transformation is

$$F(S) = \frac{1}{S(S-a)}$$

2. a) State and prove Cauchy's integral Formula. 6

b) Find residue of the function

$$F(z) = \frac{z}{(z^2-1)(z+1)} \text{ at all its poles.} \quad 6$$

OR

[2]

c) IFF $f(z) = U(x, y) + iv(x, y)$ is analytic in a domain then prove that

$$\frac{\partial U}{\partial x} = \frac{\partial v}{\partial y}, \frac{\partial v}{\partial x} = -\frac{\partial U}{\partial y} \text{ is valid in that domain. } 7$$

d) State De Moivre's theorem and using it solve the equation $x^4 - x^3 + x^2 - x + 1 = 0$. 5

3. a) State and prove Fourier integral theorem. 8

b) Find Fourier transformation of 4

$$F(x) \text{ where } F(x) = \begin{cases} x, & |x| \leq a \\ 0, & |x| > a \end{cases}$$

OR

c) Evaluate the Fourier Transformation of the function $f(x) = e^{-\alpha|x|} e^{i\beta x}$. 6

d) Find Fourier transformation of First order derivative of a Function $f(x)$. 6

4. a) Discuss inverse Laplace transformation along with its properties. 6

b) Find $F(t)$ whose Laplace transformation is

$$F(S) = \frac{2}{S^2 - 4}.$$

6

OR

[3]

c) Find Laplace transformation of $\cos at$. 6

d) Discuss about the Laplace transformation of periodic function. 6

5. a) Solve simple the problem of simple electrical circuit using Laplace transformation. 12

OR

b) Find out the solution of one dimension heat conduction equation applying Fourier transformation. 12

L-584-20

□□

Part-IV

4. a) Explain the Compton effect. How this effect is different from photoelectric effect? 6

OR

b) Describe Frank-Hertz experiment.

5. a) Explain Davison German experiment. 6

OR

b) Discuss the validity of Huygen's berg uncertainty principle with the help gamma ray microscope and estimate the ground state energy of H-atom.

6. a) Write down few experimental facts in support of magic numbers. Draw shell model for $^{208}\text{Pb}_{82}$. 6

OR

b) Explain the terms of semi-empirical mass formula those are Quantum origin.

7. a) State and explain laws of Radioactivity decay. Define decay constant. 6

OR

b) Describe the construction and working of a Nuclear reactor.

L-455-1400



2022

Full Marks - 60

Time - 3 hours

The figures in the right-hand margin indicate marks

Answer all questions

Part-I

1. Answer the following : 1 × 8

a) Photoelectric effect illustrates ___ nature of light.

b) Bohr's atom model could not explain about ___ of Hydrogen spectral line.

c) ___ waves are not electro magnetic in nature.

d) Davison-Garmer experiment confirms ___ nature of particles.

e) Write uncertainty principle in terms of time and energy.

f) Which nucleus is highly stable ?

g) The unit of Radioactivity is ___.

h) A positron has same mass as that of ___.

L455

[Turn over

[2]

Part-II

2. Answer any *eight* of the following : $1\frac{1}{2} \times 8$
- a) Define work function.
 - b) Calculate the energy associated with a photon of wave length 6000Å.
 $h = 6.62 \times 10^{-34}$ JS
 - c) Write Bohr's postulate explaining frequency condition.
 - d) Calculate the De Broglie wavelength of electron moving with a speed of 10^5 m/s, mass of electron $= 9.1 \times 10^{-31}$ kg.
 - e) Calculate the wavelength of photon whose energy is 6×10^{-18} J.
 - f) Write the failures of shell model.
 - g) Explain packing factor of nucleus.
 - h) Write down uses of Nuclear Reaction.
 - i) Define Nuclear fission.
 - j) Find the radius of ${}_8\text{O}^{16}$ nucleus.

[3]

Part-III

3. Answer any *eight* of the following : 2×8
- a) What is Compton shift ? Write its expression.
 - b) Derive Einstein's photo electron equation.
 - c) Explain wave particle duality.
 - d) State Heisenberg's uncertainty principle.
 - e) Write down the limitations of Bohr's atom model.
 - f) Write down the properties of Nuclear force.
 - g) Find the wavelength of second line of Balmer series of Hydrogen atom if wavelength of 1st line is 6683Å.
 - h) Find the energy equivalent of mass of 1amu.
 - i) Derive a relation between decay constant and half life period.
 - j) Show that density of nucleus is independent of mass number.

[4]

Part-IV

4. a) Define Integrated circuit. Write down the advantages and disadvantages of integrated circuit. 6

OR

- b) What is NAND gate? Write the truth table and logic symbol. Explain how NAND gate can be realised using diodes and transistors.

5. a) State and prove De Morgan's theorem. 6

OR

- b) Describe the construction of CRO with diagram. Find expression for electrostatic deflection.

6. a) Describe a full adder with logic circuit. 6

OR

- b) What is IC-555 timer. Describe 8-pins IC-555 timer with block diagram.

7. a) Explain data storage giving brief description of RAM and ROM. 6

OR

- b) Describe ring counter with logic diagram using D-flip-flops.

L-491-1400



IV-UG-Phy(CC)-X (NC)

2022

Full Marks - 60

Time - 3 hours

The figures in the right-hand margin indicate marks

Answer all questions

Part-I

1. Answer the following : 1 × 8

- a) Which component increases the power of a signal.
- b) The binary equivalent of $(0.75)_{10}$ is ____.
- c) n-binary literals can be combined with an AND operation in ____ possible ways.
- d) Karnaugh Map is a ____ method used to simplify Boolean expressions containing two or four variables.
- e) The 1's complement of 11011001 is ____.
- f) Write the expression for differential d at the the output of a half subtractor.

L491

[Turn over

[2]

- g) The heart of all digital circuits is ____.
- h) 1 byte = ____ bits.

Part-II

2. Answer any *eight* of the following : $1\frac{1}{2} \times 8$

- a) Write three applications of IC's.
- b) What is a water ? Write it's uses.
- c) Convert $(437)_8$ to decimal.
- d) Simplify the expression using De-Morgan's theorem
 $Y = [(A + B') - (B + C')]$
- e) Find out the decimal equivalent of minterm ABC'.
- f) What is a transducer ?
- g) Add the binary numbers $(101.11)_2$ and $(110.01)_2$.
- h) Subtract 100 from 111 by is complement method.
- i) Define decoder.
- j) Name different units of a digital computer.

[3]

Part-III

3. Answer any *eight* of the following : 2×8

- a) Draw circuit diagram for two input diode or gate.
- b) Describe how NOT gate can be obtained from NAND gate.
- c) State duality principle.
- d) Simplify the expression $-Y = AB + B(A+B) + C(B+C)$.
- e) Explain sum of product and product of sum.
- f) Draw block diagram of CRO.
- g) Distinguish between multiplexer and de-multiplexer.
- h) Write the applications of encoder.
- i) Subtract $(1011)_2$ from $(1001)_2$ by 2's complement method.
- j) Describe about control unit of a digital computer.

MODEL QUESTION

Full marks-60

Time-3hours

Answer all the questions

Part-I

1. Answer the following questions

[1x8]

- What is the Absorptive power of perfectly black body?
- Give the Einstein's photoelectric equation.
- What is the energy-momentum relation in photon?
- The rest mass of photon is _____
- The radius of nucleus is of the order of _____
- Isobars have same _____
- What is the mass of neutron?
- The most abundant isotope of natural Uranium is _____

PART-II

2. Answer any 8 of the following questions.

[1.5x8]

- What is the Wein's displacement law?
- Calculate the energy of photon of wavelength 6000 Armstrong.
- Give relation between phase velocity and group velocity.
- What is the average energy of Planck's oscillator of frequency?
- How Compton shift vary with scattering angle?
- Lyman series of hydrogen atom lies in which region?
- What is mass defect?
- What is uncertainty principle?
- Write the units of radioactivity.
- What is nuclear fission?

PART-III

3. Answer any 8 of the following questions.

[2x8]

- State Stefan's law.
- A photon has energy of 10eV. Calculate the momentum of photon.
- Define work function of a metal.
- What is the significance of Frank Hertz experiment?
- Explain De-Broglie hypothesis.
- Write the properties of nuclear forces.
- Explain N-Z graph.
- What are the properties of α rays?
- What is nuclear fusion?
- One gram of Radium decays with a half life of 1620 years. Calculate the decay constant and mean life.

PART-IV

Answer all the following questions.

[6x4]

4. Discuss Rutherford's scattering experiment and important conclusions from it.

Or

Discuss and study spectrum of Hydrogen atom.

5. Explain spread of Gaussian wave packet with time.

Or

Using Uncertainty principle prove the non-existence of electron in the nucleus.

6. Explain Liquid drop model of nucleus and derive semi empirical mass formulae.

Or

Give the salient features of nuclear shell model and point its success and failure.

7. What is nuclear reaction? Give examples. What is meant by Q-value of nuclear reaction?

Or

Explain Radioactivity and discuss laws of Radioactivity.

MODEL QUESTION

Full marks-60

Time-3hours

Answer all the questions

Part-I

1. Answer the following questions

[1x8]

- a) What is a chip?
- b) Convert 1011 to decimal number.
- c) What is the complement of $A + B + C$?
- d) What is the full form of CRO?
- e) Write the 2s complement of 111.
- f) What is a decoder?
- g) Name a memory device which has volatile memory.
- h) What is a sequential logic circuit?

PART-II

2. Answer any 8 of the following questions.

[1.5x8]

- a) What are the advantages of IC?
- b) Convert 72905 from decimal to hexadecimal.
- c) What are the universal gates?
- d) Solve the expression: $A(A + B)$
- e) Explain Half Adder with truth table.
- f) What is an encoder?
- g) What is the role of electron gun in CRO?
- h) What is memory map?
- i) What is combinational logic circuit?
- j) Explain ring counter.

3. Answer any 8 of the following questions.

[2x8]

- a) What do you mean by Active and Passive components?
- b) Draw the circuit diagram for AND and OR gate?
- c) Give the logic expression and truth table for XOR gate.
- d) Solve the expression using K-Map: $\bar{A}C + \bar{A}B + A\bar{B}C + BC$
- e) What are the applications of CRO?
- f) Describe a 4 bit parallel adder.
- g) Add $(1110)_2$ with $(1011)_2$.
- h) What do you mean by memory interfacing?
- i) What is RAM & What are its different types?
- j) Explain decade counter.

PART-IV

Answer all the following questions.

4. Write a short note on fabrication of monolithic IC.

Or

Write the difference between Analog and Digital circuit. Explain the working of NOT gate as an inverter.

5. Verify De Morgans law using truth table. State laws of complementation and Distributive law.

Or

Discuss the construction and working of CRO.

6. Differentiate a multiplexer from a demultiplexer . Explain the functioning of 1:4 demultiplexer.

Or

Sketch the pin configuration of the timer and give the function of various pins.

7. Discuss about memory organization in a computer system with block diagram.

Or

Discuss the operation of a 4 bit synchronous counter with parallel carry. Draw its waveform chart and truth table.