

B.Sc. Honours in Electronics (Major)

w.e.f. AY 2023-24

I SEMESTER

Course 1: Essentials and Applications of Mathematical, Physical and Chemical Sciences

MODEL PAPER

TIME: 3 HOURS

MAXIMUM MARKS :70

ANSWER ALL THE FOLLOWING QUESTIONS

70×1M=70M

SECTION-A: MULTIPLE CHOICE QUESTIONS

45×1M=45M

1. If $z = 3 - 4i$ is a complex number, what is its modulus?
 - a) 5
 - b) 7
 - c) 3
 - d) 4
2. Which form of a complex number involves both modulus and amplitude?
 - a) Rectangular form
 - b) Polar form
 - c) Exponential form
 - d) Logarithmic form
3. In a right-angled triangle with sides 3, 4, and 5 units, what is the sine of the angle opposite the side of length 3 units?
 - a) 3/5
 - b) 4/5
 - c) 3/4
 - d) 4/3
4. What is the result of the scalar product of two perpendicular vectors?
 - a) 1
 - b) 0
 - c) -1
 - d) They cannot be perpendicular
5. If $\vec{A} = 2i + 3j$ and $\vec{B} = 4i - 2j$ what is the vector product of \vec{A} and \vec{B}
 - a) $10i - 14j$
 - b) $10i + 14j$
 - c) $14i - 10j$
 - d) $14i + 10j$
6. If a set of data has an even number of observations, how is the median calculated?
 - a) Average of two middle values
 - b) The value that occurs most frequently
 - c) The middle value
 - d) It's impossible to calculate
7. The mean of five numbers is 12. If one number is removed and the mean becomes 15, what is the value of the removed number?
 - a) 8
 - b) 10
 - c) 12
 - d) 20



8. Which of these is a derived unit?
- a) Kilogram
 - b) Meter
 - c) Newton
 - d) Second
9. According to Newton's first law of motion, an object will remain at rest or in uniform motion unless acted upon by
- a) a net external force
 - b) gravity
 - c) friction
 - d) air resistance
10. The second law of thermodynamics states that in an isolated system, entropy tends to
- a) decrease
 - b) remain constant
 - c) increase
 - d) fluctuate randomly
11. Which type of wave requires a medium for propagation?
- a) Electromagnetic waves
 - b) Acoustic waves
 - c) Radio waves
 - d) Gamma rays
12. A changing magnetic field induces an electric field, as described by
- a) Faraday's law
 - b) Ampere's law
 - c) Gauss's law
 - d) Coulomb's law
13. What is the charge of a proton?
- a) $+1.6 \times 10^{-19} \text{ C}$
 - b) $-1.6 \times 10^{-19} \text{ C}$
 - c) $+1.6 \times 10^{-10} \text{ C}$
 - d) $-1.6 \times 10^{-10} \text{ C}$
14. The wave-particle duality suggests that particles like electrons exhibit both wave-like and particle-like behavior, as demonstrated by the
- a) Double-slit experiment
 - b) Stern-Gerlach experiment
 - c) Photoelectric effect
 - d) Compton effect
15. Which theory proposes that the universe began from a singularity and has been expanding ever since?
- a) Theory of General Relativity
 - b) Big Bang Theory
 - c) String Theory
 - d) Steady-State Theory
16. According to the cosmological principle, the universe is
- a) homogeneous and isotropic
 - b) constantly contracting
 - c) centered around our solar system
 - d) non-uniform
17. What is the primary goal of chemistry?
- a) Understanding the behavior of living organisms
 - b) Exploring historical events
 - c) Studying the structure of planets



- d) Understanding the properties and interactions of matter
18. Which of the following is an example of a chemical reaction occurring in daily life?
- a) Water evaporating from a lake c) Rust forming on iron
b) Chopping wood into smaller pieces d) Cutting a piece of paper
19. Which branch of chemistry primarily deals with the study of carbon compounds?
- a) Organic chemistry c) Physical chemistry
b) Inorganic chemistry d) Analytical chemistry
20. Elements in the same group of the periodic table tend to have
- a) similar chemical properties and the same number of valence electrons
b) different chemical properties and the same number of valence electrons
c) similar chemical properties and different numbers of valence electrons
d) different chemical properties and different numbers of valence electrons
21. What is the electronic configuration of oxygen?
- a) $1s^2 2s^2 2p^4$ c) $1s^2 2s^1 2p^6$
b) $1s^2 2s^2 2p^2$ d) $1s^2 2s^2 2p^3$
22. When iron rusts, it is an example of a
- a) Physical change c) Biological change
b) Chemical change d) Nuclear change
23. Carbohydrates primarily function as
- a) Energy storage molecules c) Enzymes in metabolic reactions
b) Structural components of cell membranes d) Signaling molecules in the body
24. Proteins are composed of:
- a) Monosaccharides c) Fatty acids
b) Amino acids d) Nucleotides
25. Which biomolecule is a major component of cell membranes?
- a) Carbohydrates c) Fats
b) Proteins d) Vitamins
26. Which branch of mathematics is extensively used to describe rates of change and accumulation in physics and chemistry?
- a) Trigonometry c) Calculus
b) Algebra d) Geometry
27. Differential equations find significant applications in describing
- a) Static systems b) Linear motion



c) Systems with changing variables

d) Quantum phenomena

28. Complex analysis is employed in physics and chemistry to understand phenomena involving

a) Simple algebraic equations

b) Systems at equilibrium

c) Oscillatory behavior and wave propagation

d) Discrete particle interactions

29. In the electronics and semiconductor industry, which physics principles are fundamental for creating transistors and microchips?

a) Quantum mechanics

c) Thermodynamics

b) Classical mechanics

d) Relativity

30. Which industry heavily relies on robotics and automation to enhance efficiency and precision?

a) Aerospace

c) Chemical manufacturing

b) Automotive

d) Food and beverage

31. Quality control and instrumentation in industries are reliant on physics principles such as:

a) Electromagnetism

c) Quantum field theory

b) Special relativity

d) Classical thermodynamics

32. Environmental monitoring and sustainable technologies often utilize physics principles related to

a) Thermodynamics

c) Astrophysics

b) Particle physics

d) Nuclear physics

33. Which industry heavily relies on chemical manufacturing processes to produce a wide array of products?

a) Aerospace

c) Electronics

b) Textiles

d) Agriculture

34. Pharmaceuticals and drug discovery industries primarily focus on developing compounds that

a) Increase entropy

c) Interact with biological systems

b) Alter electromagnetic fields

d) Enhance gravitational fields

35. Materials science heavily relies on chemistry to engineer materials with specific properties for applications in

a) Telecommunications

b) Medical devices



- c) Renewable energy
d) All of the above
36. What was the first electronic general-purpose computer called?
a) UNIVAC
b) ENIAC
c) EDVAC
d) EDSAC
37. Who is credited with inventing the World Wide Web (WWW) in 1989?
a) Tim Berners-Lee
b) Bill Gates
c) Steve Jobs
d) Larry Page
38. The ARPANET, a precursor to the internet, was developed by:
a) IBM
b) Microsoft
c) Apple
d) DARPA
39. Which type of network connects devices over a large geographical area?
a) LAN
b) WAN
c) MAN
d) PAN
40. What does IP stand for in the context of networks?
a) Internet Protocol
b) Information Provider
c) Internet Portal
d) Internal Protocol
41. The system that converts domain names into IP addresses is called:
a) DNS (Domain Name System)
b) DHCP (Dynamic Host Configuration Protocol)
c) HTTP (Hypertext Transfer Protocol)
d) FTP (File Transfer Protocol)
42. Which protocol is commonly used for transferring web pages and other resources over the internet?
a) FTP
b) HTTP
c) SMTP
d) SNMP
43. What is the fundamental purpose of cryptography in network security?
a) To prevent malware attacks
b) To hide data during transmission
c) To increase network speed
d) To improve hardware performance
44. Which type of cryptography uses a single key for both encryption and decryption?
a) Asymmetric cryptography
b) Hash cryptography
c) Symmetric cryptography
d) Public-key cryptography
45. What is the primary function of a firewall in network security?
a) To encrypt data
b) To prevent unauthorized access
c) To detect viruses
d) To increase network speed



SECTION-B: FILL IN THE BLANKS**25×1M=25M**

46. The general form of a complex number is written as _____.
47. The calculation of angles often involves the use of trigonometric functions like _____.
48. Vector addition involves the combination of vectors in _____.
49. The argument or amplitude of a complex number $z=a+bi$ is expressed as _____.
50. Tangent in a right-angled triangle is determined by dividing the _____ by the adjacent side.
51. The cross product or vector product yields a vector that is _____ to both original vectors.
52. Cosine of an angle in a right-angled triangle is computed as the _____ divided by the hypotenuse.
53. Trigonometric ratios like sine, cosine, and tangent are interrelated through _____.
54. Wave-particle duality describes the _____ nature of particles.
55. Acoustic waves travel through _____ as a medium.
56. Measurements and units in physics follow standard _____.
57. Behavior of atomic and nuclear particles is studied in _____.
58. Newtonian mechanics deals with motion at _____ speeds compared to the speed of light.
59. The _____ arranges elements based on their atomic number and chemical properties.
60. Chemical changes involve the formation of new substances with _____ properties.
61. Fats belong to a class of biomolecules called _____.
62. Carbohydrates are composed of _____, _____, and _____.
63. Environmental monitoring and sustainable technologies utilize physics principles for _____ and _____.
64. Calculus helps in analyzing _____ and _____ in physics and chemistry.
65. Industries such as robotics and automation utilize physics for optimizing _____ and _____.
66. In drug discovery, chemistry is vital for identifying potential _____ and _____.



67. The protocol commonly used for transferring web pages and resources over the internet is _____.

68. _____ refers to the process of disguising information to make it unreadable without special knowledge.

69. Information Assurance Fundamentals aim to _____ and _____.

70. _____ refers to the unique numerical label assigned to each device connected to a computer network using the Internet Protocol.

A handwritten signature in blue ink, consisting of a circular initial followed by a stylized name.

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I SEMESTER
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Sciences
MODEL PAPER

TIME: 3 HOURS

MAXIMUM MARKS :70

ANSWER ALL THE FOLLOWING QUESTIONS

70×1M=70M

SECTION-A: MULTIPLE CHOICE QUESTIONS

50×1M=50M

1. The point where two straight lines intersect is called the
 - a) Vertex
 - b) Apex
 - c) Origin
 - d) Intersection
2. Which form of the equation of a straight line is most suitable for determining its slope and intercept?
 - a) General form
 - b) Slope-intercept form
 - c) Point-slope form
 - d) Intercept form
3. What is the derivative of a constant function?
 - a) Zero
 - b) The constant itself
 - c) One
 - d) Infinity
4. The process that reverses differentiation is called
 - a) Differentiation
 - b) Integration
 - c) Reduction
 - d) Substitution
5. Which of the following is a basic method of integration?
 - a) Substitution
 - b) Derivation
 - c) Addition
 - d) Multiplication
6. The determinant of a matrix is a scalar value that expresses
 - a) The trace of the matrix
 - b) The size of the matrix
 - c) The solution of the matrix
 - d) The area/volume scaling factor of transformations
7. Which matrix operation is NOT commutative?
 - a) Addition
 - b) Multiplication
 - c) Transpose
 - d) Determinant
8. The derivative of a constant multiplied by a function is found using which rule?
 - a) Quotient rule
 - b) Chain rule



19. Quantum dots possess tunable _____ due to their size and composition.
- a) Conductivity
 - b) Magnetism
 - c) Optical properties
 - d) Thermal properties
20. Quantum communication utilizes _____ for secure information transfer.
- a) Entanglement
 - b) Radio waves
 - c) Fiber optics
 - d) Microwave signals
21. Computer-aided drug design primarily involves
- a) Physically testing all chemical compounds
 - b) Utilizing computers to model and predict drug behavior
 - c) Randomly selecting compounds for drug development
 - d) Ignoring molecular structures in drug design
22. Nanosensors are used to detect
- a) Large-scale objects
 - b) Nano-sized particles
 - c) Only biological substances
 - d) Only gaseous compounds
23. Chemical biology primarily explores the
- a) Interaction of chemicals with biological systems
 - b) Physical properties of chemicals
 - c) Production of chemicals in labs
 - d) Chemical synthesis methods
24. Chemical pollutants can impact ecosystems by
- a) Improving biodiversity
 - b) Leading to species extinction
 - c) Enhancing ecological balance
 - d) Minimizing pollution levels
25. Human health can be affected by chemical pollutants through
- a) Improved immunity
 - b) Respiratory issues
 - c) Increased energy levels
 - d) Enhanced mental acuity
26. Dye removal using catalysis methods involves
- a) Increasing dye concentrations
 - b) Enhancing dye stability
 - c) Degrading and removing dyes from solutions
 - d) Encouraging dye absorption
27. In computer-aided drug design, virtual screening involves
- a) Physically testing drug compounds
 - b) Identifying potential drug candidates through computational methods
 - c) Selecting compounds randomly for drug development



- d) Ignoring drug structures in design
28. Nano sensors can detect substances at the
- a) Macroscopic level
 - b) Microscopic level
 - c) Molecular level
 - d) Atomic level
29. Chemical biology examines the chemical basis of
- a) Biological systems and processes
 - b) Physical systems and structures
 - c) Mechanical systems and mechanisms
 - d) Electrical systems and currents
30. Chemical pollutants can disrupt ecosystems by altering
- a) Soil fertility
 - b) Atmospheric conditions
 - c) Biodiversity
 - d) Ocean currents
31. Mathematical modeling in physics and chemistry helps in
- a) Predicting complex systems behavior
 - b) Creating abstract theories
 - c) Understanding basic principles only
 - d) Ignoring experimental data
32. Grid integration in renewable energy primarily involves
- a) Minimizing renewable energy production
 - b) Balancing energy supply and demand
 - c) Encouraging energy wastage
 - d) Reducing renewable energy efficiency
33. Nanomedicine employs nanotechnology in:
- a) Building large-scale machines
 - b) Treating diseases at a molecular level
 - c) Generating excessive heat
 - d) Creating traditional medicines
34. Biophysical imaging involves using physics principles to
- a) Understand biological systems through imaging
 - b) Study geological formations
 - c) Analyze weather patterns
 - d) Investigate chemical reactions
35. Radiation therapy in medical physics uses ionizing radiation to
- a) Create genetic mutations
 - b) Treat cancerous cells
 - c) Increase cell proliferation
 - d) Induce apoptosis in healthy cells
36. Solid waste management focuses on
- a) Increasing waste generation
 - b) Disposing of waste irresponsibly
 - c) Reducing, reusing, and recycling waste
 - d) Minimizing waste reduction efforts
37. Environmental remediation using green technology aims to
- a) Introduce more pollutants
 - b) Address environmental problems sustainably
 - c) Increase carbon emissions
 - d) Promote deforestation



38. Water treatment involves purifying water to
- a) Enhance water pollution
 - b) Ensure water scarcity
 - c) Make water fit for consumption
 - d) Increase waterborne diseases
39. Mathematical modeling aids in
- a) Predicting systems behavior
 - b) Generating random data
 - c) Avoiding experimentation
 - d) Disregarding scientific principles
40. Smart grids in renewable energy help in
- a) Reducing energy efficiency
 - b) Balancing energy supply and demand efficiently
 - c) Ignoring energy fluctuations
 - d) Increasing energy wastage
41. In the hexadecimal number system, what is the base value?
- a) 2
 - b) 8
 - c) 10
 - d) 16
42. Which signal type uses continuous waves to transmit data?
- a) Analog
 - b) Digital
 - c) Modem
 - d) Codec
43. What is the purpose of a modem?
- a) Converts digital signals to analog signals
 - b) Converts analog signals to digital signals
 - c) Amplifies digital signals
 - d) Increases the speed of transmission
44. Which error detection method is based on the addition of a parity bit?
- a) CRC
 - b) Parity check
 - c) Hamming code
 - d) Checksum
45. What networking device operates at the Data Link Layer of the OSI model?
- a) Repeater
 - b) Hub
 - c) Bridge
 - d) Router
46. Which networking device is used to connect multiple network segments?
- a) Switch
 - b) Hub
 - c) Router
 - d) Gateway
47. The process of combining multiple signals into one for transmission is called
- a) Demultiplexing
 - b) Multiplexing
 - c) Modulation
 - d) Demodulation
48. Which transmission media type allows for the highest data transmission rates?
- a) Twisted pair
 - b) Coaxial cable



- c) Fiber optic
- d) Wireless
- 49. What error detection method uses polynomial division to detect errors in data?
 - a) Parity check
 - c) Hamming code
 - b) Checksum
 - d) CRC
- 50. Which networking device operates at the Network Layer of the OSI model?
 - a) Repeater
 - c) Router
 - b) Switch
 - d) Hub

SECTION-B: FILL IN THE BLANKS

11×1M=11M

- 51. Integration is the reverse process of _____.
- 52. The determinant of a square matrix is computed using various operations like _____.
- 53. In matrix multiplication, the order of matrices matters due to its _____ nature.
- 54. Renewable energy generation involves harnessing energy from _____ sources.
- 55. Energy storage solutions such as batteries and _____ are critical for managing renewable energy intermittency.
- 56. Chemical pollutants in ecosystems can lead to a decline in _____.
- 57. Dye removal through catalysis methods involves the degradation and elimination of dyes from _____.
- 58. Biomechanics explores the application of _____ principles in biological systems.
- 59. In environmental remediation, green technology aims to tackle environmental issues using _____ approaches.
- 60. Water treatment processes aim to ensure the _____ of water for various purposes.
- 61. The process of converting analog signals to digital signals is called _____.

SECTION-C: SHORT ANSWERS

9×1M=9M

- 62. What are the standard limits commonly used in calculus?
- 63. What happens when a matrix is multiplied by a scalar?
- 64. What are biophysics?
- 65. What is the significance of catalysis in environmental remediation?
- 66. Define 'catalysis' in the context of dye removal.
- 67. How does chemical biology differ from traditional biology?
- 68. What is the role of grid integration in renewable energy?
- 69. Define biophysical imaging and its relevance in science.
- 70. Explain the functions of a modem and a codec in communication.