23BCP102

UG PROGRAM (4 YEARS HONORS) WITH SINGLE MAJOR

AT THE END OF FIRST SEMESTER

ADVANCES IN MATHEMATICAL, PHYSICAL AND CHEMICAL SCIENCES

Common for B.Sc. (Mathematics, Statistics, Chemistry, Electronics, Physics, Data Science, Computer Science, Artificial Intelligence and Robotics, Psychology, Internet of Things, Chemistry / Analytical Chemistry, Geology, Geography))

(w.e.f. Admitted Batch 2023-24)

Time: 3Hours **Maximum: 70 marks**

SECTION –A (Multiple choice questions) **30X1 =30**

1. Which of the following is the equation of a vertical line ( )

(a) $y = 2x + 3$ (b) $y = 4$ (c) $x = 4$ (d) $y = x$

2. What is the point of intersection of the lines $y = 2x + 3$ and $y = -2x + 7$ ( )

(a) (1, 5) (b)(-1, -1) (c)(2, 7) (d) (0, 3)

3. What is the transpose of 2x3 matrix ( )

(a)2x3 (b)3x2 (c) 2x2 (d) 3x3

4. The determinant of A= $\begin{bmatrix} 4 & 3 \\ 3 & 2 \end{bmatrix}$ ( )

(a) 1 (b)-1 (c) 17 (d) 3

5. If $f(x) = x^2 Sin\, x$ *what is* $D(f(x))$ ( )

(a)$2x\ Sinx$ (b)$2xCosx$ (c) $x^2\ Cosx$ (d) $2xSin\, x + x^2 Cos\, x$

6. If $p(x) = \sqrt{x}$ *and* $q(x) = \frac{1}{x}$ *what is* $\frac{d}{dx}\left(\frac{p}{q}\right) =$ ( )

(a)$\frac{1}{2x\sqrt{x}}$ (b)$\frac{-1}{2x\sqrt{x}}$ (c) $\frac{-1}{2\sqrt{x}}$ (d) $\frac{1}{2\sqrt{x}}$

7. Which of the following is a renewable energy source ( )

(a) Coal (b) Natural Gas (c) Solar (d) Nuclear

8. What is the primary energy source for hydropower generation ( )

(a) Wind (b) Sunlight (c) Flowing or falling water (d) Geothermal Heating

9. Which type of storage technology is based on the Principle of gravitational potential energy ( )

(a) Flywheels (b) Compressed air

(c) Super capacitors (d) Pumped hydro

10. How are quantum dots utilized in bio-imaging ( )

(a) To catch a broader spectrum of light (b) To emit high intensity visible light

(c) To enhance electrical conductivity (d) To enable high resolution imaging

11. What recent discovery in biophysics has implications for the development of new antibiotics and understanding antibiotics resistance. ( )

(a) Protein folding mechanisms (b) DNA sequencing techniques

(c) Bacterial cell division process (d) Bacterial biofilm formation

12. In which industry are shape memory materials often used for aerospace components like aircraft wings and control surfaces? ( )

(a) Biomedical (b) Fashion (c) Automotive (d) Aerospace

13. What is the primary goal of computer-aided drug design (CADD) ( )

(a) Drug manufacturing (b) Drug discovery

(c) Drug Administration (d) Drug marketing

14. What is the primary focus of chemical biology? ( )

(a) Organic synthesis

(b) Understanding chemical reaction

(c) Investigating the biological roles of small molecules

(d) Material science

15. What type of bond holds the two strands of DNA together in the double helix structure? ( )

(a) Ionic bonds (b) Covalent bond (c) Hydrogen bonds (d) Van Der waals force

16. Which of the following is a primary source of chemical pollutants in aquatic ecosystems? ( )

(a) Volcanic activity (b) Industrial discharge (c)Wind erosion (d) None

17. Which type of chemical pollutant is commonly associated with the greenhouse effect and climate change? ( )

(a) Heavy metals (b) Greenhouses gases

(c) pesticides (d) Radioactive substances

18. Which of the following is a common health effect associated with exposure to air pollutant such as particulate matter (PM) and Ozone? ( )

(a) Skin rashes (b) Respiratory problems

(c) Digestive issues (d) Joint pain

19 Which of the following number system is not used in computers? ( )

(a) Decimal (b) Binary (c) Hexadecimal (d) Octal

20. In the Hexadecimal number system, what digit comes after 9? ( )

(a) A (b) B (c) 10 (d) 16

21. 1 zettabyte =? ( )

(a) 1024 TB (b) 1024 EB (c) 1024 ZB (d) 1024 PB

22. Which of the following is not an example of hexadecimal number ( )

(a) 1C2 (b) 2A1 (c)1ABCD (d) 67GA

23. What is the hexadecimal equivalent of the decimal number 215? ( )

(a) D7 (b) 7D (c) B7 (d) 7C

24. Which of the following is not used for web graphics? ( )

(a) JPEG (b) PNG (c) GIF (d) .exe

25. Which device forwards data packets between different networks? ( )

(a) HUB (b) Switch (c) Router (d) Repeater

26. Which device operates at the physical layer of the OSI model? ( )

(a) Router (b) Switch (c) Repeater (d) Bridge

27. $\int e^x[Tanx + Sec^2x]\,dx$ =? ( )

(a) $e^x + c$ (b) $e^xTanx + c$ (c)$e^xSec^2x + c$ (d) None

28 .If $\begin{bmatrix} x & 4 \\ 2 & 8 \end{bmatrix}$ is a singular matrix then x = ? ( )

(a)1 (b)0 (c) 8 (d) None

29. What neuro physics technique is used for studying brain function and structure? ( )

(a) X- ray (b)EEG (c) PET scan (d) NMR spectroscopy

30. Which of the following is a benefit of recycling in solid waste management? ( )

(a) Increased land fill space (b) Energy consumption

(c) Resource conservation (d)Air pollution

SECTION –B (Fill in the blanks) 10X1 =10

31. The point slope form of a straight line is _____

32.The lines are perpendicular, if the product of their slopes is_____

33.Wind turbines convert the kinetic energy of _____into electrical energy

34. Hydropower generates electricity by harnessing the energy of flowing _____

35. _____ Catalysis method is commonly used for the degradation of organic dyes in waste water treatment

36. Computational method used to predict the three-dimensional structure of a protein is _____

37. In binary addition 1+1 equals to _____

38. A computer understand only _____ code

39. _____ connects two networks

40. $\int Sinx\, dx =$ _____

SECTION –C (Very short answer questions) 10X1 =10

41. Calculate the inverse of the matrix A= $\begin{bmatrix} 2 & 1 \\ 3 & 4 \end{bmatrix}$.

42. Find the equation of a line passing through (0,0) and (1,1).

43. Find the derivative of $\sqrt{2x+3}$.

44. What is the most common type of electrochemical energy storage?

45. How do quantum dots emit light?

46. What is the main environmental advantage of hydropower?

47. What is a digital signal?

48. What is the range of infrared waves?

49. Name the common disinfection method used in water treatment.

50. Name some sources of chemical pollutions.

SECTION – D (Matching) 2X5 =10

I.

(A)		(B)
51. $\lim_{x\to 0} \frac{Sinx}{x}$	( )	a. 10101
52. Decimal equivalent to $(1111)_2$ is	( )	b. 10010
53. Base of hexadecimal system is	( )	c. Infinite
54. The value of the binary number 18	( )	d. 1
55. $\lim_{x\to 0} e^{1/x}$	( )	e. 16
		f. 15

II.

	(A)		(B)
56.	Chlorination	( )	a. Forcing water through a semi-permeable membrane to remove contaminants
57.	Reverse Osmosis	( )	b. conversion of organic waste into nutrient rich soil
58.	Activated carbon Filtration	( )	c. Thermal treatment of waste to generate energy.
59.	Composting	( )	d. Adsorption of organic impurities and improvement of taste and odor contaminants
60.	Incineration	( )	e. Disinfection by killing micro organisms.
			f. Controlled disposal of waste in designated areas.

SECTION – E (True or False) 10X1 =10

61. The derivative of a constant function is always zero ( )

62. D $\left(\frac{1}{x}\right) = Logx$ ( )

63. Transpose of the matrix $\begin{bmatrix}1 & 2 & 3\\4 & 5 & 6\end{bmatrix}$ is $\begin{bmatrix}4 & 5 & 6\\1 & 2 & 3\end{bmatrix}$ ( )

64. Dye removal from waste water is done by photocatalysis ( )

65. Pesticides are atmospheric pollutants ( )

66. Mathematical models are used only in theoretical research ( )

67. Charles Babbage introduced the concept of zero ( )

68. 64 hexadecimal equals 100 decimal ( )

69. Green roofs reduce urban heat ( )

70. $\begin{bmatrix}1 & 2\\2 & 5\end{bmatrix}$ is a symmetric matrix ( )