Time:3hrs. (Set-A) MM: 80

General Instructions :
1. This Question paper contains - five sections A, B, C, D and E. Each section is compulsory.
2. Section A has 20 MCQ's questions of 1 mark each.
3. Section B has 5 questions of 2 marks each.
4. Section C has 6 questions of 3 marks each.
5. Section D has 4 questions of 5 marks each.
6. Section E has 3 case based questions of 4 marks each.

Section – A

Q1. The decimal equivalent of the binary number 10101 is

a) 21   b) 12   c) 22   d) 31

Q2. Which of the following is equal to x?

a) $x^{12/7} - x^{5/7}$ b) $\sqrt[12]{(x^4)^{1/3}}$ c) $\sqrt{(x^3)}^{2/3}$ d) $x^{12/7} - x^{7/12}$

Q3. Which of the following is a finite set?

a) $\{x : x = 2n, n \in N\}$ b) $\{x : x \text{ is a prime number}\}$

c) $\{x : x \in N, x \text{ is a factor of } 128\}$ d) $\{x : x \in I, x \leq 7\}$

Q4. Every set is a _____ of itself

a) set   b) proper set   c) subset   d) all of above

Q5. The sum of an infinite G.P. 10, −8, 6.4, ... is

a) $\frac{50}{9}$ b) $\frac{48}{9}$ c) $\frac{42}{9}$ d) $\frac{40}{9}$

Q6. Which of the following term is not the term of the A.P. −3, −7, −11, −15 ..., −403, ... −799?

a) −500   b) −399   c) −503   d) −51

Q7. The number of ways to arrange the letters of the word CHEESE are

a) 120   b) 240   c) 720   d) 60

Q8. If $^nC_{12} = {}^nC_8$ then, n is

a) 12   b) 8   c) 20   d) 30

Q9. If 'BLEPIN' is coded as '987416', 'MATPCN' is coded as '123416', then 'TABLE' is coded as

a) 32987   b) 32897   c) 38987   d) 21987

Q10. A woman introduces a man as the son of the brother of her mother. How is that man related to the woman?

a) Son   b) Uncle   c) Nephew   d) Cousin

Q11. Find the odd man out from following

a) insurance   b) provident fund   c) salary   d) shares

Q12. The domain of the function of defined by $f(x) = \sqrt{x^2 - 9}$ is

a) $[-3,3]$ b) $(-3,3)$ c) $(-\infty, 3] \cup [-3, \infty)$ d) $[0,3]$

Q13. An urn contains 9 red, 7 white and 4 black balls. A ball is drawn at random. The probability that ball drawn is neither black nor red is

b) $\frac{13}{20}$ b) $\frac{7}{20}$ c) $\frac{9}{20}$ d) $\frac{1}{5}$

Q14. If A and B are two independent events such that $0 < P(A) < 1$ and $0 < P(B) < 1$, then which of the following is not correct?

a) A and B are mutually exclusive   b) A and B' are independent

c) A' and B are independent   d) A' and B' are independent

Q15. If mean = median = mode, then t he frequency distribution is called _____ distribution

a) negative   b) zero   c) positive   d) central

Q16. A sequence of equal payments made at equal intervals of time is called

a) team   b) annuity   c)interest   d) principal

Q17. At what rate percent per annum will a sum of Rs. 12000 become Rs. 13230 in 2 years?

a) 5%   b) 5.5%   c) 6%   d) 6.5%

Q18. The distance between the lines $y = mx + c_1$ and $y = mx + c_2$ is

a) $\frac{c_1 - c_2}{\sqrt{m^2 + 1}}$ b) $\frac{|c_1 - c_2|}{\sqrt{m^2 + 1}}$ c) $\frac{c_2 - c_1}{\sqrt{m^2 + 1}}$ d) 0

In the following questions a statements – Assertion (A) and Reason (R). Answer the question selecting appropriate option given below:
a) Both A and R are true and R is correct explanation for A.
b) Both A and R are true but R is not correct explanation for A.
c) A is true but R is false.
d) A is false but R is true.

Q19. Assertion (A) : If $f(x) = 4x^3 - 7x^2 + 8x + 9,$ then $f'(2) = 7f'\left(\frac{1}{2}\right)$

Reason (R) : $\frac{d}{dx}\{f(x).g(x)\} = f(x)\frac{d}{dx}g(x) + g(x).\frac{d}{dx}f(x)$

Q20. Assertion (A): If A, B and C are three mutually exclusive and exhaustive events such that $P(C) = \frac{1}{4}$ $P(B), P(A) = \frac{1}{2}$ $P(B)$ $then$ $P(B) = \frac{3}{7}$

Reason (R) = For three mutually exclusive and exhaustive events A, B and C

$P(A) + P(B) + P(C) = 1$

Section – B

Q21. Taps A and B can fill a tank in 4 hours and 6 hours respectively and tap C an empty it in 12 hours. If all the three taps are opened together when the tank is empty, find after how many hours the tank will be full.

Q22. If a relation $R = \{(0,0), (2,4), (-1,-2), (3,6), 1,2)\}$ then

(i) write domain of R   (ii) Writ range of R

Q23. If $P(A) = \frac{6}{11}, P(B) = \frac{5}{11}, P(A \cup B) = \frac{7}{11}$, find

a) $P(A \cap B)$ b) $P(A/B)$

Q24. Find the coefficient of correlation between X and Y when Cov (X, Y)= -2.75, Var (X) = 6.25, Var (Y) = 20.05

Q25. If distance between the points (a, -2) and (5, 1) is 5 units, find the values(s) of a.

Section – C

Q26. In how many ways can a cricket eleven to be chosen out of a batch of 15 players if

a) these is no restriction on the selection?
b) a particular player is always chosen?
c) a particular player is never chosen?

Q27a) Statement I – All rectangles are quadrilaterals.

Statement II – No quadrilateral is a triangle.

Conclusion-I – All quadrilaterals are rectangles.

Conclusion-II – No triangle is a rectangle

In above question, which of the conclusion is/are true on basis of given statement. Draw diagram also

b) Find Q in   3 1 Q

    + 1 Q 3

    ‾‾‾‾‾
    5 0 1

Q28. If the function $f(x) = \begin{cases} 3ax + b, x > 1 \\ 11, x = 1 \\ 5ax - 2b, x < 1 \end{cases}$ is continuous at $x = 1$, find the values of a & b.

Q29. Compute the amount and the compound interest on Rs. 10,000 compounded annually for 2½ years at 4% per annum.

Q30. A bank pays 8% interest per annum compounded half yearly. What equal amount should be deposited at the end of each half year for 1½ years to get an amount of Rs. 2000 at the end of 18 months? $[(1.04)^3 = 1.125]$

Q31. Find the angles between the lines $\sqrt{3}x + y = 1 \ and \ x + \sqrt{3}y = 1$

Section – D

Q32. In a survey of 100 students, the number of students studying the various languages were found to be English only 18, English but not Hindi 23, English and German 8, English 26, German 48, German and Hindi 8, no language 24. Find the numbers of students who were studying

i) Hindi
ii) English and Hindi
iii) English, Hindi and German

Q33. *The number of loans sanctioned by a particular branch of a bank under different heads and percentage of defaulters in each category is given below:*

Type of loan	Number of loans approved	Defaulters (%)
Personal loan	15	3%
Education loan	5	1%
Housing loan	10	2%
Car loan	10	5%

If the loan application form picked up at random for review is found to be of a person who has defaulted, then find the probability that the application was for car loan.

Q34. Calculate Karl Pearson's coefficient of Skewness for following data :

x_i	4	6	8	10	12
f_i	4	8	14	11	3

Q35. A retailer buys a TV from a manufacturer for Rs. 25000. He marks the price of the TV 20% above his cost price and sells it to a consumer at 10% discount on the marked price. If the sales are intra-state and rate of GST is 12%, find:

a) The marked price of the TV.
b) Consumer's cost price of TV inclusive of tax (under GST)
c) GST paid by the retailer to the Central and State Governments.

Section – E

Case Study based questions:

Q36. Let y = f(x) be a function of x and let independent variable x change from x to x + δx, then y changes from y to y + δy

$$\frac{dy}{dx} = \lim_{\delta x \to 0} \frac{f(x+\delta x) - f(x)}{\delta(x)} = f'(x)$$

Based on above information answer following

1. Find derivative of $y = f(x) = 3x^7 - 5x^2 + 9$ (1)

2. Find derivative of $\frac{x-a}{x-b}$ (2)

3. If $f(x) = x^2 - 5x + 7$ find $f'(3)$ (1)

Q37. In financial year 2019-20, Mr. Chawla's (age 61 yrs) income from salary was Rs. 9,35,000 (exclusive of HRA) and income from interest on savings account was Rs. 15080. He deposited Rs. 11000 per month in GPF and paid Rs. 34000 as LIC premium. He donated Rs. 30,000 in National Security Fund. He paid Rs. 25000 as interest on education loan for higher studies of his son. Calculate the income tax at the end of the financial year.

Tax Regime for Senior Citizens

Taxable Income	Income Tax
Upto Rs. 3,00,000	NIL
Rs. 3,00,000 to Rs. 25,00,000	5% of taxable income exceeding Rs. 3,00,000
Rs. 5,00,000 to Rs. 10,00,000	Rs. 10,000 + 20% of taxable income exceeding Rs. 5,00,000
Above Rs. 10,00,000	Rs. 1,10,000 + 30% of taxable income exceeding Rs. 10,00,000

a) Find the amount invested by Mr. Chawla under section 80 – C. (1)
b) Under which section the donation in National Security Fund is claimed? (1)
c) Find the taxable income of Mr. Chawla. (2)

38. Six persons P, Q, R, S, T and U are sitting in a circle with their faces towards the centre. S is on the immediate left of T, P is on the immediate left of S and U is immediate neighbour of T, R is sitting second to the right of U.

i) Write the seating arrangement. (2)

ii) Name the immediate neighbours of Q. (1)

iii) Who is between S and R? (1)