BK BIRLA CENTRE FOR EDUCATIO

SARALA BIRLA GROUP OF SCHOOLS
SENIOR SECONDARY CO-ED DAY CUM BOYS' RESIDENTIAL SC

MID-TERM EXAMINATION 2024-25

APPLIED MATHEMATICS (241)

Class: XI   **Duration: 3 Hrs**
Date:23/09/24   **Max. Marks: 80**
Name: **Exam RNo.:**

General Instructions:
1. This Question Paper has 5 Sections A, B, C, D and E.
2. Section A has 20 MCQs carrying 1 mark each
3. Section B has 5 questions carrying 02 marks each.
4. Section C has 6 questions carrying 03 marks each.
5. Section D has 4 questions carrying 05 marks each.
6. Section E has 3 case-based integrated units of assessment (04 marks each) with sub-parts.
7. All Questions are compulsory. However, an internal choice in 2 Qs of 5 marks, 2 Qs of 3 marks and 2 Questions of 2 marks have been provided. An internal choice has been provided in the 2marks questions of Section E
8. Draw neat figures wherever required. Take $\pi = 22/7$ wherever required if not stated.

SECTION A

1. The base of the binary number system is   1m
   (a) 1   (b) 2   (c) 3   (d) 4

2. The one's complement of $(101)_2$ is   1m
   (a)10   (b)100   (c) 001   (d) none of these

3. The sum of $(10111)_2$ and $(1111)_2$ is   1m
   (a) 111111   (b) 101111   (c) 100110   (d) none of these

4. The value of $8^{-25} - 8^{-26}$ is   1m
   (a) 7×8^{-25} (b) 7×8^{-25} (c) 8×8^{-26} (d) none of these

5. If $a = b^x$, $b = c^y$, and $c = a^z$ then the value of x is   1m
   (a) 0   (b) -1   (c) 1   (d) none of these

6. If $\sqrt{2^n} = 64$, *the* value of n is   1m
   (a) 2   (b) 4   (c) 8   (d) 12

7. A batsman in his 17th innings makes a score of 85 and thereby increases his average by 3. What is his average after 17 innings?   1m
   (a) 27   (b) 30   (c) 37   (d) 40

8. If three years ago, the average age of A, B and C was 27 years and that of B and C five years ago was 20 years, then the present age of A is   1m
   (a) 30 years   (b) 35 years   (c) 38 years   (d) 40 years

9. How many rotations will the hour hand of a clock complete in 72 hours?   1m
   (a) 3   (b) 6   (c) 9   (d) none of these

10. If P be the set of all positive Prime integers and E be the set of all positive even integers then $P \cap E$ is   1m
    (a) {1,2} (b) {2} (c) 2 (d) {2,1}

11. Which of the following is not true?   1m
    (a) $A \cap B = B \cap A$ (b) $A \cap A = A$ (c) $A \cap \phi = \phi$ (d) $A \cap U = U$

12. If $f(x) = x^3 - (1/x^3)$, then $f(x) + f(1/x)$ is equal to   1m
    (a) $2x^3$ (b) $1/2x^3$ (c) 0 (d) none of these

13. If $f(x) = ax + b$, where a and b are integers, $f(-1) = -5$ and $f(3) = 3$, then a and b are equal to   1m
    (a) $a = -3, b = -1$ (b) $a = 2, b = -3$ (c) $a = 0, b = 2$ (d) none of these

14. The 10th common term between the series 3+7+11+…and 1+6+11+….. is   1m
    (a) 191 (b) 193 (c) 220 (d) none of these

15. If 9 times the 9th term of an A.P is equal to 13 times the 13th term, then the 22nd term of the A.P is   1m
    (a) 0 (b) 22 (c) 220 (d) none of these

16. The first and the last term of an A.P. are 1 and 11. If the sum of its terms is 36, then the number of terms will be   1m
    (a) 6 (b) 7 (c) 8 (d) none of these

17. The number of 2-digit even numbers that can be formed with the digit 1,2,3,4,5 ,if no digits being repeated is   1m
    (a) 8 (b) 10 (c) 20 (d) none of these

18. The number of 2-digit even numbers that can be formed with the digit 1,2,3,4,5 if the digits can be repeated is   1m
    (a) 10 (b) 30 (c) 20 (d) none of these

19. (A) The collection of all-natural numbers less than 100 is a set.   1m
    (R) A set is a well-defined collection of distinct objects.
    (a) Both A and R are true and R is the correct explanation of A.
    (b) Both A and R are true but R is not the correct explanation of A.
    (c) A is true but R is false.
    (d) A is false but R is true

20. (A) $f(x) = 5x^4 - 9x^2 + 3$ is an even function.
    (R) A function $f(x)$ is said to be an even function if $f(-x) = -f(x)$.
    (a) Both A and R are true and R is the correct explanation of A.
    (b) Both A and R are true but R is not the correct explanation of A.
    (c) A is true but R is false.
    (d) A is false but R is true

SECTION B

21. Subtract $(11011)_2$ from $(110101)_2$.   2m

OR

Add the following binary numbers:
101011 + 110101

22. If log 2 = 0.3010 and log 3 = 0.4771, find the values of log 360   2m

Or

Use of the property of logarithms, solve for the value of x for $\log_3 x = \log_3 4 + \log_3 7$

23. Rekha goes to school at a speed of 3 km/hr and returns to her home at 2km/hr. If she takes 5 hours, what is the distance between her home and school? **2m**

24. In how many ways can 5 children be arranged in a line such that **2m**
    (i) Two particular children are always together and
    (ii) Two particular children are never together?
    (i)

25. Write the following sets in roster form: **2m**
    (i) A = {x : x is an integer and –3 ≤ x < 7}
    (ii) B = {x : x is a natural number less than 6}

SECTION C

26. Find the seventh root of 0.00001427. **3m**

OR

Evaluate $(0.038)^{1/4}$, given log38 = 1.5798

27. If P(5,r) = 2 x P(6,r-1), find r. **3m**

OR

If C(n, r-1) = 36, C(n,r) = 84 and C(n, r+1) = 126, then find C(r,2). **3m**

28. By walking at 3/4 of his usual speed a man reaches his office 10 minutes late than his usual time. find the usual time taken by him to reach his office. **3m**

29. Let a,b,c be in A.P. If p is the Arithmetic mean between a and b and q is the Arithmetic mean between B and C then prove that b is the Arithmetic mean between p and q. **3m**

30. Find the domain and range of the real function $f(x) = \dfrac{x}{1+x^2}$. **3m**

31. Find the domain for which $f(x) = 2x^2 - 1$ and $g(x) = 1 - 3x$ are equal. **3m**

SECTION D

32. Find the product of 45 and 107 using binary numbers and check your answer. **5m**

OR

Divide 101010 by 110 and check your answer.

33. A alone can do a piece of work in 6 days and B alone can do it in 8 days. A and B undertook to do it for rupees 3200 with the help of C. They completed the work in three days. Find the share of each person. **5m**

OR

At what time between 4 and 5 o'clock, will the hands of a clock be at the right angle?

34. If A = {3,4,6} , B = { 1,3 } and C = {1,2,6} ,then find   5m
    (i)   A X (B∩C)
    (ii)   A X (B – C)
    (iii)   (A-B) X (A – C)

35. Draw the graph of the following function: 5m

$$f(x) = \begin{cases} 3 - x \,, if \ x > 1 \\ 1, if \ x \ = \ 1 \\ 2x, if \ x \ < \ 1 \end{cases}$$

SECTION E

36. A and B together can do a piece of work in 24 days, B and C together can do   4m
    the same in 40 days, and C and A together can do it in 30 days.
    1. Find the number of days in which A, B and C can finish the work together.
    2. Find the number of days in which A alone can finish the work.
    3. Find the number of days in which B alone can finish the work.

37. The figure shows are big Triangle in which multiple other Triangles may be   4m
    observed in the pattern
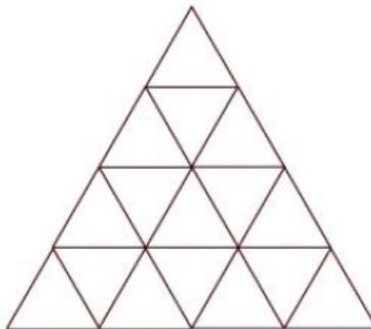
    1.How many triangles will be there in the 15th row?
                                Or
    Write the difference between number of triangles in 7th row and 10th row.
    2. In which row will the number of triangles be 47?
    3. How many small triangles will be there in the figure in 10th row?

38. The Task is to form different words with the letters of the word "BHARAT".   4m
    1. In how many of these B and H are never together?
    2. How many of these begin with B and end with T?
    3. How many total permutations are possible?

********BEST OF LUCK*********