BK BIRLA CENTRE FOR EDUCATION

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

MID TERM EXAMINATION (2024-25)

APPLIED MATHEMATICS (241)

Class: XII Commerce
Date: 25/09/24
Admission Number: _____

Duration: 3 Hour
Max. Marks: 80
Roll number: ____

General Instructions:
1. This Question paper contains - five sections A, B, C, D and E. Each section is compulsory. However, there are internal choices in some questions.
2. Section A has 18 MCQ's and 02 Assertion-Reason based questions of 1 mark each.
3. Section B has 5 Very Short Answer (VSA)-type questions of 2 marks each.
4. Section C has 6 Short Answer (SA)-type questions of 3 marks each.
5. Section D has 4 Long Answer (LA)-type questions of 5 marks each.
6. Section E has 3 source based/case based/passage based/integrated units of assessment of 4 marks each with sub parts.

Section –A (Multiple Choice Questions)
Each question carries 1 mark

1. (18x10) (mod7) is:

    (A) 5   (B) 4   (C) 6   (D) 7

2. 20 litres of a mixture contains milk and water in the ratio 3:1. The amount of milk, in litres to be added to the mixture so as to have milk and water in the ratio 4:1 is

    (A) 7   (B) 4   (C) 5   (D) 6

3. Two pipes A and B can fill a tank in 30 minutes and 40 minute respectively. Both pipes are opened. The tank will be filled in 21 minutes, if the pipe B is turned off after

    (A) 9 minutes   (B) 10 minutes   (C) 1 minutes   (D) 12 minutes

4. If $|x - 2| \geq 7, x \in R, then$

    (A) x$\in [-5,9]$ (B) x$(-5,9]$

    (C) x$\in (-\infty, -5] \cup [9, \infty)$ (D) x$\in (-\infty, -5) \cup (9, \infty)$

5. If x$\in R, |x| \leq 9, then$

    (A)-9$\leq x \leq 9$ (B) x≥ 9 (C) x≤ -9 (D) -9$< x < 9$

6. The solution set of the in equation $|x + 2| \leq 5\ is$

    (A) (-7,5)   (B) $[-7,3]$ (C) $[-5,5]$ (D) (-7,3)

7 The matrix A = $\begin{bmatrix} 0 & 0 & 2 \\ 0 & 2 & 0 \\ 0 & 0 & 2 \end{bmatrix}$ is a

(A) scalar matrix   (B) diagonal matrix   (C) square matrix   (D) none of these

8 If A = $\begin{bmatrix} -3 & x \\ y & 5 \end{bmatrix}$ and A=A', then

(A) =5,y=-3   (B) x=-3,y=5   (C) x=y   (D) none of these

9 If $\begin{vmatrix} 3x & 4 \\ 5 & x \end{vmatrix} = \begin{vmatrix} 4 & -3 \\ 5 & -2 \end{vmatrix}$, then x=

(A) 3 only   (B) -3 Only   (C) 3or -3   (D) 6 or -6

10 If $\begin{vmatrix} 1 & 3 & 9 \\ 1 & x & x^2 \\ 4 & 6 & 9 \end{vmatrix}$ is singular matrix, then x=

(A) 3   (B) 3 or 6   (C) 3 or $\frac{3}{6}$ (D) -3,$\frac{3}{2}$

11 The rise in prices before Diwali is an example of

(A) seasonal trend   (B) cyclic trend   (C) Long term trend (D) Irregular trend

12 Seasonal variations are

(A) short term   (B) long term   (C) sudden   (D) none of these

13 A factory production is delayed for three weeks due to breakdown of a machine and unavailability of spare parts. Under which trend oscillation does this situation fall?

(A) seasonal   (B) cyclic   (C) secular   (D) irregular

14 The present value of a perpetuity of Rs.750 payable at the beginning of each year, if money is worth 5% p.a., is

(A) 15000   (B) 15750   (C) 14250   (D) none of these

15 Rohan invested Rs. 300000 in a fund for two years. At the end of two years the investment was worth Rs. 327000. Rohans rate of return is

(A) 6%   (B) 7%   (C) 8%   (D) 9%

16 A vehicle costing Rs. 125000 has scrap value of Rs. 25000. If annual depreciation charge is Rs.12500, then useful life of the vehicle is:

(A) 4yrs   (B) 6yrs   (C) 8 yrs   (D) 10 yrs

17 If the objective function for a L.P.P. is Z= 5x+7y and the corner points of the bounded feasible region are (0,0), (7,0), (3,4) and (0,2) , then the maximum value of Z occurs at

(A) (0,0)   (B) (7,0)   (C) (3,4)   (D) (0,2)

18 If the objective function for an LPP is Z= 3x-4y and the corner points for the bounded feasible region are (0, 0), (5, 0), (6, 8), (4, 10) and (0, 8), then the minimum value of Z occurs at

(A) (0,0)   (B) (0,8)   (C) (5,0)   (D) (4,10)

Assertion and Reasoning questions: In the following two questions, a statement of Assertion (A) is followed by a statement of Reason (R). Choose the correct answer out of the following choices.

    (A)   Both A and R are true and R is the correct explanation of A.
    (B)   Both A and R are true and R is not the correct explanation of A.
    (C)   A is true but R is false.
    (D)   A is false but R is true.

19   Assertion (A): If a, b are both positive real numbers, then $\sqrt{ab}$ lie between a and b
    Reason (R):   for positive real number A.M. $\geq G.M.$

20   Assertion (A): The EMI under flat rate method for a loan of Rs. 100000 at the rate of 12% for 4 years is Rs. 3083.33.
    Reason (R):   Under flat rate method of calculating EMI, the borrower is at loss because the interest remains constant for every EMI and does not reduce as the outstanding principal amount decreases with every EMI.

Section –B
[This section comprises of very short answer type questions (VSA) of 2 marks each]

21   If $147 \equiv 3(\bmod m)$, then find the value of m

22   Solve the inequality 3-2x$\geq$ x-32, given that x$\in I$.

23   Find the values of a and b for which the following hold: $\begin{bmatrix} a & b \\ -a & 2b \end{bmatrix}\begin{bmatrix} 2 \\ -1 \end{bmatrix}=\begin{bmatrix} 5 \\ 4 \end{bmatrix}$.

24   Find the value of x if $\begin{vmatrix} 2x+5 & 3 \\ 5x+2 & 9 \end{vmatrix}=0$

25   Sanjay takes a personal loan of Rs. 500000 at the rate of 12% per annum for 3 years. Calculate his EMI by using flat rate method.

Section – C
[This section comprises of short answer type questions (SA) of 3 marks each]

26   Find all pair of consecutive even positive integers, both of which are larger than 5, such that their sum is less than 23

<p align="center">OR</p>

    Solve the following system of linear inequalities: $4x-5< 11 , -3x - 4 \geq 8$.

27   Find the matrix X for which $\begin{bmatrix} 5 & 4 \\ 1 & 1 \end{bmatrix}X =\begin{bmatrix} 1 & -2 \\ 1 & 3 \end{bmatrix}$.

28   Solve the system of linear equation by Cramer's rule: 6x+y-3z-5=0, x+3y-2z-5=0, 2x+y+4z-8=0

<p align="center">OR</p>

    Using matrix method, solve the following system of linear equation: 3x+2y-2z=3, x+2y+3z=6, 2x-y+z=2.

29   Fit a straight line trend by the method of least square for the following data. Also tabulate the trend value.

Year	2004	2005	2006	2007	2008	2009	2010
Profit (Rs.000)	114	130	126	144	138	156	164

30   A firm anticipates an expenditure of Rs. 500000 for plant modernization at end of 10 years from now. How much should the company deposit at the end of each year into a sinking fund earning interest 5% per annum. If $(1.05)^{10}= 1.629$.

OR

The average number, in lakh, of working days lost in strikes during each year of the period (1981-90) was as under

1981	1982	1983	1984	1985	1986	1987	1988	1989	1990
1.5	1.8	1.9	2.2	2.6	3.7	2.2	6.4	3.6	5.4

31   Solve the following linear programming problem graphically: Maximize and minimize $Z= 60x+15y$ subject to the constraints $x+y \leq 50$, $3x+y \leq 90$, $x,y \geq 0$.

Section –D

[This section comprises of long answer type questions (LA) of 5 marks each]

32   Two vessels A and B contain milk and water in the ratio 7:5 and 17:7 respectively. In what ratio mixtures from two vessels should be mixed to get a new mixture containing milk and water in the ratio 5:3?

OR

A boat goes 12km downstream and comes back to the starting point in 3 hours. If the speed of the stream is 3km/hr, find the speed of the boat in still water.

33   If A$= \begin{bmatrix} 1 & -1 \\ 2 & -1 \end{bmatrix}$, B$= \begin{bmatrix} a & 1 \\ b & -1 \end{bmatrix}$ and $(A+B)^2 = A^2 +B^2$, find a and b.

34   Mr Dinesh has two investment options either 10% per annum compounded semi-annually or 9.8% per annum compounded quarterly. Which option is better for Mr Dinesh? Given $(1.0245)^4= 1.1017$.

35   One kind of cake requires 300g of flour and 15g of fat, another kind of cake requires 150g of flour and 30g of fat. Find the maximum number of cakes which can be made from 7.5kg four and 600g of fat, assuming that there is no shortage of the other ingredients used in making the cakes, make it an L.P.P. and solve it graphically.

Section –E

[This section comprises of 3 case- study/passage based questions of 4 marks each with sub parts. The all three case study questions have three sub parts (i), (ii), (iii) of marks 1, 1, 2 respectively.

36   Marks obtained by Radhika in quarterly and half yearly exams of Mathematics are 60 and 70 respectively.
Based on the above information, answer the following questions:
(A)   Find the maximum marks, she should get in the annual exam to have an average of atmost 75 marks.
(B) Find the range of marks in annual exam, so that the average mark is at least 60 and at most 70.

(C) If average of at least 60 marks is considered pass, then find the minimum marks she need to score in annual exam to pass.

37   On his birthday, Ishan decided to donate some money to children of an orphanage home. If there were 8 children less, everyone would have got Rs. 10 more. However, if there were 16 children more, everyone would have got Rs. 10 less.
Let the number of children be x and amount distributed by Ishaan to each child be Rs. Y.
Based on the above information, answer the following questions:
(A) Write matrix equation represent the information given below.
(B) If A is the coefficient matrix of above situation, then what is (adjA)?
(C) Find the number of children and amount donated by Ishan.

38   Linear programming is a method for finding the optimal values (maximum or minimum) of quantities subject to the constraints when relationship is expressed as linear equation or in equations.
     Based on the above information, answer the following questions.
  (A) At which point the optimal value of the objective function is attained?

  (B) Draw the graph of the inequality $3x + 4y < 12$.

  (C) The feasible region for an LPP is shown in the figure. Let $Z = 2x + 5y$ be the objective function. Maximum of Z occurs at

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