Academic Year	**:**	**2025 – 2026**
Examination	**:**	**BOARD**
Month	**:**	**MARCH 2026**
CLASS	**:**	**12**

Paper Code : 241

Roll No. | | | | |

Candidates must write the Code on the title page of the answer-book.

Name of the Candidate :

NOTE	
(I)	Please check that this question paper contains ***12*** printed pages.
(II)	Code Number given on the right-hand side of the question paper should be written on the title page of the answer-book by the candidate.
(III)	Please check that this question paper contains **38** questions.
(IV)	**Please write down the Serial Number of the question in the answer-book before attempting it.**
(V)	The first 15 minutes time has been allotted to read this question paper. The students will read the question paper only and will not write any answer on the answer-book during this period.
(VI)	Please write down the Roll No. and the Name of the Candidate on the top of the question paper, in the space provided, before reading the questions.

APPLIED MATHEMATICS

Time allowed : Three hours

Maximum Marks : 80

P.T.O.

General Instructions:

Read the following instructions very carefully and strictly follow them:

1. *This Question Paper has 5 Sections A - 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 with sub-parts of the values of 1, 1 and 2 marks each respectively.*
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 has 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.*
9. *Use of calculators is not allowed.*

Section - A

Section A consists of 20 questions of 1 mark each.

1. If $A = \begin{bmatrix} 4 & 1 \\ 3 & 2 \end{bmatrix}$ and $I = \begin{bmatrix} 1 & 0 \\ 0 & 1 \end{bmatrix}$, then $(A^2 - 6A)$ is equal to **1**

(A) 3 I

(B) – 5 I

(C) 5 I

(D) – 3 I

2. In a 1 km race, player P beats player Q by 18 metres or 9 seconds. What is P's time to complete the race? **1**

(A) 512 seconds

(B) 502 seconds

(C) 491 seconds

(D) 481 seconds

3. In a 100 m race, *A* can beat *B* by 25 m and *B* can beat *C* by 4 m. By how much can *A* beat *C* in the same race? **1**

(A) 32 m

(B) 28 m

(C) 24 m

(D) 20 m

4. The test statistic for a one sample *t*-test, denoted by *t*, is defined as **1**

(A) $t = \frac{\bar{x}-\mu}{\left(\frac{S}{\sqrt{n}}\right)}$

(B) $t = \frac{\bar{x}-\mu}{\left(\frac{S}{n}\right)}$

(C) $t = \frac{\bar{x}-\mu}{\left(\frac{S^2}{n}\right)}$

(D) $t = \frac{\bar{x}-\mu}{\left(\frac{S}{n^2}\right)}$

where μ is the population mean and $\bar{x}$ is the sample mean.

5. The number of solutions of an L.P.P. to minimize $z = 3x + 2y$ under the constraints **1**

$x + y \geq 8$,

$3x + 5y \leq 15$

and $x, y \geq 0$, is

(A) 2

(B) 5

(C) infinitely many

(D) zero

6. In a large consignment of electric bulbs of a batch of batteries are defective. A random sample of 80 is taken for inspection with replacement. Then the Variance of the number of defectives in the sample, is 5% **1**

(A) 18/5

(B) 19/5

(C) 4.55

(D) 8

7. A random variable X takes the values – 1, 0, 1. If its mean is 0.6 and $P(X = 0) = 0.2$, then $P(X = 1)$ is **1**

(A) 0.7

(B) 0.5

(C) 0.4

(D) 0.3

8. An investment's starting value is ₹10,000 and it grows to ₹60,000 in 4 years. The CAGR is (Given $6^{1/4} = 1.56508$) **1**

(A) 1.56%

(B) 5.65%

(C) 15.65%

(D) 56.50%

9. Which of the following is true? **1**

(A) $0 < P(A) < 1$

(B) $0 \leq P(A) \leq 1$

(C) $0 < P(A) \leq 1$

(D) $0 \leq P(A) < 1$

10. One hundred identical coins each with probability p showing up heads are tossed once. If $0 < p < 1$ and the probability of heads on 50 coins is equal to that of heads showing on 51 coins, then the value of p is **1**

(A) 1/2

(B) 49/101

(C) 50/101

(D) 51/101

11. If the annual depreciation of an asset is ₹40,000 and its scrap value after useful life of 15 years is ₹50,000, then the original cost of the asset is **1**

(A) ₹7,60,000

(B) ₹7,20,000

(C) ₹6,50,000

(D) ₹6,30,000

12. At what rate of interest will the present value of a perpetuity of ₹500 payable at the end of each quarter be ₹40,000? **1**

(A) 1.25% p.a.

(B) 2.5% p.a.

(C) 5% p.a.

(D) 6% p.a.

13. The effective rate of interest equivalent to the nominal rate 6% compounded semi-annually is **1**

(A) 6.05%

(B) 6.07%

(C) 6.09%

(D) 6.1%

14. Standard deviation of a sample from a population is called a - **1**

(A) Standard error

(B) Parameter

(C) Statistic

(D) Central limit

15. A specific characteristic of a sample is known as a **1**

(A) population

(B) parameter

(C) statistic

(D) variance

16. A player rolls one fair die. If the die shows an odd number, the player wins the value that appears on the die, else loses half the value that appears on it. The expected gain of the player is **1**

(A) $-1/2$

(B) 0

(C) $1/2$

(D) 1

17. For the given values 23, 32, 40, 47, 58, 33, 42; the 5-yearly moving averages are **1**

(A) 38, 40, 42

(B) 40, 42, 44

(C) 40, 42, 46

(D) 42, 44, 46

18. For the annual payment R to remain the same in case the interest rate decreases from 6% to 4%, the present value of a perpetuity **1**

(A) will decrease.

(B) will remain the same

(C) will increase

(D) will no longer be valid

DIRECTION: In question numbers 19 and 20, a statement of **Assertion** (**A**) is followed by a statement of **Reason** (**R**). Choose the correct option.

19. ***Assertion*** **A**: The function $f(x) = x^2 - x + 1$ is strictly increasing on $(-1, 1)$. **1**

Reason **R**: If $f(x)$ is continuous on $[a, b]$ and derivable on (a, b), then $f(x)$ is strictly increasing on $[a, b]$ if $f'(x) > 0$ for all $x \in (a, b)$.

(A) Both Assertion (A) and Reason (R) are true, and reason (R) is the correct explanation of assertion (A)

(B) Both Assertion (A) and Reason (R) are true, and Reason (R) is not the correct explanation of Assertion (A)

(C) Assertion (A) is true, but Reason (R) is false.

(D) Assertion (A) is false, but Reason (R) is true.

20. ***Assertion*** **A**: The degree of the differential equation **1**

$$\left(\frac{d^2y}{dx^2}\right)^3 + \left(\frac{dy}{dx}\right)^2 + \sin\left(\frac{dy}{dx}\right) + 1 = 0$$

is 3.

***Reason* R**: The highest power of the highest order derivative involved in a differential equation, when it is written as a polynomial in derivatives, is called its degree.

(A) Both Assertion (A) and Reason (R) are true, and reason (R) is the correct explanation of assertion (A)

(B) Both Assertion (A) and Reason (R) are true, and Reason (R) is not the correct explanation of Assertion (A)

(C) Assertion (A) is true, but Reason (R) is false.

(D) Assertion (A) is false, but Reason (R) is true.

Section - B

Section B consists of 5 questions of 2 marks each.

21. Two pipes P and Q together can fill a tank in 10 minutes. If pipe P takes 15 minutes less than Q to fill the tank alone, then find the time taken by pipe Q to fill the tank alone. **2**

OR

In a 200 m race, A beats B by 35 m or 7 seconds. Find the time taken by A to complete the race.

22. Find the solution to the following linear programming problem (if it exists) graphically **2**

Maximize $Z = x + y$

subject to the constraints

$x - y \leq -1$

$-x + y \leq 0$

where $x, y \geq 0$.

23. Suppose that a 95% confidence interval states that population mean is greater than 100 and less than 300. How would you interpret this statement? **2**

24. Using Cramer's rule, solve the following system of equations **2**

$2x_1 + 3x_2 = 5$

$11x_1 - 5x_2 = 6$

25. Find the present value of a perpetuity of ₹4,200 payable at the beginning of each year, if money is worth 5% compounded annually. **2**

OR

Mr Surya borrowed a sum of ₹500000 with total interest to be paid ₹200000 (flat) and he is paying an EMI of ₹12500. Calculate loan tenure.

SECTION C

Section C consists of 6 questions of 3 marks each.

26. Solve $3x + 8 > 2$, when **3**

(i) x is an integer.

(ii) x is a natural number.

(iii) x is a whole number.

OR

A man goes 12 km downstream and comes back to the starting point by swimming non-stop in 3 hours. If the speed of the stream is 3 km/h, find the speed with which the man can swim in still water.

27. A company has approximated the marginal cost and marginal revenue functions for one of its products by $MC = 81 - 16x + x^2$ and $MR = 20x - 2x^2$ respectively. Determine the profit maximizing output and the total profit at the optimum output, assuming fixed cost as zero. **3**

28. Evaluate: $\begin{vmatrix} 1 & x & x^2 \\ 1 & y & y^2 \\ 1 & z & z^2 \end{vmatrix}$ **3**

29. Evaluate the following integral: **3**

$$\int \frac{2x^2 + 1}{x^2 - 3x + 2}\, dx$$

30. Differentiate x^x w. r. t. x. **3**

31. A recent accounting graduate opened a new business and installed a computer system that costs ₹55,200. The computer system will be depreciated linearly over 4 years and will have a scrap value of ₹0. **3**

(i) What is the rate of depreciation?

(ii) Give a linear equation that describes the computer system's book value at the end of t^{th} year, where $0 \leq t \leq 4$.

(iii) What will be the computer system's book value at the end of the second year and a half?

OR

Find the effective rate which is equivalent to normal rate of 10% p. a. compounded

(i) semi-annually.

(ii) quarterly.

[Given $(1{\cdot}05)^2 = 1{\cdot}1025$, $(1{\cdot}025)^4 = 1{\cdot}1038$]

SECTION D

Section D consists of 4 questions of 5 marks each.

32. Madhu exchanged her old car valued at ₹1,50,000 with a new one priced at ₹6,50,000. She paid ₹x as down payment and the balance in 20 monthly equal instalments of ₹21,000 each. The rate of interest offered to her is 9% p.a. Find the value of x. **5**

[Given that $(1{\cdot}0075)^{-20} = 0{\cdot}86118985$]

33. The annual rice production (in million tonnes) in a particular state over the past five years is as follows: **5**

Year	2017	2018	2019	2020	2021
Rice Production (million tonnes)	9.5	10	10.5	11.2	12

Find the best fitted trend line by the method of least squares and tabulate the trend values that represents the rice production. Also predict the production for the year 2025.

P.T.O.

OR

The following data shows the number of vehicles passing through a busy traffic intersection on a specific road in National Capital of India during the months of March to December in 2023:

Month	**Number of vehicles (in thousands)**
March	30
April	35
May	38
June	36
July	40
August	42
September	39
October	45
November	48
December	47

Calculate the 3-month moving average for the given data and determine the trend. Plot the graph to represent the trend values.

34. A dietician has to develop a special diet using two foods *P* and *Q*. Each packet (containing 30 g) of food *P* contains 12 units of calcium, 4 units of iron, 6 units of cholesterol and 6 units of Vitamin *A*. Each packet of the same quantity of food *Q* contains 3 units of calcium, 20 units of iron, 4 units of cholesterol and 3 units of Vitamin *A*. The diet requires at least 240 units of calcium, at least 460 units of iron and at most 300 units of cholesterol. How many packets of each food should be used to minimize the amount of Vitamin *A*? What is the minimum amount of Vitamin *A*? Formulate the above problem as an L.P.P. and solve it graphically. **5**

35. Find all the points of local maxima and local minima of the function: **5**

$$f(x) = -\frac{3}{4}x^4 - 8x^3 - \frac{45}{2}x^2 + 105$$

OR

Find the intervals in which the following function f is strictly increasing or strictly decreasing:

$$f(x) = 20 - 9x + 6x^2 - x^3.$$

SECTION E

This section comprises 3 case study-based questions of 4 marks each.

36. Case Study based – 1

Rohini wants to give a rectangular plot of land for a school in her village. When she was asked to mention the dimensions of the plot, she told that if its length is decreased by 50 m and breadth is increased by 50 m, then its area does not alter, but if its length is decreased by 10 m and breadth is decreased by 20 m, then its area will decrease by 5300 sq m. Based on the above information, answer the following questions.

(i) Assuming x m and y m as the length and breadth of the plot respectively, write the system of linear equations in x and y. **1**

(ii) Write the system of linear equations obtained in (i) in the matrix equation $AX = B$. **1**

(iii) Determine A^{-1}. **2**

OR

Find the area of the plot.

37. Case Study based – 2

For providing water to the families of a colony, a large water tank with two inlet pipes A and B and an outlet pipe C, is installed. Pipes A and B can fill the tank in 10 hours and 12 hours respectively; whereas pipe C can empty the tank in 15 hours. Based on the above information, answer the following questions.

(i) If both pipes A and B are opened together, then find the time in which the tank will be filled completely. **1**

(ii) If both pipes A and C are opened together, then find the time in which the tank will be filled completely. **1**

2

(iii) If all the three pipes A, B and C are opened together, then find the time in which the tank will be filled completely.

OR

Pipes A and B are opened together for some time and then pipe B is turned off after some time. If the tank is completely filled in 6 hours, then after how many hours is pipe B turned off?

38. Case Study based – 3

The Mathematics scores of a group of 500 students follow a normal distribution with a mean of 75 and a standard deviation of 8. Based on this data, answer the following questions:

(i) What percentage of students scored below 75 marks? **1**

(ii) Find the number of students who scored more than 82 marks. **1**

(iii) Calculate the number of students scoring between 67 and 83 marks. **2**

OR

The top 10% of students are awarded a scholarship. The Z-score for the 90th percentile is 1.28. Determine the minimum score required to qualify for the scholarship.

[Use $P(Z < 0.875) = 0.8092$, $P(Z < 1) = 0.8413$, $P(Z < -1) = 0.1587$.]