Delhi Public School, Howrah

FINAL EXAMINATION (2024 - 2025)

Class - XI

Care must be taken not to write anything on the question paper. All the questions must be attempted in the correct sequence.

Subject: - Applied Mathematics (Code No. - 241)

Time: 3 Hours **F.M.80**

General Instructions:

1. This Question paper contains - five sections A, B, C, D and E. Each section is compulsory. However, there is some internal choice in some questions.
2. Section A has 18 MCQ's and 2 Assertion Reason based questions of 1 mark each.
3. Section B has 5 Very Short Answer (VSA) questions of 2 marks each.
4. Section C has 6 Short Answer (SA) questions of 3 marks each.
5. Section D has 4 Long Answer (LA) questions of 5 marks each.
6. Section E has 3 sources based/case based/passage based/integrated units of assessment (4 marks each) with sub parts.
7. Internal Choice is provided in 2 questions in Section-B, 2 questions in Section-C, 2 Questions in Section-D. You have to attempt only one alternative in all such questions.

SECTION A

(All Questions are compulsory. No internal choice is provided in this section)

1) The decimal equivalent of the binary number 100101 is 1

(a) 21 (b) 12 (c) 31 (d) None of these

2) Characteristic of log 0.0003798 is 1

(a) $\bar{4}$ (b) $\bar{3}$ (c) 4 (d) 3

3) It was Thursday on February 12, 2004. What was the day of the week on February 12, 2003? 1

(a) Friday (b) Wednesday (c) Saturday (d) Tuesday

4) In a cylinder, if radius is halved and height is doubled, then the volume will be 1

(a) same (b) doubled (c) halved (d) four times

5) If the 3rd term of a Geometric Progression is 2, then the product of the first five terms of the series is 1

(a) 25 (b) 32 (c) 9 (d) 243

6) If $n(U) = 50, n(A) = 38, n(B) = 30$ then the least value of $n(A \cup B)$ is 1

(a) 30 (b) 38 (c) 50 (d) 18

7) Find the value of $\log(\log x^2) - \log(\log x)$. 1

(a) $-\log 2$ (b) $\log 3$ (c) 0 (d) $\log 2$

8) In a certain language, 321 means "Glass of Tea", 426 means "Tea is brown" and 796 means "Trunks are brown". Which of the following represents "is" in that language? 1

(a) 6 (b) 7 (c) 4 (d) 2

9) The value of the function at $x = 0$, so that the function $f(x) = \frac{2^x - 2^{-x}}{x}, x \neq 0$ is continuous at $x = 0$ is 1

(a) 0 (b) log 2 (c) log 4 (d) 16

10) The letters of the word "SOCIETY" are placed at random in a row. The probability that the three vowels occur together is 1

(a) $\frac{1}{7}$ (b) $\frac{2}{7}$ (c) $\frac{3}{7}$ (d) $\frac{4}{7}$

11) The amount of money today which is equal to series of payments in future is 1

(a) Nominal value of annuity (b) sinking value of annuity

(c) present value of annuity (d) future value of annuity

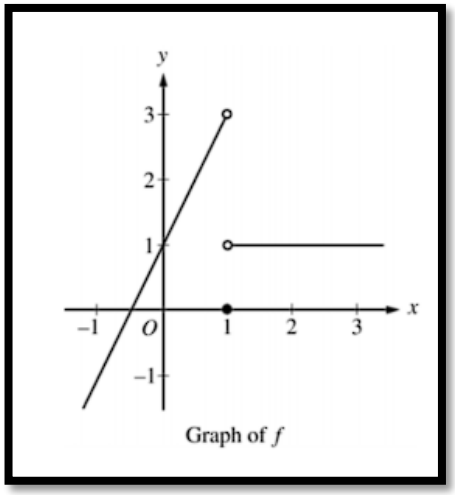
12) The variance of first 5 natural numbers is 1

(a) 1 (b) 2 (c) 3 (d) 4

13) Evaluate: $(256)^{0.16} \times (256)^{0.09}$. 1

(a) 4 (b) 16 (c) 64 (d) 256.25

14) The graph of $y = f(x)$ is given below. Find the value of $Lt_{x \to 1} f(x)$. 1



Graph of f

(a) 0 (b) 1 (c) 3 (d) Non - existent

15) The variance of a mesokurtic distribution is 9. The fourth central moment is 1

(a) 243 (b) 343 (c) 81 (d) 342

16) At what rate percent per annum will a sum of ₹ 12000 becomes ₹ 13230 in 2 years? 1

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

17) The coefficient of correlation is 1

(a) Greater than the coefficient of determination

(b) the square of the coefficient of determination

(c) the square root of the coefficient of determination

(d) equal to the coefficient of determination

18) The amount of a regular annuity of ₹ 10000 payable at the end of each year for 3 years at 10 % per annum compounded annually is 1

(a) ₹ 3310 (b) ₹ 11000 (c) ₹ 12000 (d) ₹ 12100

ASSERTION REASON BASED QUESTIONS

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

(i) Both A and R are true and R is the correct explanation of A.

(ii) Both A and R are true and R is not the correct explanation of A.

(iii) A is true but R is false.

(iv) A is false but R is true.

19) Assertion (A): If A and B are two mutually exclusive events associated with a random experiment and F is an event such that $P(F) \neq 0$, then $P\left(\frac{AUB}{F}\right) = P\left(\frac{A}{F}\right) + P(\frac{B}{F})$.

Reason(R): For two mutually exclusive events A and B, $P(A \cap B) = 0$. 1

(a) (i) (b) (ii) (c) (iii) (d) (iv)

20) A shopkeeper in U.P. buys an article for ₹ 10000 from a wholesaler in Delhi. Shopkeeper sells the article to a consumer in M.P at a profit of 20 %. Rate of GST is 12 %.

Assertion (A): IGST paid by the consumer is ₹ 1440.

Reason(R): IGST paid by the whole seller to the central Government is ₹ 120. 1

(a) (i) (b) (ii) (c) (iii) (d) (iv)

SECTION B

(All Questions are compulsory. In case of internal Choice, attempt any one question only)

21) A polygon has 44 diagonals. Find the number of sides of the polygon. 2

22) (a) If $y = \frac{e^x + e^{-x}}{e^x - e^{-x}}$, prove that $\frac{dy}{dx} = 1 - y^2$. 2

OR

(b) Evaluate: $\lim_{x \to -3} \frac{x^2 - 9}{\sqrt{x^2 + 16} - 5}$. 2

23) A ball is drawn from a bag containing 5 white and 7 black balls. What is the probability of drawing a black ball? Also, calculate the odds against drawing a white ball? 2

24) (a) If the line $y = \sqrt{3}x + k$ touches the circle $x^2 + y^2 = 16$, then find the value of k. 2

OR

(b) Find the equation of the parabola with focus $(6,0)$ and directrix $x + 6 = 0$. Also find the length of the latus rectum. 2

25) Mr. Pandey lives in Lucknow, Uttar Pradesh. The reading of electric meter of his house is found to be 5678 units. If the previous month's reading was 4803 units and connection load is 4 kW, calculate his electricity bill for that month. Tariff Plan is given below: 2

Number of Units	0 -150	151 - 300	301 – 500	>500
Price per unit (in ₹)	₹ 5.5	₹ 6	₹ 6.5	₹ 7

Fixed Charges is ₹ 110 per kW/month, energy tax is 5 % of tariff rates and surcharge is ₹ 0.26 per unit.

SECTION C

(All Questions are compulsory. In case of internal Choice, attempt any one question only)

26) (a) A, B and C working separately can do a work in 2,3 and 4 days respectively. If they all work together and earn ₹ 3900 of the whole work, how should they divide the money? 3

OR

(b) Five friends are standing in a line and facing towards the wall wearing red, grey, yellow, violet and black shoes. The persons wearing yellow and red shoes are not standing at the end position. The person in the middle position is wearing black shoes and the person with red shoes is not in his left. The person wearing Violet shoes is standing on extreme right. Based on the above information, answer the following questions:

(i) Who is on 4th position from right? 2

(ii) Who is standing on the extreme left position? 1

27) If $n_{C_4}, n_{C_5}, n_{C_6}$ are in A.P, find the value of n. 3

28) Find the relationship between a and b so that the function f defined by

$f(x) = \begin{cases} ax + 1, if\ x \leq 3 \\ bx + 3, if\ x > 3 \end{cases}$ is continuous at $x = 3$. 3

29) (a) If the two sides of a square lie on the lines $5x - 12y + 26 = 0$ and $5x - 12y - 65 = 0$, find its area. 3

OR

(b) Find the equations of the lines which cuts off intercepts on the axes whose sum and products are 1 and (-6) respectively. 3

30) If $y = \sqrt{\log x + \sqrt{\log x + \sqrt{\log x + \cdots \infty}}}$, then prove that $x(2y - 1)\frac{dy}{dx} = 1$. 3

31) Asha invests ₹ 240000 for 2 years at 10 % per annum compounded annually. If the income tax at 20 % is deducted at the end of each year on the interest accrued, find the amount she received at the end of 2 years. 3

SECTION D

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

32) (a) Calculate the mean, variance and standard deviation for the following data: 5

Classes	0 - 30	30 - 60	60 -90	90 -120	120 - 150	150 - 180	180 - 210
Frequencies	2	3	5	10	3	5	2

OR

(b) For the following frequency distribution, compute the percentile rank corresponding to the score 66. 5

Class Interval	48 - 52	53 - 57	58 - 62	63 - 67	68 - 72	73 - 77	78 - 82	83 – 87	88 - 92	93 – 97
Frequency	4	5	10	7	6	3	8	5	7	4

33) A retailer buys a TV from a manufacturer for ₹ 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 the rate of GST is 12 %, answer the following questions:

(i) Find the marked price of the TV. 2

(ii) Evaluate the consumer's cost price of the TV (inclusive of GST). 2

(iii) Find the GST paid by the retailer to the Central and State Governments. 1

34) (a) In a family there are 7 members P, Q, R, S, T, U and V. P, the head of the family is a Lawyer. R and T are brothers and both are doctors. S, the wife of T is a social worker. Q is the son of U, who is the daughter – in law of P. V is the cousin sister of Q. If there are two married couples and a female teacher who is married in the family, answer the following questions.

(i) Who is married to R? 1

(ii) What is the profession of U? 1

(iii) How is T related to V? 1

(iv) How is P related to S? 1

(v) Who is married to U? 1

OR

(b) (i) Find the values of A, B, C where [A, B] is a two – digit number. 3

$$\begin{array}{r} AB \\ \times \quad 5 \\ \hline CAB \end{array}$$

(b)(ii) Ina a certain language, "ORANGE" is coded as "AEGNOR", how is "PINEAPPLE" coded? 2

35) From the following data, find the values of a, b and Karl Pearson's coefficient of correlation: 5

x	10	13	16	a	25	26	30
Y	6	8	10	12	b	15	19

Given that $\bar{x} = 20$ and $\bar{y} = 12$.

SECTION E

(This section comprises of 3 source based questions (Case Studies) of 4 marks each)

36) **Case Study – 1 :**

The Purna Kumbh Mela, held every 12 years, has witnessed a tremendous increase in attendance over the decades. Starting from the year 1988, the attendance has been observed to follow a geometric progression due to better infrastructure, increasing media coverage, and global participation.

- In 1988, the attendance was 50 million.
- In 2000, the attendance increased to 60 million.
- The growth trend continues in a geometric progression.

The organizers predict that this trend will persist for future events.

Based on the above information, answer the following questions:

(i) Find the ratio that represents the growth pattern of attendance in the Kumbh Mela? 1

(ii) Predict the attendance for the Kumbh Mela in 2024. 1

(iii) Calculate the total attendance (in millions) for all the Kumbh Melas from 1988 to 2024. 2

OR

(iv) The government plans to design facilities for a future Kumbh Mela when attendance exceeds 180 million. In which year will this milestone be achieved? 2

37) **Case Study – 2:**

A traffic signal at a busy intersection is programmed to operate with three phases: green, yellow, and red. Observations show that:

- 50% of the time, the signal is green.
- 10% of the time, it is yellow.
- 40% of the time, it is red.

During rush hours, the probability of vehicles successfully crossing the intersection is influenced by the signal phase:

- 90% of vehicles cross during the green phase.
- 60% of vehicles cross during the yellow phase.
- 20% of vehicles cross during the red phase.

A vehicle approaches the intersection during rush hour. You are tasked with analyzing the probabilities of different events related to the traffic signal and vehicle crossing.

Based on the above information, answer the following questions:

(i) What is the probability that a vehicle crosses the intersection? 1

(ii) If a vehicle successfully crosses the intersection, what is the probability that the signal was green? 2

(iii) A vehicle is randomly selected, and it is known that the signal was red. What is the probability that the vehicle successfully crossed the intersection? 1

OR

(iv) If 1,000 vehicles approach the signal during rush hour, estimate the number of vehicles that successfully cross the intersection. 1

38) **Case Study – 3 :**

Makar Sankranti is celebrated with much enthusiasm in a village where households prepare traditional sweets. The three most popular sweets are Laddus, Chikkis, and Puran Poli. Every household participates by preparing one or more of these sweets. The following data was collected from 100 households:

- L: Number of households preparing Laddus = 50
- C: Number of households preparing Chikkis = 40
- P: Number of households preparing Puran Poli = 45

The additional information about the overlap between the sets is as follows:

- 20 households prepare both Laddus and Chikkis.
- 15 households prepare both Chikkis and Puran Poli.
- 25 households prepare both Laddus and Puran Poli.
- 10 households prepare all three types of sweets: Laddus, Chikkis, and Puran Poli.

Based on the above information, answer the following question:

(a) How many households prepare at least one type of sweet? 1

(b) How many households prepare only one type of sweet? 1

(c) How many households prepare sweets from exactly two categories? 2

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