PT4/ANNUAL EXAMINATION, 2024-25

APPLIED MATHEMATICS (241)

Time – 3 hrs. **Class – XI** **M.M. – 80**

Date - 14.02.2025 (Friday)

Name of the student _____ ***Section*** _____

General instructions:

- This Question paper contains - five sections A, B, C, D and E. Each section is compulsory. However, there are internal choices in some questions.
- Section A has 20 MCQs of 1 mark each.
- Section B has 5 Very Short Answer (VSA)-type questions of 2 marks each.
- Section C has 6 Short Answer (SA)-type questions of 3 marks each.
- Section D has 4 Long Answer (LA)-type questions of 5 marks each.
- Section E has 3case based questions (4 marks each) with sub parts.
- ***Answer of the MCQ must be written completely along with the correct option.***

SECTION A

Multiple Choice Questions. Each question carries 1 mark.

Q1 The value of $\left(\frac{1}{\log_3 60}+\frac{1}{\log_4 60}+\frac{1}{\log_5 60}\right)$ is

A) 0 B) 1 C) 60 D) None of these

Q2. If in a certain language, METAL is coded as LFSBK, how is MUMBAI coded in that code ?

A) LVLCZJ B) LVLCAJ C) LVLBZJ D)LVLDZJ

Q3. If 3rd term of a GP is 4 then the product of first 5 terms is-

A) 512 B) 1024 C) 128 D) 4096

Q4. The length of the attitude (in cm) of a rhombus if lengths of its two diagonals are 12 cm and 16 cm respectively

A) 19.2 B) 9.6 C) 4 D) none of these

Q5. The value of P(n, n – 1) is

A) n B) 2n C) n ! D) 2n!

Q6 Convert the binary equivalent 10101 to its decimal equivalent.

A) 21 B) 12 C) 22 D) 31

Q7. $8^{x+1} = 64$, what is the value of 3^{2x+1} ?

A) 1 B) 3 C) 9 D) 27

Q8. The average of 25 observations is 36. If the average of the first 13 observations is 32 and that of the last 13 observations is 39, find the 13th observation.

A) 21 B) 22 C) 23 D) 24

Q9. A clock gains 5 seconds for every 3 minutes. If the clock started working at 7 a.m. in the morning, then what will be the correct time if the wrong clock shows 4.15 p.m. on the same day?

A) 4.30 PM B) 4.00 PM C) 4.05 PM D) 4.10 PM

Q10. On January 1, 2006, it was Sunday. What was the day of the week on January 1, 2010?

A) Saturday B) Friday C) Monday D) Sunday

Q11. If A and B together can build a house in 10 days; B and C can build it together in 12 days and C and A can build it in 15 days. In how many days A, B & C together can build the house ?

A) 6 days B) 4 days C) 8 days D) 12 days

Q12. A, P, R, X, S and Z are sitting in a row. S and Z are in the centre. A and P are at the ends. R is sitting to the left of A. Who is to the right of P ?

A) A B) X C) S D) Z

Q13. Odd one out among 693, 462, 572, 427, 671, 264 is :

A) 693 B) 572 C) 427 D) 264

Q14. Karl Pearson's coefficient of skewness is given by

A) (Mean-Mode)/(S.D.) B) (Mean-Median)/(S.D.) C) Both A & B D)None of these

Q15. If $\beta_2 = \mu_4 / (\mu_2)^2$ and $\beta_2 > 3$ then the frequency curve is called

A) Mesokurtic B) Platykurtic C) Leptokurtic D) None of these

Q16. If $y = \sqrt{x} + \frac{1}{\sqrt{x}}$, then $\frac{dy}{dx}$ at x = 1 is

A) 1 B) $\frac{1}{2}$ C) $\frac{1}{\sqrt{2}}$ D) 0

Q17. Evaluate $\lim_{x \to 0} \frac{\sqrt{2+x} - \sqrt{2}}{x}$

A) $\frac{1}{2\sqrt{2}}$ B) $\frac{1}{2}$ C) $\frac{1}{\sqrt{2}}$ D) 0

Q18. Probability of getting 53 Sundays or 53 Mondays in a leap year is

(A) $\frac{1}{7}$ (B) $\frac{2}{7}$ (C) $\frac{3}{7}$ (D) $\frac{4}{7}$

Q19. Equation of a line passing through (2,3) and perpendicular to 4x+5y =6 is

A) 5x-4y +2 = 0 B) 4x+5y = 23 C) 5x-4y = 23 D) 4x+5y+2 =0

Q20. Center and radius of circle $x^2 + y^2 - 4x - 6y - 3 = 0$ are

A) (2,-3) &2 units B) (-2, 3) &3 units C) (2,3) & 4 units D) (-2,-3) &5 units

SECTION B

(This section comprises of very short answer type-questions (VSA) of 2 marks each)

Q21. Let A = {1, 2, 3,...,14}. Define a relation R from A to A by R = {(x, y) : 3x – y = 0, where x, y ∈ A}. Write down its domain, codomain and range.

OR

A = {1, 2, 3, 5} and B = {4, 6, 9}. Define a relation R from A to B by R = {(x, y): the difference between x and y is odd; x ∈ A, y ∈ B}. Write R in roster form

Q22. Ravi is son of Aman's father's sister. Sahil is the son of Divya who is the mother of Gaurav and grandmother of Aman. Ashok is the father of Tanya and grandfather of Ravi. Divya is the wife of Ashok. Explain.

i) How is Ravi related to Divya?

ii) How is Gaurav's wife related to Tanya?

Q23. In a class of 60 students, 30 opted for NCC, 32 opted for NSS and 24 opted for both NCC and NSS. If one of these students is selected at random, find the probability that the student has opted neither NCC nor NSS.

OR

4 cards are drawn from a well shuffled deck of 52 cards. What is the probability of obtaining 3 diamonds and one spade?

Q24. **Statements:** Some actors are singers. All the singers are dancers.

Conclusions:

1. Some actors are dancers.
2. No singer is actor.

Explain with appropriate diagrams which conclusion is correct and which one is the wrong conclusion.

Q25. Find domain and range of the real function f(x) = $\sqrt{9-x^2}$

SECTION C

(This section comprises of short answer type questions (SA) of 3 marks each)

Q26. Insert 3 GMs between 4 & 2500.

OR

If *a, b, c* and *d* are in G.P. show that$(a^2 + b^2 + c^2),(ab+ bc+ cd),\ (b^2 + c^2 + d^2)$ are also in GP.

Q27. Find the coordinates of the focus, axis of the parabola, the equation of the directrix and the length of the latus rectum of parabola $y^2=12x$

Q28. Find value of k if f(x) is continuous.

$$f(x)=\begin{cases}\dfrac{2^{x+2}-16}{4^x-16}, & if\ x\neq 2\\ k, & if\ x=2\end{cases} \text{ at } x=2$$

OR

$$\text{If } \lim_{x\to 1}\frac{x^4-1}{x-1}=\lim_{x\to k}\frac{x^3-k^3}{x^2-k^2}, \text{ then find the value of } k.$$

Q29. Using first principle find the derivative of function f(x)= x^4

OR

Find dy/dx if y= log $\sqrt{x}$ + $\sqrt{logx}$

Q30. The mean of 5 observations is 4.4 and their variance is 8.24. if three of the observations are 1,2 & 6 then find the other two observations.

OR

If X 5 4 3 2 1

& Y 4 2 10 8 6

then find the Karl Pearson's coefficient of correlation between X & Y.

Q31. The scores for eight students in English and Science are as follows:

Student	A	B	C	D	E	F	G	H
English	20	28	15	60	40	80	20	12
Science	30	50	40	20	10	60	30	30

Find the coefficient of Spearman's rank correlation.

SECTION D

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

Q32. Calculate monthly electricity bill of a domestic consumer in a state whose tariff chart has been provided below, if he has contract load of 4 KW and in a particular month total units consumed are 600. Tariff (Electricity Rates)

Units	0-100	101-200	201-400	401-600	601 and above
Energy Charges (Rs./Unit)	3.90	4.10	5.50	6.50	8.10

Fixed Charges :- Contract load upto 5 kW Rs. 20/ kWh/ month, Contract load more than 5 kW and upto 10 kW Rs. 30/ kWh/ month. Monthly Charges :- Fixed Charge Duty @ 10% (Energy Charges) Cess @ 10 paise / unit

Q33. A borrows Rs 40,000 from B at 10% pa interest compounded annually and lends the same to C at same rate compounded half yearly. Find overall gain or loss of A in this transaction over a period of one and half year.

OR

Find a sum which becomes 2420 in 2 years and 2662 in 3 years at the same rate p.a compounded annually.

Q34. Calculate income tax of a male of age 30 years under the new tax regime proposed in the budget of 2024-25 if his annual gross salary in FY 2024-25 is ₹7,95,000. Calculate and show Marginal Tax Relief also while calculating the Income Tax. Standard Deduction is ₹75000 and education & health cess is 4% over the tax payable. Also find increase in his final Income Tax if he gets a bonus of ₹ 10000 in the same FY.

OR

A shopkeeper buys an article whose printed price is Rs 4000 from a wholesaler at a discount of 20% and sells it to a consumer at the printed price. If the sales are intra-state and rate of GST is 12 % then find-

i) the price of article inclusive of GST at which shopkeeper bought it.

ii) the amount of GST paid by shopkeeper to the state government.

iii) the amount of GST received by the central government.

iv) the amount which the consumer pays for the article.

Q35. A manufacturer has three machine operators A, B and C. The first operator A produces 2% defective items, whereas the other two operators B and C produce 3% and 4% defective items respectively. A is on the job for 10% of the time, B is on the job for 20% of the time and C is on the job for 70% of the time. If an item selected at random is found defective then find the probability that (i) it was produced by A (ii) it was not produced by B.

SECTION E

(This section comprises of 3 case-study/passage-based questions of 4 marks each)

Q36. **Case-Study 1 :** Read the following passage and answer the questions given below.

In a school students were motivated to subscribe some good and popular newspapers to enhance their reading skills as well as to make them updated with the current affairs and happenings in the country as well as outside the country. After the drive a survey was also done to know the output. During the survey of 120 students of a class, it was found that 50 students read newspaper H, 52 read newspaper T, 52 read newspaper I, 18 read both H and I, 22 read both H and T, 16 read both T and I, 6 read all three newspapers. Based on the above information, answer the following questions. (Show by appropriate venn diagram)

i) The number of students who read newspaper T only :

ii) The number of students who read exactly one newspaper :

iii) The number of students who read exactly two newspapers :

iv) The number of students who still don't read any newspaper :

Q37. **Case-Study 2 :** Read the following passage and answer the questions given below.

In a school it was decided to prepare a 5 members team to take care of environment in school campus from a group of 4 girls and 7 boys. In how many ways can a team of 5 members be selected if the team has -

(i) no girl ?

(ii) at least one boy and one girl ?

(iii) at least 3 girls ?

(iv) In how many ways these 4 girls and 7 boys can be seated for the selection process if no two girls are seating together ?

Q38. **Case-Study 3 :** In a class test the marks of 5 students were recorded as 30,50,10,40,20. Two students Mohit and Satish discussed over these data and gave two different statements. Mohit told, "if a number say 5 is added to each of the values then the resulting mean would increase by 5 but there would be no change in the variance of the data." While Satish told, "if a number say 3 is multiplied to each value then the resulting mean would be 3 times of the original mean and the variance would be 3^2 i.e. 9 times of the original variance.". Now by showing proper calculation determine whose statement is right and whose is wrong.