

SET NO.- 1**CHOUDHARY'S Sample Question Paper CLASS: XII
APPLIED MATHEMATICS****(Subject Code: 241) SESSION – 2022-23****Time Allowed: 3 hours****Maximum Marks: 80****General Instructions:**

- This question paper contains five sections A, B, C, D and E. Each section is compulsory.
- Section - A** carries 20 marks weightage, **Section - B** carries **10 marks** weightage, **Section - C** carries **18** marks weightage, **Section - D** carries **20** marks weightage and **Section - E** carries **3** case-based with total weightage of **12 marks**.
- Section – A** : It comprises of **20 MCQs** of 1 mark each.
- Section – B** : It comprises of 5 VSA type questions of 2 marks each.
- Section – C** : It comprises of 6 SA type of questions of 3 marks each.
- Section – D** : It comprises of 4 LA type of questions of 5 marks each.
- Section – E** : It has **3** case studies. Each case study comprises of 3 case-based questions, where 2 VSA type questions are of 1 mark each and 1 SA type question is of 2 marks. Internal choice is provided in 2 marks question in each case-study.
- 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 of the alternatives in all such questions.

SECTION – A (All questions are compulsory. No internal choice is provided in this section)		Marks
1	Find $3^{(12^8)} \pmod{7}$ a) 2 b) 4 c) 0 d) none of these	1
2	If x, y, z are positive real numbers, then the least value of $(x + y)(y + z)(z + x)$ is a) xyz b) 2xyz c) $x^2y^2z^2$ d) 8xyz	1
3	An observed set of the population that has been selected for analysis is called a) a sample b) a process c) a forecast d) a parameter	1
4	A dice is thrown twice, the probability of occurring of 5 at least once is a) $\frac{11}{36}$ b) $\frac{7}{12}$ c) $\frac{35}{36}$ d) None of these	1

5	A boat running down stream covers a distance of 16 Km in 2 hours while for covering the same distance upstream it takes 4 hours. What is the speed of the boat in still water? a) 4 Km /hr b) 6 Km /hr c) 8 Km /hr d) 10 Km /hr	1
6	At what rate converted semi-annually will the present value of perpetuity of ₹450 payable at the end of each 6 months be ₹ 20,000. a) 4% b) 5% c) 4.25% d) 4.5%	1
7	Two pipes can fill a cistern in 8 and 12 hours respectively. The pipes are opened simultaneously and it takes 12 minutes more to fill the cistern due to leakage. If the cistern is full, what will be the time taken by the leakage to empty it? a) 140 hrs b) 125 hrs c) 130hrs d) None of these	1
8	Methods of calculation of EMI or Instalment are a) Flat rate method b) Reducing – Balance method or Amortization of loan c) Both (a) and (b) d) None of these	1
9	Find the area of the region bounded by the curves $y^2 = 4x$, y-axis and the line $y = 3$ a) 9 sq. units b) 4.5 sq. units c) 8 sq. units d) None of these	1
10	The data in any time series are based on following components a) Secular trend component b) Seasonal component c) Cyclical component d) All of the above	1
11	Degree of freedom (d. f.) for N sample size = a) N b) N + 1 c) $N^2 - 1$ d) N – 1	1
12	Which of the following sets is convex? a) $\{(x, y): x^2 + y^2 \geq 1\}$ b) $\{(x, y): 2x^2 + 3y^2 \leq 6\}$ c) $\{(x, y): 4 \leq x^2 + y^2 \leq 9\}$ d) None of these	1
13	The differential equation $y \frac{dy}{dx} + x = c$ represents a) family of hyperbolas b) family of parabolas c) family of ellipses d) family of circles	1
14	In what ratio Bislery drinking water costing ₹20 per litre must be added in cow milk costing ₹60 per litre, so that resulting mixture would be worth ₹ 50 per litre. a) 1 : 2 b) 2 : 3 c) 1 : 3 d) None of these	1
15	If 't' represents time, A the original amount, y or f(t) represents the quantity at time t and k is a constant that depends on the rate of growth or decay then $y =$ a) $A e^{kt}$ b) $A e^{kt^2}$ c) $A k^{et}$ d) None of these	1

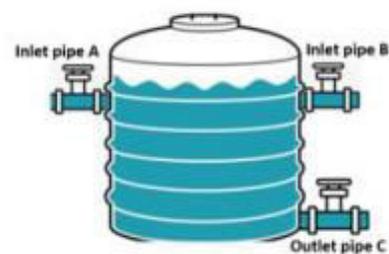
16	<p>What does it mean that you calculate a 95% confidence interval?</p> <p>a) The process you used will capture the true parameter 95% of the time in long run</p> <p>b) You can be 95% confident that your interval will include the population parameter</p> <p>c) You can be 5% confident that your interval will not include the population parameter</p> <p>d) All of the above statements are true</p>	1
17	<p>For the given five values 15,24,18,33,42 the three years moving averages are:</p> <p>a) 19, 22, 33 b) 19, 25, 31 c) 19, 30, 31 d) 19, 25, 33</p>	1
18	<p>The variation of peak demand in the consumption of electricity is an example of</p> <p>a) Irregular component b) Cyclical component</p> <p>c) Seasonal component d) Secular trend component</p>	1
<p>For questions 19 and 20, two statements are given – one labelled Assertion (A) and the other labelled Reason (R). Select the correct answer to these questions from the codes (i), (ii), (iii) and (iv) as given below:</p> <p>(i) Both A and R are true and R is the correct explanation of the assertion</p> <p>(ii) Both A and R are true but R is not the correct explanation of the assertion</p> <p>(iii) A is true, but R is false</p> <p>(iv) A is false, but R is true</p>		
19	<p>Assertion (A): Equation of the curve is $y = x^3 - 3x^2$. The slope of the normal at (1, 2) is $\frac{1}{3}$.</p> <p>Reason (R) : The slope of the normal is $(- \frac{dy}{dx})$.</p>	1
20	<p>Assertion (A) : If $A = \begin{bmatrix} 3 & -2 \\ 4 & -2 \end{bmatrix}$ and $I = \begin{bmatrix} 1 & 0 \\ 0 & 1 \end{bmatrix}$ then the value of K such that $A^2 = KA - 2I$ is -1.</p> <p>Reason (R) : If A and B are square matrices of same order, then $(A + B) (A + B)$ is equal to $A^2 + AB + BA + B^2$</p>	1
<p>SECTION – B (All questions are compulsory. In case of internal choice, attempt any one question only)</p>		
21	<p>If $x\sqrt{1+y} + y\sqrt{1+x} = 0$, prove that $\frac{dy}{dx} = -\frac{1}{(1+x)^2}$, where $-1 < x < 1$.</p> <p style="text-align: center;">OR</p> <p>Find the equation of the tangent to the circle $x^2 + 3y - 3 = 0$ which is parallel to the line $y = 4x - 5$.</p>	2

22	Find the intervals in which the function $f(x) = \frac{x^4}{4} - 2x^3 + \frac{11}{2}x^2 - 6x$ is. (a) Increasing (b) Decreasing.	2
23	If $A = \begin{bmatrix} 1 & 2 & -1 \\ -1 & 1 & 2 \\ 2 & -1 & 1 \end{bmatrix}$, then find $\det(\text{adj}(\text{adj} A))$.	2
24	A container contains 40 litre milk. From this container 4 litre milk was taken out and replaced with water. This process was repeated further two more times. How much milk is there in the container now? OR A retailer has 250 kg of rice, a part of which he sells at 10% profit. The remaining quantity of rice is low quality and he sold it at 5% loss. Overall he made a profit of 7%. Find the quantity of rice sold at 5% loss.	2
25	Moulika has two investment options – either a 10% per annum compounded semi annually or 9.5% per annum compounded continuously. Which option is preferable and why? (Given: $e^{(0.095)} = 1.0996$)	2
SECTION – C		
(All questions are compulsory. In case of internal choice, attempt any one question only)		
26	A company established sinking fund to provide the payment of ₹ 1,00,000 debt maturing in 4 years. Contributions to the fund are to be made at the end of every year. Find the amount of each annual deposit (in multiples of ₹ 100) if interest is 18% per annum. (Given: $(1.18)^4 = 1.9388$)	3
27	The monthly incomes of Aanya and Shubh are in the ratio 3: 4 and their monthly expenditures are in the ratio 5 : 7. If each saved ₹ 15000 per month find their monthly incomes using matrix method.	3
28	Evaluate : $\int \left(\frac{1}{\log x} + \frac{1}{(\log x)^2} \right) dx$ OR Evaluate: $\int_1^3 \frac{\sqrt[3]{x}}{\sqrt[3]{x} + \sqrt[3]{4-x}} dx$.	3
29	The demand and supply functions for a commodity are $p_d = 56 - x^2$ and $p_s = 8 + \frac{x^2}{3}$. Find the consumer's surplus at equilibrium price. OR Find the area of the region bounded by the curves $x^2 = 4y$ and the line $x = 4y - 2$.	3
30	A machine costing ₹ 50,000 depreciates at a constant rate. It is expected to have a useful life of 4 years and scrap value of 10,000. Find the annual depreciation charge and the depreciation rate by using the linear depreciation method.	3

31	<p>Tanishkaa wishes to purchase a house for ₹10,00,000 with a down payment of ₹ 2,00,000. If she can amortize the balance at 9% per annum compounded monthly for 25 years, what is her monthly payment? What is the total interest paid ? Give your answer in nearest ₹100. (Given a $\frac{1000000}{300 \times 1.0075^{300}}$ = 120).</p>	3
<p>SECTION – D (All questions are compulsory. In case of internal choice, attempt any one question only)</p>		
32	<p>If the sum and the product of mean and variance of a binomial distribution are 24 and 128 respectively, then find the probability of one or two successes.</p> <p style="text-align: center;">OR</p> <p>If a random variable X follows the Binomial distribution B(33, p) such that $3P(X = 0) = P(X = 1)$, Then find the value of</p> $\frac{P(X = 15)}{P(X = 18)} - \frac{P(X = 16)}{P(X = 17)}$	5
33	<p>A firm has the cost function $C = \frac{x^3}{3} - 7x^2 + 111x + 50$ and demand function $x = 100 - p$.</p> <p>i) Write the total revenue profit function R(x) in terms of x. ii) Formulate the total profit function P(x) in terms of x. iii) Find the profit maximizing level of output x iv) What is the maximum profit?</p> <p style="text-align: center;">OR</p> <p>A wire of length 50 m is to be cut into two pieces. One piece is bent in the shape of a square and the other in the shape of a circle. What should be the lengths of each piece so that the combined area of the two shapes in minimum?</p>	5
34	<p>Express the matrix $A = \begin{bmatrix} 1 & 3 & 5 \\ -6 & 8 & 3 \\ -4 & 6 & 5 \end{bmatrix}$, as the sum of a symmetric and a skew symmetric matrix.</p>	5
35	<p>A furniture firm manufactures chairs and tables, each requiring the use of three machines A, B and C. Production of one chair requires 2 hours on machine A, 1 hour on machine B and 1 hour on machine C. Each table requires 1 hr each of machine A and AB and 3 hrs on machine C. The profit obtained by selling one chair is ₹ 100. While by selling one table the profit is ₹ 300. The total time available per week on machine A is 70 hours, on machine B is 40 hours and on machine C is 90 hours. How many chairs and tables (all possible pairs) should be made per week so as to maximize the profit? Formulate the problem as L.P.P. and solve it graphically.</p>	5

SECTION – E**(All questions are compulsory. In case of internal choice, attempt any one question only)****36****CASE STUDY – I**

Pipe 'A' fills a tank of 800 litres capacity at the rate of 60 litres a minute. Another pipe 'B' fills the same tank at the rate of 40 litres a minute. A pipe 'C' at the bottom of the tank drains the tank at the rate of 30 litres a minute. If pipe A is kept open for a minute and then closed and pipe B is kept open for a minute and then closed and then pipe C is kept open for a minute and then closed and the cycle is repeated till the empty tank just overflow.

**Based on the above information answer the following questions:**

- a)** If each of the pipe is kept open for a minute in the same order then find the net flow of water in each cycle of working of pipes A, B and C. **1**
- b)** Find the volume of the water left for filling the tank by A after complete cycles of closing and opening of the pipes A, B and C. **1**
- c)** How long will it take for the empty tank to just overflow? **2**
- OR**
- How long it will take to fill the tank when pipes A and C are opened together?

37**CASE STUDY – II**

The table below gives details of the electricity generated from a plant in million kilowatt hours in each quarter for the years 2002 to 2004.

Year	QUARTER			
	1st	2nd	3rd	4th
2002	8	7	6	9
2003	10	7	7	10
2004	11	7	8	10

Based on the above information answer the following questions:

- a)** Tabulate the data for calculation of 4 quarterly moving averages. **1**
- b)** Calculate the four quarterly moving averages **1**

c)	<p>Show these moving averages on a graph paper. Comment on the general trend.</p> <p style="text-align: center;">OR</p> <p>Write the detailed procedure for calculation of 4 quarterly moving averages</p>	2
38	<p style="text-align: center;"><u>CASE STUDY - III</u></p> <div style="text-align: center;">  </div> <p>Let X denote the no. of colleges where you will apply after your results and P(X = x) denotes your probability of getting admission in x number of colleges. It is given that</p> $P(X = x) = \begin{cases} kx, & \text{if } x = 0 \text{ or } 1 \\ 2kx, & \text{if } x = 2 \\ k(5 - x), & \text{if } x = 3 \text{ or } 4 \\ 0, & \text{if } x > 4 \end{cases}, \text{ where } k \text{ is a positive constant.}$ <p>Based on the above information answer the following questions:</p>	
a)	Find the value of k.	1
b)	<p>Find the probability that you will get admission in</p> <p>i) exactly one college</p> <p>ii) more than 4 colleges</p>	1
c)	<p>Find the probability that you will get admission in</p> <p>i) at most two colleges</p> <p>ii) at least two colleges</p> <p style="text-align: center;">OR</p> <p>What is the degree of freedom? Explain the meaning of higher degree of freedom. Find the degree of freedom when the sample size is 2023.</p>	2

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