SET NO.- 3

CHOUDHARY'S Sample Question Paper CLASS: XII
APPLIED MATHEMATICS

(Subject Code: 241) SESSION – 2022-23

Time Allowed: 3 hours **Maximum Marks: 80**

General Instructions:

1. This question paper contains five sections A, B, C, D and E. Each section is compulsory.
2. **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**.
3. **Section – A:** It comprises of **20 MCQs** of 1 mark each.
4. **Section – B:** It comprises of 5 VSA type questions of 2 marks each.
5. **Section – C:** It comprises of 6 SA type of questions of 3 marks each.
6. **Section – D:** It comprises of 4 LA type of questions of 5 marks each.
7. **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.
8. 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	The remainder when 678 +687 + 6879 + 6890 is divided by 17 = a) 4 b) 13 c) 7 d)None of these	**1**
2	If x, y, z are three real numbers of the same sign then find the value of $\frac{x}{y} + \frac{y}{z} + \frac{z}{x}$ a) [2 , ∞) b) (- ∞, 3] c) [3 , ∞) d) None of these	**1**
3	If we reject the null hypothesis, we might be making a) Type – I error b) Type – II error c) A correct decision d) A wrong decision	**1**
4	A rifleman is firing at a distance target and has only 10% chance of hitting it. The least number of rounds , he must fire in order to have more than 50% chance of hitting it at least once is a)11 b) 96 c) 7 d)5	**1**

5	A man can row a boat in still water at a speed of 4.5 Km/hr. In a river flowing at the rate of 1.5 Km/hr he starts his journey from a point downstream and comes back to the same point. Find his average speed for the total journey. a) 3 Km/hr b) 3.4 Km/hr c) 4.5 Km/hr d)none of these	**1**
6	How much money is needed to endure a series of lectures costing ₹ 2500 at the beginning of each year indefinitely, if money is worth 3% compounded annually? a) 85830 b)85840 c) 85833 d) none of these	**1**
7	Two pipes A and B can fill a tank in 6 hrs and 4 hrs respectively. If they are opened on alternate hours and if pipe A is opened first, in how many hours, the tank shall be full? a) 4.3 hrs b) 4.5 hrs c) 4 hrs d) 5 hrs	**1**
8	If P= amount of loan, R = size of equal payment, i = rate per period, n = no. of equal payments then total interest paid = a) $\frac{P+i}{n}$ - P b) $\frac{P}{a_{\overline{n}\rceil i}}$ c) nR - p d) none of these	**1**
9	If the graphs of the curves y = f(x) and y = g(x) cross each other at finitely many points, then write the area enclosed between the graphs of the two curves and the ordinates x = a and x = b a) $\int_a^b \lvert f(x) + g(x) \rvert \, dx$ b) $\int_a^b \lvert f(x).g(x) \rvert \, dx$ c) $\int_a^b \lvert f(x) - g(x) \rvert \, dx$ d) $\int_a^b \lvert f(y) - g(y) \rvert \, dx$	**1**
10	When data is collected in a combination of time series data and cross sectional data, it is called --- a) Pooled data b) cross sectional data c) Combined data d) none of these	**1**
11	We reject the null hypothesis if the measured t value is ---- than the critical t value a) equal b) greater c) lesser d) none of these	**1**
12	Objective function of LPP is a a) constant b) function to be optimized c) relation between the variables d) none of these	**1**
13	The number of solutions of $\frac{dy}{dx} = \frac{y+1}{x-1}$ when y (1) = 2 is a) none b) one c) two d) infinite	**1**

14	Suppose a container contains x unit of a liquid from which y unit are taken out and replaced by water. if we repeat the same operation n times then the quality of pure liquid is given by a) $x(1+\frac{y}{x})^n$ b) $x(1-\frac{y}{x})^n$ c) $y(1+\frac{y}{x})^n$ d) $y(1+\frac{y}{x})^n$	**1**
15	Find the sum of order and degree of the differential equation: $ydx + x \log(\frac{y}{x})dy - 2x\,dy = 0$ a) 2 b) 3 c)4 d) none of these	**1**
16	Which of the following is true statement for comparing the t– distribution with standard normal distribution? a) The normal curve is symmetrical where as t-distribution are slightly skewed b) The proportion of area beyond a specific value of 't' is less than the proportion of normal curve c) Greater the degree of freedom , the t-distribution resembles the standard normal distribution d) none of these	**1**
17	Method of ------ is a technique for finding the equation which best fits a given set of observations. a) Moving average b) least square c) Index number d) none of these	**1**
18	Which of the following is/are true statement **I** : Sinking fund and saving accounts, both, involves setting aside an amount of money for the future. **II** : Sinking fund is set up for a particular purpose and is to be used at a particular time, while the savings account is set up for any purpose that it may serve, a) Both I and II b) Only I c) Only II d) none of these	**1**
	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: (i) Both A and R are true and R is the correct explanation of the assertion (ii) Both A and R are true but R is not the correct explanation of the assertion (iii) A is true, but R is false (iv) A is false, but R is true	
19	**Assertion (A):** Assume an investment's starting value is ₹10,000 and it grows to ₹1,60,000 in 4 years then CAGR (Compound Annual Growth Rate) is 100%. **Reason (R) :** CAGR (Compound Annual Growth Rate) is expressed in percentage. It can be used to compare historical returns in different investment portfolio. It also eliminates the effects of volatility on periodic investment.	**1**

20	**Assertion (A):** To minimize Z= 3x + 2y subject to the constrains x + y ≥ 8, 3x + 5 y ≤ 15, x ≥ 0, y ≥ 0 has no feasible solution. **Reason (R):** If there is no point satisfying all the constrains simultaneously as such no feasible region possible. Hence no feasible solution exists.	**1**
	SECTION – B **(All questions are compulsory. In case of internal choice, attempt any one question only)**	
21	Mrs Lohia has two investment options – 8.4% p.a. compounded monthly or 8.5% compounded semi-annually. Which option is better for Mrs Lohia [Use $(1.007)^{12} = 1.0873$, $(1.0425)^2 = 1.0868$].	**2**
22	Which of the following equations are consistent? If consistent, solve them. **i)** 2x – y = 5, 4x -2y = 7 **ii)** x + 2y = 5 , 3x + 6y = 15.	**2**
23	Using the property of Modulus find the remainder when (127 ×137× 23× 50 ×235 ×15) is divided by 7. **OR** Find all the positive integers less than 30 forming the equivalence class of 5 for modulo 7.	**2**
24	What is the meaning of EMI? Write formulas to calculate the EMI by using different methods.	**2**
25	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?	**2**
	SECTION – C **(All questions are compulsory. In case of internal choice, attempt any one question only)**	
26	Find the intervals in which the function f(x) $= \frac{x^4}{4} - 2x^3 + \frac{11}{2}x^2 - 6x$ is **(i)** increasing **(ii)** decreasing **OR** The cost function C(x) of a commodity is given by C(x) = $2x\left(\frac{x+3}{x+2}\right) + 2$. Prove that the marginal cost falls as the output "x" increases.	**3**
27	Solve the following system of equations using Cramer's Rule x + y + z = 10; 2x + y = 13 ; x + y - 4z = 0.	**3**
28	Find: $\int \frac{(x^4 - x)^{\frac{1}{4}}}{x^5}$ dx. **OR** Evaluate: $\int_3^5 \frac{x^2}{(x-1)(x-2)}$ dx.	**3**

29	The weekly marginal cost of producing x pairs of tennis shoes is given by MC = $17 + \frac{200}{x+1}$, where C(x) is cost in rupees . If the fixed costs are ₹ 2000 per day, find the cost function.	**3**
30	A coin is biased so that the head is 3 times as likely to occur as tail. If the coin is tossed three times, find the probability distribution of tails. **OR** A drunken man takes a step forward with probability 0.4 and backwards with probability 0.6. Find the probability that at the end of eleven steps he is just one step away from the starting point.	**3**
31	If the sum of the mean and variance of a binomial distribution for 5 trails is 1.8. Find the Binomial distribution.	**3**
	SECTION – D **(All questions are compulsory. In case of internal choice, attempt any one question only)**	
32	Suppose 220 misprints are distributed randomly throughout a book of 200 pages. Find the probability that a given page contains (i) no misprints (ii) one misprint (iii) 2 misprints (iv) two or more misprints [Given $e^{(-1.1)} = 0.33287$] **OR** If the heights of 1000 students are normally distributed with mean 173 cm and standard deviation 7.5 cm, how many students have heights (i) Greater than 183 cm? (ii) less than 162.5 cm (iii) between 165 cm and 180 cm [Use Z < 1.33 = 0.9082, Z < -1.4 = 0.0808, Z < -1.074 = 0.1423]	**5**
33	There is a factory located at each of the two places P and Q .From these locations, a certain commodity is derived to each of the three depots situated at A, B and C. The weekly requirements of the depots are respectively 5 ,5 and 4 units of the commodity while the production capacity of the factories at P and Q are 8 and 6 units respectively. The cost of transportation per unit is given below: **From/to** | **Costs (in ₹)** **A** | **B** | **C** P: 16 | 10 | 15 Q: 10 | 12 | 10 How many units should be transported from each factory to each depot in order that the transportation cost is minimum? Formulate above as a linear programming problem.	**5**
34	Compute the trends by the method of moving averages, assuming that 4-year cycle is present in the following series. Year: 1980 | 1981 | 1982 | 1983 | 1984 | 1985 | 1986 | 1987 | 1988 | 1989 Index number: 400 | 470 | 450 | 410 | 432 | 475 | 461 | 500 | 480 | 430	**5**

35	Three shopkeepers A, B and C are using polythene bags, handmade bags and newspaper bags. A uses 20, 30 and 40 number of bags of respective type. B uses 30, 40 and 20 of each respective kind while C uses 40, 20 and 30 of each type. Each shopkeeper spent ₹ 250, ₹ 220 and ₹ 200 on the bags. Find the cost of each carry bag using matrix method.	**5**
	SECTION – E **(All questions are compulsory. In case of internal choice, attempt any one question only)**	
36	**CASE STUDY – I** A Veterinary doctor was examining a sick cat brought by a pet lover. When it was brought to the hospital, it was already dead. The pet lover wanted to find its time of death. He took the temperature of the cat at 11.30 pm which was 94.6°F. He took the temperature again after one hour; the temperature was lower than the first observation. It was 93.4°F. The room in which the cat was put is always at 70°F. The normal temperature of the cat is taken as 98.6°F when it was alive. The doctor estimated the time of death using Newton law of cooling which is governed by the differential equation: $\frac{dT}{dt} \propto (T - 70)$, where 70°F is the room temperature and T is the temperature of the object at time t.  Substituting the two different observations of T and t made, in the solution of the differential equation $\frac{dT}{dt} = k(T - 70)$ where k is a constant of proportion, time of death is calculated. **Based on the above information answer the following questions:**	
a)	State the degree of the above given differential equation. Also state the method of solving a differential equation in calculation of the time of death.	**1**
b)	If the temperature was measured 2 hours after 11:30 PM, will the time of death change? Give reason in support of your answer.	**1**
c)	Find the solution of the differential equation $\frac{dT}{dt} = k(T - 70)$. If t = 0 when T is 72°F then find the value of constant of integration C. **OR** Verify that the equation $y = ax^3 + bx^2 + cx + d$ is the solution of the differential equation $\frac{d^3y}{dx^3} = 6a$.	**2**

37	**CASE STUDY – II**  A school plans to award ₹6000 in total to its students to reward for certain values - honesty, regularity and hard work. When three times the award money for hard work is added to the award money given for honesty amounts to ₹11000. The award money for honesty and hard work together is double the award money for regularity. Use matrix method to find the prize money for each category of award. **Based on the above information answer the following questions:**	
a)	Write the given information in the matrix form: AX = B	**1**
b)	Determine adj A.	**1**
c)	Find the award money for honesty, regularity and hard work. **OR** Solve the following system of equations using Cramer's rule: **2x – 3 y = 5; - 4x + 6y = - 10.**	**2**
38	**CASE STUDY – III** The fuel cost per hour for running a train is proportional to the square of the speed it generates in Km/hr. If the fuel costs **₹48** per hour at speed **16** km per hour and the fixed charges to run the train amount to **₹1200** per hr. Assume speed of the train as **v** km/hr. **Based on the above information answer the following questions:**	
a)	Given that the fuel cost per hour is k times the square of the speed of the train generates in km/h then find the value of k.	**1**
b)	If the train has travelled a distance of 500 km, then find the function representing the total cost of running the train.	**1**
c)	Find the most economical speed to run the train. Also find the total cost of the train to travel 500 km at the most economical speed. **OR** Find the points on the curve $y = x^3$ at which the slope of the tangent is equal to the y – coordinates of the point.	**2**