

SET NO.- 2**CHOUDHARY'S Sample Question Paper CLASS: XII
APPLIED MATHEMATICS****(Subject Code: 241) SESSION – 2022-23**

Time Allowed: 3 hours		Maximum Marks: 80
General Instructions:		
<ol style="list-style-type: none"> 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 the least non- negative remainder when $64 \times 65 \times 66$ is divided by 67 a) 64 b) 65 c) -6 d) 61	1
2	If $y = 3^{(x-1)} + 3^{(-x+1)}$, x is real, then find the least value of y a) 3 b) $\frac{1}{3}$ c) 2 d) 1	1
3	A statement made about a population parameter for testing purpose is called a) statistic b) parameter c) hypothesis d) level of significance	1
4	In a binomial distribution, the probability of getting a success is $\frac{1}{4}$ and the standard deviation is 3. Then its mean is a) 6 b) 8 c) 12 d) 48	1
5	The speed of a motor boat and that of the water is in the ratio 36:5. The boat goes along with the current in 5 hours 10 minutes. How much time will it take to come back? a) 6 hr 10 min b) 6 hr 20 min c) 6 hr 30 min d) 6 hr 50 min	1

6	The present value of a perpetual income of ₹ x at the end of each six months is ₹40,000 Find the value of x if money is worth 6% compounded semi-annually. a) ₹1200 b) ₹1400 c) ₹1500 d) None of these	1
7	Two pipes can separately fill a tank in 20 hrs and 30 hrs respectively. Both the pipes are opened to fill the tank but when the tank is $\frac{1}{3}$ full a leak develops in the tank through which $\frac{1}{3}$ of the water supplied by both the pipes leak out. What is the total time taken to fill the tank? a) 12 b) 10 c) 14 d) None of these	1
8	Viduushi Bagri takes a loan of ₹2,00,000 with 10% annual interest rate for 5 years. Calculate the EMI under flat rate system. a) ₹4500 b) ₹4000 c) ₹5000 d) None of these	1
9	If the graphs of the curves $x = f(y)$ and $x = g(y)$ cross each other at finitely many points, then write the area enclosed between the graphs of the two curves and the abscissa $y = c$, $y = d$ a) $\int_c^d f(y) + g(y) dy$ b) $\int_c^d f(y) - g(y) dy$ c) $\int_c^d f(x) - g(x) dx$ d) $\int_c^d f(y).g(y) dy$	1
10	When data for one or more variables is collected at the same point in time, it is called----- a) Cross sectional data b) Pooled data c) time series data d) None of these	1
11	The ----- is used to compare a sample mean to a specific value a) one sample t- test b) hypothesis test c) sampling distribution test d) Estimation test	1
12	The area of the feasible region for the following constraints $3y + x \geq 3$, $x \geq 0$ and $y \geq 0$ will be a) bounded b) un bounded c) convex d) concave	1
13	The integrating factor of $x \frac{dy}{dx} - y = x^4 - 3x$ is a) x b) log x c) $\frac{1}{x}$ d) -x	1
14	In what ratio must a person mix two sugar solutions of 30% and 50% concentration respectively so as to get a solution of 45% concentration? a) 1 : 3 b) 2 : 3 c) 1 : 2 d) 4 : 5	1
15	Solve the differential equation $y \log y dx - x dy = 0$ a) $y = e^{cx}$ b) $y = cx$ c) $y = x \log y$ d) None of these	1

16	<p>In testing the statistical hypothesis, which of the following statement is false?</p> <p>a) The critical region is the values of the test statistic for which we reject the null hypothesis</p> <p>b) the level of significance is the probability of Type - I error</p> <p>c) In testing $H_0 : \mu = \mu_0$, $H_1 : \mu \neq \mu_0$, the critical region is two sided</p> <p>d) The p-value measures the probability that the null hypothesis is true</p>	1
17	<p>According to the principle of least squares, which is/ are true</p> <p>I : The sum of the deviations of the actual values of y and estimated value of y is zero.</p> <p>II : The sum of squares of the deviations of the actual values of y and estimated value of y is least.</p> <p>a) only I b) only II c) Both I and II d) none of these</p>	1
18	<p>Quantitative method of forecasting can be used</p> <p>a) When the past information about the variable is available</p> <p>b) When information and data of the variable can be quantified</p> <p>c) On the assumption that the pattern of the past will continue in the future</p> <p>d) The variable has a cause – and – end effect relationship with no other variables</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) : If the sum of the mean and variance of a binomial distribution for 5 trials is 1.8 then $p = 0.8$.</p> <p>Reason (R) : In binomial distribution, Mean = $n.p$, Variance = npq and $p + q = 1$</p>	1
20	<p>Assertion (A): Bhavya Parakh took a loan of ₹20,000 for 6 months . lender deducts ₹1,000 as interest while lending . Then the effective rate of interest charged by lender is $(\frac{20}{19})^{0.5} - 1$</p> <p>Reason (R): Effective rate of return (per rupee) compounded continuously is $e^{\frac{r}{100}} - 1$, where $r =$ annual rate of interest.</p>	1

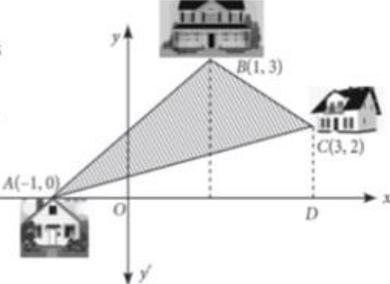
SECTION – B**(All questions are compulsory. In case of internal choice, attempt any one question only)**

21	If A and B are symmetric matrices of the same order then prove that $(AB - BA)$ is always skew symmetric matrix.	2
22	Solve the differential equation : $\frac{dy}{dx} + \frac{y}{x} = x^2$ OR Find the differential equation representing the curve $y = e^{-x} + ax + b$, where a, b are arbitrary constant.	2
23	600 g of jaggery syrup has 40 % jaggery in it. How much jaggery should be added to make it 50% in the syrup?	2
24	A boat goes 12 km downstream and comes back to the starting point in 3 hrs. If the speed of the stream is 3 km/hr, find the speed of the boat in still water.	2
25	Find the interval in which the function $f(x)$ is strictly increasing or strictly decreasing. $f(x) = 20 - 9x + 6x^2 - x^3$. OR Prove that the maximum value of $(\frac{1}{x})^x$ is $e^{\frac{1}{e}}$.	2

SECTION – C**(All questions are compulsory. In case of internal choice, attempt any one question only)**

26	The book store of a particular city has 10 dozen Applied Mathematics books, 8 dozen Economics books and 5 dozen Accountancy books. Their selling prices are ₹680, ₹730 and ₹470 respectively. Find by matrix method the total amount received by the book store from selling all these items.	3																
27	Evaluate: $\int_2^4 \{ x - 2 + x - 3 + x - 4 \} dx$ OR Evaluate : $\int \frac{\sqrt{16 + (\log x)^2}}{x} dx$.	3																
28	A manufacturers produces three products x, y, z which he sells in two markets. Annual sales are indicated below: <table border="1" style="margin-left: auto; margin-right: auto;"> <thead> <tr> <th rowspan="2">Market</th> <th colspan="3">Products</th> </tr> <tr> <th>x</th> <th>y</th> <th>z</th> </tr> </thead> <tbody> <tr> <td>I</td> <td>10,000</td> <td>2,000</td> <td>18,000</td> </tr> <tr> <td>II</td> <td>60,000</td> <td>20,000</td> <td>8,000</td> </tr> </tbody> </table> <p>If unit sale price of x, y and z are ₹ 2.50, ₹ 1.50 and ₹ 1.00 respectively, find the total revenue in each market using matrix.</p>	Market	Products			x	y	z	I	10,000	2,000	18,000	II	60,000	20,000	8,000	3	
Market	Products																	
	x	y	z															
I	10,000	2,000	18,000															
II	60,000	20,000	8,000															
29	Calculate Z – Score for a normal distribution of 7 rare species of Indian butterfly that you have in your garden. <table border="1" style="margin-left: auto; margin-right: auto;"> <thead> <tr> <th>Butterfly</th> <th>1</th> <th>2</th> <th>3</th> <th>4</th> <th>5</th> <th>6</th> <th>7</th> </tr> </thead> <tbody> <tr> <td>Length (in cm) x_i</td> <td>2</td> <td>2</td> <td>3</td> <td>2</td> <td>5</td> <td>1</td> <td>6</td> </tr> </tbody> </table>	Butterfly	1	2	3	4	5	6	7	Length (in cm) x_i	2	2	3	2	5	1	6	3
Butterfly	1	2	3	4	5	6	7											
Length (in cm) x_i	2	2	3	2	5	1	6											

	OR																	
	At a busy traffic intersection, the probability p of an individual car having an accident is very small, say $p = 0.0001$. However, during a certain part of the day, a large number of cars, say 1000, pass through the intersection. Under these conditions what is the probability of two or more accidents occurring during that period? (Use $e^{-0.1} = 0.9048$.)																	
30	A machine costing ₹2,00,000 has effective life of 7 years and its scrap value is ₹30,000. What amount should the company put into a sinking fund (in multiples of ₹100) earning 5% per annum, so that it can replace the machine after its useful life? Assume that a new machine will cost ₹ 3,00,000 after 7 years. [Given $(1.07)^7 = 1.407$]	3																
31	Pritika Lohia borrowed ₹ 10,00,000 from a bank to purchase a house and decided to repay by monthly equal instalments in 10 years. The bank charges interest at 9 % compounded monthly. The bank calculated his EMI as ₹ 12668. Find the principal at interest paid in first year. [Given $a_{10 0.0075} = 73.84$].	3																
SECTION - D																		
(All questions are compulsory. In case of internal choice, attempt any one question only)																		
32	Given below are the consumer price index numbers (CPI) of the industrial workers. <table border="1" style="margin-left: auto; margin-right: auto;"><thead><tr><th>Year</th><th>2014</th><th>2015</th><th>2016</th><th>2017</th><th>2018</th><th>2019</th><th>2020</th></tr></thead><tbody><tr><th>Index No.</th><td>145</td><td>140</td><td>150</td><td>190</td><td>200</td><td>220</td><td>230</td></tr></tbody></table> Find the best fitted trend line by the method of least squares and tabulate the trend values.	Year	2014	2015	2016	2017	2018	2019	2020	Index No.	145	140	150	190	200	220	230	5
Year	2014	2015	2016	2017	2018	2019	2020											
Index No.	145	140	150	190	200	220	230											
33	A cake is taken out from an oven when its temperature has reached 185°F and is placed on a table in a room whose temperature is 75°F . If the temperature of the cake reaches 150°F after an hour, what will be its temperature after 45 minutes? [Given $(0.6818)^{1.5} = 0.56$] OR Nembutal, a sodium salt (sodium pentobarbital) acts as a sedative and has many applications. Suppose Nembutal is used to anesthetize a dog. The dog is anesthetized when its blood stream concentration contains at least 45mg of sodium pentobarbital per kg of the dog's body weight. If the rate of change of sodium pentobarbital say, x in the body, is proportional to the amount of drug present in the body. Show that sodium pentobarbital is eliminated exponentially from the dog's blood stream given that its half-life is 5 hours. What single dose should be administered in order to anesthetize a 50 Kg dog for 1 hour? [Given $(2)^{0.2} = 1.149$].	5																
34	If $A = \begin{bmatrix} 1 & -1 & 1 \\ 2 & 1 & -3 \\ 1 & 1 & 1 \end{bmatrix}$ find A^{-1} . Hence solve the following system of equations: $x + 2y + z = 4$; $-x + y + z = 0$; $x - 2y + z = 2$.	5																

35	<p>A telephone company in a town has 500 subscribers on its list and collects fixed charges of ₹300 per subscriber. The company proposes to increase the annual subscription and it is believed that every increase of ₹1 one subscriber will discontinue the service. Find what increase will bring maximum revenue?</p> <p style="text-align: center;">OR</p> <p>Manufacturer can sell x items at a price of ₹ $(5 - \frac{x}{100})$ each. The cost price is ₹ $(\frac{x}{2} + 500)$. Find the number of items he should sell to earn maximum profit.</p>	5
<p>SECTION – E (All questions are compulsory. In case of internal choice, attempt any one question only)</p>		
36	<p style="text-align: center;">CASE STUDY – I</p> <div style="text-align: center;">  </div> <p>For a Poisson distribution model, if arrival rate of passengers at an airport is recorded as 30 per hour on a given day. [Given $e^{-5} = 0.007$]. Based on the above information answer the following questions:</p>	
a)	The expected number of arrivals in the first 10 minutes of an hour	1
b)	The probability of exactly 4 arrivals in the first 10 minutes of an hour	1
c)	<p>i) The probability of 4 or fewer arrivals in the first 10 minutes of an hour ii) The probability of 10 or more arrivals in an hour given that there are 8 arrivals in the first 10 minutes of that hour</p> <p style="text-align: center;">OR</p> <p>Given that the scores of a set of candidates on an IQ test are normally distributed. If the IQ test has a mean of 100 and a standard deviation of 10, what is the probability that a candidate who takes the test will score between 90 and 110? [Given $P(Z < 1) = 0.8413$ and $P(Z < -1) = 0.1587$]</p>	2
37	<p style="text-align: center;">CASE STUDY – II</p> <div style="text-align: center;">  </div> <p>Location of three houses of society are represented by the points A (-1, 0), B (1, 3) and C (3, 2) as shown in figure.</p>	

	Based on the above information answer the following questions:	
a)	Equation of line AB and BC	1
b)	Area of region ABCD	1
c)	i) Area of triangle ADC ii) Area triangle ABC OR The demand function for a commodity is $p = \frac{10}{x+1}$. Find the consumers' surplus when the prevailing market price is 5.	2
38	<p style="text-align: center;"><u>CASE STUDY - III</u></p> <p>Simran is rowing a boat. She takes 6 hours to row 48 km upstream whereas she takes 3 hours to go the same distance downstream.</p>  <p>Based on the above information answer the following questions:</p>	
a)	What is her speed of rowing in still water? Also find the speed of the stream.	1
b)	What is her average speed?	1
c)	The stream is flowing at the speed of 4 km/h. If Simran rows a certain distance upstream in 3.5 hours and returns to the same place in 1.5 hours, then find the speed of Simran's boat in still water. OR The speed of a boat in still water is 12 km/ h . it takes twice as long as to go upstream to a point as to return downstream to the starting point. What is the speed of the stream?	2

2
