

**Sample Question Paper (Set-4)**  
**CLASS: XII Session: 2022-23**  
**Applied Mathematics (Code-241)**

**Maximum Marks: 80**

**Time Allowed: 3 hrs**

**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.

**Section – A**

3. It comprises of 20 MCQs of 1 mark each.

**Section – B**

4. It comprises of 5 VSA type questions of 2 marks each.

**Section – C**

5. It comprises of 6 SA type of questions of 3 marks each.

**Section – D**

6. It comprises of 4 LA type of questions of 5 marks each.

**Section – E**

7. 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**

Q.1	If $\left  \begin{matrix} x & 4 \\ 9 & x \end{matrix} \right  = \left  \begin{matrix} 6 & 4 \\ 9 & 6 \end{matrix} \right $ , then x is equal to (A) 6 (B) $\pm 6$ (C) -6 (D) 4	1
Q.2	If A is a skew symmetric matrix of order 3, then the value of  A  is (A) 3 (B) 0 (C) 9 (D) 27	1
Q.3	A sample of 50 bulbs is taken at random. Out of 50 we found 15 bulbs from Bajaj, 17 from Surya and 18 from Crompton. What is the point estimate of population proportion of Surya ? (A) 0.3 (B) 0.4 (C) 0.36 (D) 0.34	1
Q.4	The interval on which the function $f(x) = 2x^3 + 9x^2 + 12x - 1$ is decreasing (A) $[-1, \infty)$ (B) $(-\infty, -2)$ (C) $[-2, -1]$ (D) $[-1, 1]$	1
Q.5	The speed of a boat in still water is 15 km/h and the rate of current is 3 km/h. The distance travelled by boat downstream in 12 minutes is (A) 3.6 km (B) 1.8 km (C) 2.4 km (D) 1.2 km	1
Q.6	Inferential statistics is a process that involves all of the following except (A) estimating a parameter (B) estimating a statistic (C) test a hypothesis (D) analyse relationships.	1
Q.7	Pipes A and B can fill a tank in 4 hours and 5 hours respectively. Another pipe C can empty the full tank in 10 hours. If all the three pipes are opened together then the tank will be filled in (A) $1\frac{2}{7}$ hours (B) $2\frac{2}{7}$ hours (C) $1\frac{1}{2}$ hours (D) $2\frac{6}{7}$ hours.	1
Q.8	If in a binomial distribution $n=4$ , $P(X=0) = \frac{16}{81}$ , then $P(X=4)$ equals (A) $\frac{1}{16}$ (B) $\frac{1}{81}$ (C) $\frac{1}{27}$ (D) $\frac{1}{8}$	1
Q.9	The graph of the inequality $2x+3y > 6$ is (A) half plane that contains the origin (B) entire XOY plane (C) whole XOY plane excluding the points on the line $2x+3y=6$	1

	(D) half plane that neither contains the origin nor the points of the line $2x+3y=6$ .	
Q.10	The rise in Prices before DIWALI is an example of (A) Seasonal trend (B) Cyclical trend (c) Long term trend (D) Irregular Trend	1
Q.11	A Vehicle costing Rs. 1200000 has a Scrap value of Rs. 300000. If annual depreciation charge is Rs. 90000. Its useful life in Years. (A) 8 Years (B) 9 Years (C)10 years (D) 12 Years	1
Q.12	If the objective function for a L.P.P. is $Z = 5x + 7y$ and the Corner points of the bounded feasible region are $(0, 0)$ , $(6, 0)$ , $(3, 4)$ and $(0, 3)$ , Then the Maximum value of Z occurs at (A) $(0,0)$ (B) $(7,0)$ (C) $(3,4)$ (D) $(0,2)$	1
Q.13	The sum of the order and the degree of the differential equation $(2 + 3\frac{dy}{dx})^2 = 5\frac{d^2y}{dx^2}$ is : (A) 3 (B) 2 (C) 5 (D) 0.	1
Q.14	An Investment of Rs. 10,000 becomes Rs. 50,000 in 8 Years, Then the CAGR (compound annual growth rate) is given by- (A) $(\sqrt[8]{5} - 1) \times 100$ (B) $(\sqrt[8]{5} + 1) \times 100$ (C) $\frac{(\sqrt[8]{5} + 1)}{100}$ (D) $\frac{(\sqrt[8]{5} - 1)}{100}$	1
Q.15	If $[x \ 1] \begin{bmatrix} 1 & 0 \\ -2 & 0 \end{bmatrix} = 0$ , then x equals (A) 0 (B) -2 (C) -1 (D) 2	1
Q.16	The area of the region bounded by the curve $x^2 = 4y$ , the line $x=2$ and x-axis is (A) 1 sq unit (B) $\frac{2}{3}$ sq unit (C) $\frac{4}{3}$ sq unit (D) $\frac{8}{3}$ sq unit	1
Q.17	For the given five Values 15,24,18,33,42 the three years moving averages are (A) 19,25,33 (B) 19,30,31 (C)19,25,31 (D) 19,22,33	
Q.18	$\int_{-1}^1 (x^{91} + x^{93}) dx$ is equal to (A) 0 (B) 2 (C) $\frac{93}{4324}$ (D) - 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	
Q.19	<u>Assertion</u> (A) :Sale of woollen clothes goes up in winter and sale of cold drinks goes up during summer season. <u>Reason</u> (R) : Seasonal variations mean the variations occurring within parts of a year. (A) (i) (B) (ii) (C) (iii) (D) (iv)	1
Q.20	The total revenue received from the sale of x units of a product is given by $R(x) = 3x^2 + 36x + 5$ in rupees. <u>Assertion</u> (A) : The marginal revenue when $x=5$ is 66. <u>Reason</u> (R) : Marginal revenue is the rate of change of total revenue with respect to the number of item sold at an instance. (A) (i) (B) (ii) (C) (iii) (D) (iv)	1

### SECTION-B

Q.21	At what rate of Interest will the present value of a Perpetuity of Rs. 500 at the end of every 6 months be Rs. 10,000 ?	2
Q.22	If $A = \begin{bmatrix} 1 & -1 \\ -1 & 1 \end{bmatrix}$ and $A^2 = kA$ , then find the value of k.  OR If $A = \begin{bmatrix} 2 & 3 \\ -1 & 2 \end{bmatrix}$ , find $f(A)$ , where $f(x) = x^2 - 4x + 7$ .	2
Q.23	In a binomial distribution, the sum of its mean and variance is 1.8. Find the probability of two successes if the event was conducted 5 times	2

Q.24	A man can swim a certain distance downstream in 3 hours and returns back the same distance upstream in 6 hours. If the speed of stream is 2 km/hr, then find the speed of man in still water.  OR In a 200 m race, Ram can beat Ramesh by 5 m or 3 seconds. How much time did Ram take to complete the race?	2
Q.25	Mr. Singh invested Rs. 200000 in the fund for one year. At the end of the year, the investment was worth Rs. 216000. What is the nominal rate of interest, if the market price is the same at the end of the year?	2

### SECTION-C

Q.26	From the following data calculate 2 yearly moving average .  <table border="1" style="width: 100%; text-align: center;"> <tr> <td>YEAR:</td> <td>2005</td> <td>2006</td> <td>2007</td> <td>2008</td> <td>2009</td> <td>2010</td> <td>2011</td> <td>2012</td> </tr> <tr> <td>Income</td> <td>62</td> <td>65</td> <td>60</td> <td>57</td> <td>57</td> <td>55</td> <td>53</td> <td>49</td> </tr> </table> OR The following data shows the percentage of urban Indian who have a high speed internet connection at home  <table border="1" style="width: 100%; text-align: center;"> <tr> <td>Year</td> <td>2015</td> <td>2016</td> <td>2017</td> <td>2018</td> <td>2019</td> </tr> <tr> <td>Urban</td> <td>9</td> <td>18</td> <td>21</td> <td>29</td> <td>38</td> </tr> </table> Based on the above information use the method of least-squares to find the best-fit trend line equation for Urban Indians .	YEAR:	2005	2006	2007	2008	2009	2010	2011	2012	Income	62	65	60	57	57	55	53	49	Year	2015	2016	2017	2018	2019	Urban	9	18	21	29	38	3
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Q.27	A container has 40 litre of 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?	3																														
Q.28	Evaluate  $\int \frac{x^2}{(x-1)(x-2)(x-3)} dx$ OR Evaluate $\int_{-2}^1  x^3 - x  dx \int \frac{(x+1)(x+\log x)}{2x} dx$	3																														
Q.29	The mean weekly sales of a four-wheeler was 50 units per agency in 20 agencies. After an advertising campaign, the mean weekly sales increased to 55 units per agency with standard deviation of 10 units . Test whether the advertising campaign was successful?	3																														
Q.30	Mr. Ramesh wishes to purchase a new house, costing ₹ 45,00,000 with a down payment of ₹ 5,00,000 and Balance in EMI For 25 years . If the bank charges 6% per annum compounded monthly (reducing balance method) Calculate the EMI . [Use $(1.005)^{300} = 4.4650$ ]	3																														
Q.31	Mr. Ram has set up a sinking fund so that he can accumulate Rs. 10,000,00 in 10 years for his Children's higher education. How much should he deposit every six months if interest is 5 % per annum compounded semi-annually? [Use $(1.025)^{20} = 1.6386$ ]	3																														

## SECTION-D

Q.32	<p>It is known that 5 % of plastic buckets manufactured in a factory are defective. Using the Poisson distribution on a sample of 100 buckets, find the probability of:</p> <p>(i) Zero defective buckets</p> <p>(ii) At most one bucket is defective [Use <math>e^{-5} = 0.0067</math> ]</p> <p style="text-align: center;">OR</p> <p>In a math aptitude test, student scores are found to be normally distributed having mean as 45 and standard deviation 5. What percentage of students have scores - more than the mean score?</p>	5
Q.33	<p>An event management company charges ₹ 4,800 per guest, for a bulk booking for 100 guests. In addition, it offers a discount of ₹ 200 for each group of 10 guests over and above 100 guest booking. What is the number of guests that will maximise the amount of money the company receives on a booking? What is the maximum profit on such booking?</p> <p style="text-align: center;">OR</p> <p>To manufacture 'x' number of dolls, a company's total cost function C(x) is given by <math>C(x) = 100 + 0.025x^2</math> and the total revenue function R (x) is described as <math>R(x) = 5x</math>. Given that C (x) and R (x) are in thousand rupees, what number of dolls shall be manufactured to maximize the profit of the company? What is the maximum profit?</p>	5
Q.34	<p>A machine costs a company 52,000 and its effective life is estimated to be 25 years. A sinking fund is created for replacing the machine by a new model at the end of its life time, when its scrap realizes a sum of 2500 only. The price of the new model is estimated to be 25% more than the price of present one. Find what amount should be set aside at the end of each year out of the profits for the sinking fund, if it accumulates at 3.5% per annum compound? (Given <math>(1.035)^{25} = 2.3632</math>)</p>	5
Q.35	<p>Solve the system of equations using matrix method</p> $2x - 3y + 5z = 11, \quad 3x + 2y - 4z = 5, \quad x + y - 2z = -3$	5

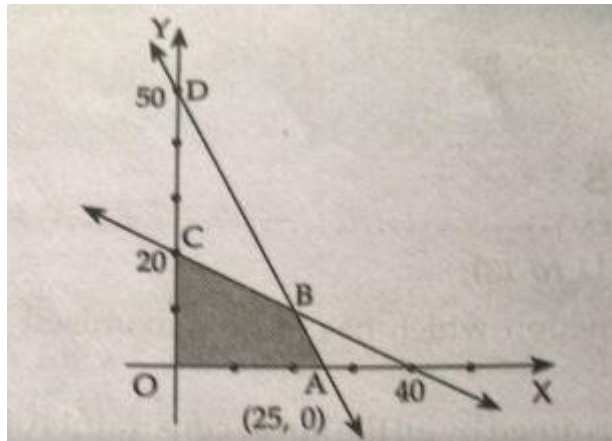
## SECTION-E

Q.36	<p><b>CASE STUDY – 1</b></p> <p>A Pipe is connected to a tank or cistern. It is used to fill or empty the cistern. The amount of work done by a pipe is a part of the tank filled or emptied in unit time. Three pipes A,B and C are connected to a tank . A and B fill the tank in 6 hours and 8 hours respectively when operated independently Pipe C empty the full tank in 12 hours when opened alone.</p> <p>Base on the above information, Answer the following questions:</p> <p>(1) For a routine cleaning of the tank, the tank needs to be emptied. If pipes A and B are closed at the time when the tank is filled to two-fifth of its total capacity, how long will pipe C take to empty the tank completely?</p> <p>(2) How long will it take for the empty tank to fill completely, if all the three pipes are opened simultaneously?</p> <p>(3) On a given day, pipes A, B and C are opened (in order) at 5 am, 8 am and 9 am respectively, to fill the empty tank. In how many hours will the tank be filled completely?</p> <p style="text-align: center;">OR</p> <p>(3) Given that the tank is half-full, only pipe C is opened at 6 AM, to empty the tank. After closing the pipe C and an hour's cleaning time, tank is filled completely by pipe A and B together. What is the total time taken in the whole process?</p>	1+1 +2
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Q.37

CASE STUDY – 2

The feasible region for an LPP IS SHOWN IN THE FIGURE Given below



Base on the given information, answer the following question

- (1) Find the equation of the line AD.
- (2) Find the equation of the line BC
- (3) Find the co-ordinates of points B and C

OR

- (3) Find the Constraints for the LPP

1+1  
+2

Q.38

CASE STUDY – 3

In a survey of studies, Let X be the random variable which count the number of hours a students of class XII studied. X has a probability distribution P(X) of the following form

X	0	1	2	3	4
P(X)	K	2 K	3 K	4 K	5 K

Where K is constant.

Based on the above information, answer the following questions. Show steps to support your answers.

- (1) Find the value of K.
- (2) What is the probability that student's studies at least 1 hour.
- (3) Calculate the mathematical expectation of number of hour's studies by students.

1+1  
+2