SAMPLE QUESTION PAPER (SET-3)

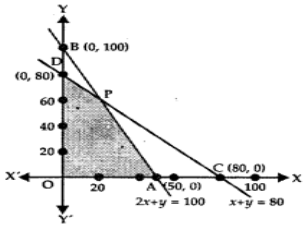
CLASS: XII **Applied Mathematics (241)**

Time Allowed: 3 hrs **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.

Sr. No.	SECTION – A	Marks
1	What is the value of m that satisfies, 157 ≡ 13(mod m), when 50 < m < 144? (a) 40 (b) 38 (c) 72 (d) 94	1
2	Solution the following inequality for real x is : $3\,(2-x\,) \geq 2\,(1\ -\ x)$ (a) $x \leq 6$ (b) $x \leq 4$ (c) $x \geq 4$ (d) $x \geq 6$	1
3	For any square matrix A, $A-A^T$ is a (a) unit matrix (b) symmetric matrix (c) skew-symmetric matrix (d) diagonal matrix	1
4	Let A be a nonsingular square matrix of order 4 × 4. Then |adj A| is equal to (a) | A | (b) | A | ^{3} (c) | A | ^{4} (d) 4|A|	1
5	A person can swim 8km/h in still water. if the speed of the stream is 4km/h, then find the time taken by the person to cover the distance of 24 km downstream? (a) 1 hour (b) 2 hours (c) 4 hours (d) 6 hours	1
6	Integrate: $\int (x^2 - e^x)dx$ (a) $x^2 - e^x + C$ (b) $2x^2 - e^x + C$ (c) $x^3/3 - e^x + C$ (d) NONE	1
7	Find the present value of a sequence of payments of 60 made at the end of each 6 months and continuing forever, if money is worth 4% compounded semi-annually (a) 3000 (b) 2000 (c) 4000 (d) 2500	1
8	If A is a square matrix, then $A\,A'$ is a (a) diagonal matrix (b) skew-symmetric matrix (c) symmetric matrix (d) none of these	1
9	Find the area of the region bounded by the curve $y^2 = x$ and the lines x = 1, x = 4 and the x-axis in the first quadrant. (a) 14/3 (b) 28/3 (c) 32/3 (d)16/3	1
10	Assume an investment's starting value is 2,00,000 and it grows to 12,00,000 in 4 years. Calculate CAGR (a) 56.5% (b) 50.5% (c) 60.5% (d) 60%	1
11	A machine costing 40,000 is expected to have a useful life of 4 years and a final scrap value of 8000. Find the annual depreciation charge using the straight-line method. (a) 8000 (b) 10000 (c) 5000 (d) 4000	1

12	General solution of differential equation: $dy = (x^2+1)\,dx$ is : (a) $y = x^3/3 + \log\|x\| + C$ (b) $y = x^3 + \log\|x\| + C$ (c) $y = x^3/3 + x + C$ (d) $\log y = x^3 + x + C$	1
13	In the given figure what is the LPP shaded region known as?  (a) Feasible region (b)Feasible solution (c) Optimal region (d)Objective region	1
14	A price index which is based on the prices of the items in the composite, weighted by their relative index is called: (a) price relatives (b) Consumer price index (c) Weighted aggregative price index (d) Simple aggregative index	1
15	In what ratio shall I mix two types of oranges worth ₹ 50 per kg and ₹ 95 kg respectively so as to get a mixture at ₹ 80 per kg ? (a) 2:3 (b) 3:2 (c) 1:2 (d) 3:5	1
16	. The degree of the differential equation, $\left(\frac{d^2y}{dx^2}\right)^3 + \left(\frac{dy}{dx}\right)^2 + \frac{dy}{dx} = 0$ (a) 1 (b) 2 (c) 3 (d) 4	1
17	Cost of living at two different cities can be compared with the help of: (a) Value index (b) Consumer price index (c) Volume index (d) Un-weighted index	1
18	The probability distribution of X is X | 0 | 1 | 2 | 3 | 4 P(X) | 0.2 | 3K | 2K | 2K | K Find K (a) 1.5 (b) 0.10 (c) 0.05 (d) 0.15	1
19	Index number is always expressed in (a) Percentage (b) Ratio (c) Proportion (d) None of the above	1
20	The derivative of $(\log x)^2$ is (a) $1/x$ (b) $1/x^2$ (c) $2 \log x/x$ (d) $2 \log x$	1
	SECTION – B	
21	The following data are from a random sample : 5,8,10,7,10,14 (i) What is the point estimate of the population mean? (ii) What is the point estimate of the population standard deviation?	2
22	Find the area of the triangle whose vertices are (3, 8), (– 4, 2) and (5, 1). OR Find the inverse of matrices A $\begin{bmatrix} 2 & -2 \\ 4 & 3 \end{bmatrix}$ (if it exists)	2
23	A manufacturing company makes two models A and B of a product. Each piece of Model A requires 9 labour hours for fabricating and 1 labour hour for finishing. Each piece of Model B requires 12 labour hours for fabricating and 3 labour hours for finishing. For fabricating and finishing, the maximum labour hours available are 180	2

	and 30 respectively. The company makes a profit of Rs 8000 on each piece of model A and Rs 12000 on each piece of Model B. How many pieces of Model A and Model B should be manufactured per week to realise a maximum profit? Formulate the linear programming problem to maximise the manufacturer profit?	
24	A pipe can fill the tank in 3 hours and another pipe can empty the full tank in 4 hours. If both the pipes are opened together, then find how much time will they take to fill the tank ?	2
25	Find local maximum and local minimum values of the function f given by $f(x) = 3x^4 + 4x^3 - 12x^2 + 12$ OR Differentiate the following w.r.t. x: $log\ (log\ x)$	2
	SECTION – C	
26	Mr . Ajay took a loan of 2,000 for 6 months. Lender deducts 200 as interest while lending. Find the effective rate of interest charged by lender OR Mr. Raj takes a loan of 2,00,000 with 10% annual interest rate for 5 years. Calculate EMI under Flat Rate system	3
27	Solve the following system of equations by matrix method. $3x - 2y + 3z = 8$ $2x + y - z = 1$ $4x - 3y + 2z = 4$ OR Express the following matrices as the sum of a symmetric and a skew symmetric matrix $\begin{bmatrix} 6 & -2 & 2 \\ -2 & 3 & -1 \\ 2 & -1 & 3 \end{bmatrix}$	3
28	Integrate: $x\ (\log x)^2$ OR $(x^2 + 1) \log x$	3
29	A person can row a boat 5 km an hour in still water. It takes him thrice as long to row upstream as to row downstream. Find the rate at which the stream is flowing.	3
30	Calculate Fisher's price index number for the given data	3
31	Consider the following hypothesis test : $H_0 : \mu \leq 25$ $H_a : \mu > 25$ A sample of 40 provided a sample mean of 26.4. the population deviation is 6 (i)compute the value of the test statistics . (ii)what is the P – value .	3

Commodity	Quantity(2008) (Q_0)	Price(2008) (p_0)	Quantity(2012) (Q_1)	Price(2012) (p_1)
Rice	4	10	6	13
Wheat	7	15	8	18
Rent	5	25	9	29
Fuel	8	11	10	14

	(iii) At $\alpha = 0.01$, what is your conclusion .	
	SECTION – D	
32	It is known that $\frac{2}{1000}$ of razor blades manufactured in a factory are defective. Using the Poisson distribution on a sample of 10 razor blades. In a consignement of 10000 packets ,find the probability of: (i) No defective razor blades. (ii) one razor blades is defective . i[Use $e^{-0.02} = 0.9802$] **OR** In a math aptitude test, student scores are found to be normally distributed having mean as 30 and standard deviation 10.If 1000 students appeared in the test ,calculate the number of students scoring: (i)Less than 33 marks ? (ii)between 30 and 45 ?	5
33	Find the income derived from 88 shares of 25 each at 5 premium, brokerage being ¼ per share and the rate of dividend being 7 ½ % per annum. Also find the rate of interest on the investment ?	5
34	A factory manufactures two types of screws, A and B. Each type of screw requires the use of two machines, an automatic and a hand operated. It takes 4 minutes on the automatic and 6 minutes on hand operated machines to manufacture a package of screws A, while it takes 6 minutes on automatic and 3 minutes on the hand operated machines to manufacture a package of screws B. Each machine is available for at the most 4 hours on any day. The manufacturer can sell a package of screws A at a profit of Rs 7 and screws B at a profit of Rs 10. Assuming that he can sell all the screws he manufactures, how many packages of each type should the factory owner produce in a day in order to maximize his profit? Determine the maximum profit.	5
35	Find the general solution of given differential equations : $(x^2 + xy)\, dy = (x^2 + y^2)\, dx$ OR $(x^2 - y^2)\, dx + 2xy\, dy = 0$	5
	SECTION – E	
36	**CASE STUDY – I**	

	 In the year 2000, Mr. Manish took a home loan of ₹ 3000000 from the State Bank of India at 7.5% p.a. compounded monthly for 20 years. Based on the above information, answer the following questions: (i) Total interest paid by Mr. Manish was? (ii)The equated monthly installment paid by Mr. Manish was? (iii)Principal outstanding at the beginning of 193rd month was? OR (iii) Calculate the interest paid in 193rd month?	1 1 2 OR 2
37	**CASE STUDY – II**	1 2 OR 2 1

The probability that a bulb produced by a factory will fuse after 150 days of use is 0.05. Find the probability that out of 5 such bulbs by using binomial distribution.

(i) none of them will fuse.

(ii) not more than one will fuse.

OR

Only one bulb is fuse

(iii) more than one will fuse .

38 **CASE STUDY – III**

An overhead water tank has three pipes A, Band C attached to it. The inlet pipes A and B can fill the empty tank independently in 15 hours and 12 hours respectively. The outlet pipe C alone can empty a full tank in 20 hours.

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

(i) 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 1

	pipe C take to empty the tank completely? (ii) How long will it take for the empty tank to fill completely, if all the three pipes are opened simultaneously? (iii) 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? OR How much water will be filled by pipe A and Pipe B in 2 hours?	1 2 OR 2