Subject Code - 241

Sample Question Paper
CLASS: XII
Session: 2021-22
Applied Mathematics (Code-241)
Term - II

Time Allowed: 2 hrs **Maximum Marks: 40**

General Instructions:

- **The question paper is divided into 3 sections – A, B and C**
- **Section A comprises of 6 questions of 2 marks each. Internal choice has been provided in two questions.**
- **Section B comprises of 4 questions of 3 marks each. Internal choice has been provided in one question.**
- **Section C comprises of 4 questions. It contains one case study based question. Internal choice has been provided in one question.**

SECTION – A

1.	The marginal revenue function for a commodity is given by $MR = 9 + 2x - 6x^2$. Find the demand function. **OR** The marginal cost of producing x pairs of tennis shoes is given by $MC = 50 + \frac{300}{x+1}$ If the fixed cost is ₹2000, find the total cost function.	2
2.	Find the present value of perpetuity of ₹600 at end of each quarter if money is worth 8% compounded quarterly.	2
3.	What effective rate is equivalent to a nominal rate of 8% per annum compounded quarterly? **OR** Find the present value of an annuity of ₹1000 payable at the end of each year for 5 years if money is worth 6%compounded annually. $[Given\ (1.06)^{-5} = 0.7473]$	2
4.	A sampling distribution of the sample means $\overline{X}$ is formed from *a* population with mean weight $\mu = 60kg$ and standard deviation $\sigma = 9kg$. What is the expected value and standard deviation of $\overline{X}$, if sample size is 36?	2
5.	Find the trend values using 3 yearly moving average for the loans sanctioned to farmers by a particular branch of a bank in a village.	2

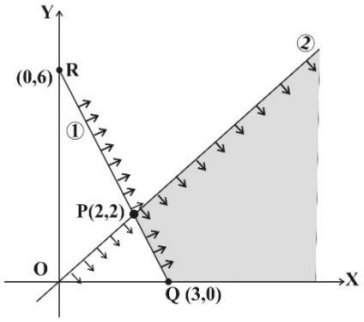
Year	2016	2017	2018	2019	2020	2021
Amount (in ₹ lakh)	25	30	32	40	45	50

6. The feasible region of the LPP — 2

Min $Z = 3x + 2y$

subject to constraints

$2x + y \geq 6,\ x - y \geq 0,\ x \geq 0, y \geq 0$ is given below:



Determine the optimal solution. Justify your answer.

SECTION – B

7. The supply function for a commodity is given by $p = x^2 + 4x + 3$, where x is the quantity supplied at the price p. Find the producers surplus when the price of the commodity is ₹48. — 3

8. The following table shows the quarterly sales (in ₹crore) of a real estate company. Compute the trend by quarterly moving averages. — 3

Quarters / Years	Q_1	Q_2	Q_3	Q_4
2018	12	14	18	20
2019	18	16	20	22
2020	27	24	30	36

OR

Fit a straight line trend by the method of least squares and estimate the trend for the year 2023.

Year	2014	2015	2016	2017	2018	2019	2020
Sales (in ₹ lacs)	26	26	44	42	108	120	166

9. A machine produces washers of thickness 0.50 mm. To determine whether the machine is in proper working order, a sample of 10 washers is chosen for which the mean thickness is 0.53mm and the standard deviation is 0.03 mm. Test the hypothesis at 5% level of significance that the machine is working in proper order. — 3

$[Given\ critical\ value, t_{0.025} = 2.262\ at\ \nu(d.f) = 9\ ]$

10.	A person invested ₹15000 in a mutual fund and the value of investment at the time of redemption was ₹25000. If CAGR for this investment is 8.88%, Calculate the time period for which the amount was invested? $[Given \log(1.667) = 0.2219 \ \& \ \log(1.089) = 0.037]$	3
	SECTION – C	
11.	S & D chemicals produces two products, an alkaline solution and a base oil that are sold as raw material to companies manufacturing soaps and detergents. On the basis of current inventory levels and estimated demand for the coming month, S & D's management has decided that combined production of alkaline solution and base oil must be at least 3500 gallons. S & D chemicals are also committed to supply 1250 gallons of alkaline solution to one of its major customer. The alkaline solution and base oil requires respectively 2 hours and 1 hour of processing time per gallon. The total processing time available for the coming month is 6000 hours. The production cost is ₹200 per gallon for the alkaline solution and ₹300 per gallon for base oil. Formulate the above as a L.P.P and solve it by graphical method to help S & D chemicals determine the minimum production cost.	4
12.	A machine costing ₹50,000 is to be replaced at the end of 10 years, when it will have a salvage value of ₹5000. In order to provide money at that time for a machine costing the same amount, a sinking fund is set up. If equal payments are placed in the fund at the end of each quarter and the fund earns 8% compounded quarterly, then what should each payment be? $[Given \ (1.02)^{40} = 2.208 \ ]$	4
13.	A couple wishes to purchase a house for ₹15,00,000 with a down payment of ₹4,00,000. If they can amortize the balance at an interest rate 9% per annum compounded monthly for 10 years, find the monthly installment **(EMI)**. Also find the total interest paid. $[Given \ (1.0075)^{-120} = 0.4079 \ ]$ **OR** A ₹2000, 8% bond is redeemable at the end of 10 years at ₹105. Find the purchase price to yield 10% effective rate. $[Given (1.1)^{-10} = 0.3855]$	4
14.	**CASE STUDY** General anesthesia is used for major operations to cure the patients and conduct pain free surgeries. Propofol is a commonly used anesthetic injected for major operations such as knee replacement or open heart surgery. It also acts as a sedative and an analgesic.	

A patient is rushed to operation theatre for a 2-hour cardiac surgery. A person is anesthetized when its blood stream contains at least 3 mg of propofol per kg of body weight. The rate of change of propofol(x), in the body is proportional to the quantity of propofol present at that time. Based on the above information. Answer the following questions:

a. Show that propofol given intravenously is eliminated exponentially from the patients' blood stream — 2

b. What dose of propofol should be injected to induce unconsciousness in a 50 Kg adult for a two hours operation?
(Given $(2)^{\frac{1}{5}} = 1.1487$ & assume half-life of propofol = 5 hours) — 2
