SET-C

MOCK EXAMINATION I 2022-2023

APPLIED MATHEMATICS (241)

Exam No: _____ **Max. Marks: 80**

Std / Sec: XII-D **Time: 3 hrs.**

Date :

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 types questions of 2 marks** each.

Section – C:

5. It comprises of **6 SA types of questions of 3 marks** each.

Section – D:

6. It comprises of **4 LA types 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.

- **Use of Calculator not permitted.**

Section –A

(Each question (1-20) carries 1 mark each, all questions are compulsory. No internal choice in this section)

1. The value of $5^8 \pmod 4$ is

   (a) 0 (b) 1 (c) 2 (d) 3

2. If $|2x+3|<7, x \in R$, then

   (a) $x \in (-5,2]$ (b) $x \in (-\infty,-5) \cup (2,\infty)$ (c) $x \in (-5,2)$ (d) $x \in (-\infty,-5] \cup [2,\infty)$

3. The present value of a perpetuity of ₹750 payable at the beginning of each year, if money is worth 5% p.a., is

   (a) ₹15000 (b) ₹15750 (c) ₹14250 (d) none of these

4. For the purpose of t-test of significance, a random sample of size (n) 34 is drawn from a normal population, then the degree of freedom (v) is -

   (a) 1/34 (b) 33 (c) 34 (d) 35

5. 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/h, then the speed of man in still water is

   (a) 6 km/h (b) 7 km/h (c) 8 km/h (d) 8.5 km/h

6. In a school, a random sample of 125 students is taken to check whether a student's average calory intake is 1650 or not. The collected data of average calories intake of sample students is presented in a frequency distribution, which is called a:

(a) Statistics (b) Sampling distribution (c) parameter (d) population mean

7. At a game of billiards, A can give 15 points in 60 and A can give C to 20 points in 60. How many points can B give C in a game of 90?

(a) 30 points (b) 20 points (c) 10 points (d) 12 points

8. A money/fund which is created to accumulate money over the years to years to discharge a future obligation is called_____.

(a) perpetuity (b) coupon payment (c) sinking fund (d) loan

9. If the marginal revenue function of a commodity is $MR = 2x - 9x^2$, then the revenue function is

(a) $2x^2 - 9x^3$ (b) $2 - 18x$ (c) $x^2 - 3x^3$ (d) $18 + x^2 - 3x^3$

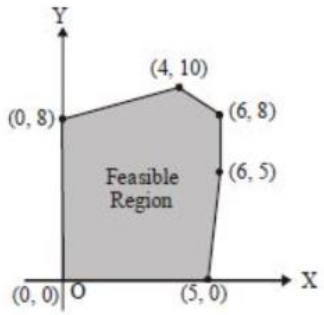
10. For predicting the straight-line trend in the sales of scooters (in thousands) on the basis of 6 consecutive years' data, the company makes use of 4-year moving averages method. If the sales of scooters for respective years are *a*, *b*, *c*, *d*, *e* and *f* respectively, then which of the following average will not be computed?

(a) $\frac{a+b+c+d}{4}$ (b) $\frac{b+c+d+e}{4}$ (c) $\frac{a+c+d+e}{4}$ (d) $\frac{c+d+e+f}{4}$

11. A newspaper printing machine costs ₹400000 and estimated scrap value of ₹30000 at the end of its useful life of 10 years. What is its annual depreciation as per linear method?

(a) ₹40000 (b) ₹37000 (c) ₹44000 (d) ₹37700

12. The feasible region for an LPP is shown below:
Let $Z = 3x - 4y$ be the objective function. Minimum of Z occurs at



(a) (0,0) (b) (0,8) (c) (5,0) (d)(4,10)

13. The general solution of the differential equation $\frac{dy}{dx} = e^{x-y}$ is

(a) $e^y = e^x + C$ (b) $e^{-y} = e^x + C$ (c) $e^{-y} = e^{-x} + C$ (d) $e^y e^x + C$

14. Assume an investment's starting value is 10,000 and it grows to 60,000 in 4 years. Calculate CAGR. (Given $(6)^{1/4}$=1.56508)

(a) 56.50% (b) 1.56% (c) 56.58% (d) 55.60%

15. Three types of wheat costing ₹18 per kg, ₹20 per kg and ₹25 per kg are mixed together. If the mixed variety is sold at ₹22 per kg, then the ratio in which these types of wheat should be mixed respectively is

(a) 1:2:3 (b) 2:2:2 (c) 2:3:1 (d) 1:1:2

16. What sum of money invested now could establish a scholarship of ₹2500, which is to be awarded at the end of every year forever, if money is worth 4% compounded annually?

(a) ₹62500 (b) ₹125000 (c) ₹31250 (d) ₹62000

17. For the given five values **15, 24, 18, 33, 42**, the three years moving averages are

(a) 19, 22, 33 (b) 19, 25, 31 (c) 19, 30, 31 (d) 19, 25, 33

18. If we reject the null hypothesis, we might be making

(a) Type-I Error (c) Type-I Error

(b) A correct decision (d) A wrong decision

Directions (19-20)the below given questions are of the type Assertion and Reason. Each question contains Assertion and Reason. Each question has 4 choices (a), (b), (c) and (d)out of which ONLY ONE is correct. So select the correct choice.

(a) Both the Assertion and Reason is true, and the reason is correct explanation for assertion.

(b) Both the Assertion and Reason is true, and the reason is not correct explanation for assertion.

(c) Assertion is true, reason is false

(d) Assertion is false, reason is true

19. **Assertion:** The mean of the numbers obtained on throwing a die having written and 1 on three faces, 2 on two faces and 5 on one face is 2.

Reason: The mean $\mu = \sum p_i x_i = p_1 x_1 + p_2 x_2 + ... + p_n x_n$, is also called average or expected value or expectation, denoted as E(X).

20. **Assertion:** Mr Dinesh has two investment options either 10% per annum compounded semiannually or 9.8% per annum compounded quarterly and he finds first option is better.

Reason: Effective rate of option 1 is 10.25% and option 2 is 10.17% provided $(1.0245)^4 = 1.1017$

Section – B

(Each question (21-25) carries 2mark each, all questions are compulsory. In case of internal choice attempt only one question)

21. The average heart rate for Indians is 72 beats per minute. To lower their heart rate, a group of 25 people participated in an aerobics exercise programme. The group was tested after six months to see if the group had significantly slowed their heart rate. The average heart rate for the group was 69 beats/minute with a standard deviation of 6.5. Was the aerobics program effective in lowering heart rate? (Given $\alpha = 0.05$, $t_\alpha = 1.711$)

22. If the matrix $\begin{bmatrix} -2 & x-y & 5 \\ 1 & 0 & 4 \\ x+y & z & 7 \end{bmatrix}$ is symmetric, find the values of x,y and z.

(OR)

If $A=\begin{bmatrix} 3 & -5 \\ 4 & 2 \end{bmatrix}$, find $A(adjA)$.

23. Two pipes can fill a cistern in 8 and 12 hours respectively. The pipes are opened simultaneously and it takes 12 minutes more to fill the cistern due to leakage. If the cistern is full, what will be the time taken by the leakage to empty it?

(OR)

In a game, A can give 15 points to B, A can give 30 points to C and B can give 20 points to C. How many points make the game?

24. A retired person wants to invest an amount of upto ₹20000. His broker recommends investing in two types of bonds A and B, bond A yielding 8% return on the amount invested and bond B yielding 7% return on the amount invested. After some consideration, he decides to invest atleast ₹5000 in bond A and no more than ₹8000 in bond B. He also wants to invest atleast as much in bond A as in bond B. Formulate as L.P.P. to maximize his return on investments.

25. Find the declared rate of return compounded semiannually which is equivalent to 6% effective rate of return. [Given $(1.06)^{1/2}$=1.0296]

SECTION – C

(Each question (26-31) carries 3 marks each, all questions are compulsory. In case of internal choice attempt only one question)

26. A ladder 5 m long is leaning against a wall. The bottom of the ladder is pulled along the ground, away from the wall, at the rate of 2 cm/s. How fast is its height on the wall decreasing, when the foot of the ladder is 4 m away from the wall?

27. A trust fund has ₹30,000 that must be invested in two different types of bonds. The first bond pays 5% interest per year, and the second bond pays 7% interest per year. Using matrix multiplication, determine how to divide ₹30,000 among the two types of bonds. If the trust fund must obtain an annual total interest of ₹2000.

28. Evaluate: $\int \frac{e^x}{(1+e^x)(2+e^x)}dx$

(OR)

Evaluate: $\int_{-2}^{3} |1-x^2|dx$

29. The marginal cost of producing x units of a book set of class XII given by $MC = 150 + \frac{1}{x+3}$. If the cost is ₹2200, find the total cost function.[Given log3=04.771]

(OR)

In a bank, principal increases continuously at the 5% per year. In how many years ₹1000 double itself?

30. Mr Ajay Prakash purchased a motorcycle of ₹150000 with ₹x down payment. He wishes to repay balance in equal monthly payments as ₹3110.66 in 4 years. If bank charges 9% per annum compounded monthly, find the down payment made by Mr Ajay Prakash.
Given $(1.0075)^{48}$ =1.4314

31. Mr Ganesh has bought 200 shares of city look company at ₹100 each in 2015. After selling them he has received ₹30000 which accounts for 22.47% CAGR. Calculate the number of years for which he was holding the shares.[Given log1.5=0.1761, log1.2247=0.0882]

SECTION – IV

(Each question (32-35) carries 5 marks each, all questions are compulsory. In case of internal choice attempt only one question)

32. If the sum and the product of the mean and variance of Binomial Distribution are 1.8 and 0.8 respectively, find the probability distribution and the probability of atleast one success.

(OR)

A radar unit is installed to measure the speeds of cars on a highway. The speeds are normally distributed with mean 80 km/h and standard deviation 10 km/h. If a car is chosen at random, find the probability that car is running
(i) At more than 100 km/h
(ii) Between 90 km/h and 110 km/h
Given F(2)=0.9772, F(-2)=0.0228, F(1)=0.8413, F(-1)=0.1587, F(3)=0.9986, F(-3)=0.0013

33. A manufacturer can produce x items at a total cost of $\left(120x + \frac{x^2}{2}\right)$. If he sells the whole produce at p per item, where $p = 2\left(100 - \frac{x}{4}\right)$, then find the production level x at which the profit is maximum. What is the price per item and the total profit?

(OR)

A company is selling a certain product. The demand function for the product is linear. The company can sell 2000 units when the price is ₹8 per unit and it can sell 3000 units when the price is ₹4 per unit. Determine:

(i) The demand function

(ii) The total revenue function

34. A manufacturer produces two models of bikes-model X and model Y. Model X takes a 6 man-hours to make per unit, while model Y takes 10 man-hours per unit. There is a total of 450 man-hours available per week. Handling and marketing costs are ₹2000 and ₹1000 per unit for Models X and Y respectively. The total funds available for these purposes are ₹80000 per week. Profit per unit for models X and Y are ₹1000 and ₹600 respectively. How many bikes of each model should the manufacturer produce so as to yield a maximum profit? Form an L.P.P. and solve it graphically using iso-profit/iso-cost method.

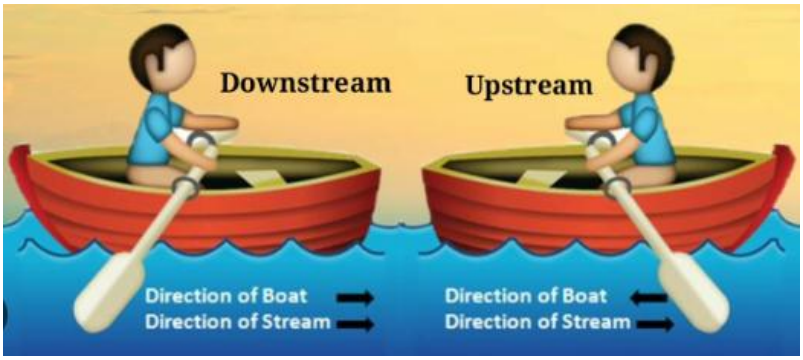
35. Two schools A and B want to award their selected teachers on the values of Honesty, Hard Work and Regularity. The school A wants award ₹ x , ₹ y and ₹ z each for the three respective values to its 3,2 and 1 teachers respectively with a total award money of ₹1.28 lakhs. School B wants to spend ₹1.54 lakhs to award its 4, 1 and 3 teachers on the respective values (by giving the same award money for the three values as School A). If the total amount of award for one prize on each value is ₹57000. Using matrices, find the award money for each value.

SECTION – E

(All the questions (36-38) are compulsory. In case of internal choice attempt only one question)

36. **Case I:**

Stacy is rowing a boat. she takes 6 hours to row 48km upstream whereas she takes 3 hours to go the same distance downstream.



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

(a) What is her speed of rowing in still water? **[1m]**

(b) What is the speed of the stream? **[1m]**

(c) What is the average speed? **[2m]**

(OR)

The stream is flowing at the speed of 4 km/h. if stacy rows a certain distance upstream in 3.5 hours and returns to the same place in 1.5 hours, then find the speed of stacy's boat in still water **[2m]**

37. **CASE II:**

When observed over a long period of time, a time series data can predict trend that can forecast increase or decrease or stagnation of a variable under consideration. Such analytical studies can benefit a business for forecasting or prediction of future estimated sales or production. Mathematically, for finding a line of best-fit to represent a trend, many methods are available. Methods like moving-averages and least-squares squares are some of the techniques to predict such trends.

Mr. Kabilan runs a shoe factory and the record of his sales ('000) for the period of 2015- 2019 is as follows:

Year	2015	2016	2017	2018	2019
sales (in '000)	70	80	96	100	95

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

(a) By taking year 2017 as origin, use method of least-squares to find the best-fit trend line equation for Mr. Kabilan's shoe factory sales. Show the steps of your working. **[2m]**

(OR)

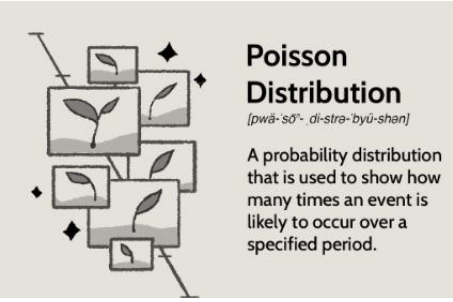
Demonstrate the technique to fit the best-suited straight-line trend by the method of 3-years moving averages. Also draw the trend line. **[2m]**

(b) Estimate the likely sales of the shoe factory during 2022? **[1m]**

(c) Mr. Kabilan's wishes to grow his business to yearly sales of 110000. In which year will he be able to reach his target? **[1m]**

38. **CASE III:**

a group of social activist wants to check the human life time of a town of 55 year old people. there are 500 persons of age 55 years in a town. the chace that a person aged 55 years will die within next 5 years is 1%.



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

(a) What is the probability that exactly 4 persons of age 55 years will die within next 5 years? **[1m]**

(b) What is the probability that none of the person aged 55 years will die within next 5 years? **[1m]**

(c) What is the probability that atleast 3 persons of age 55 years will die within next 5 years? **[2m]**

(OR)

What is the probability that atmost than 3 persons of age 55 years will die within next 5 years? **[2m]**

**********All the best**********