INDIAN SCHOOL AL WADI AL KABIR

FIRST REHEARSAL EXAMINATION (2023-24)

SUB: Applied Mathematics (241) ISWK/P1/241/Set-1

ROLL NUMBER: | | | | | |

Date: 30/11/2023 Set I Time Allowed :3 hours

Class: XII Maximum Marks: 80

General Instructions:

1. This question paper contains - five sections A, B, C, D and E. Each section is compulsory. However, there are internal choices in some questions.
2. Section A has 18 MCQ's and 02 Assertion-Reason based questions of 1 mark each.
3. Section B has 5 Very Short Answer (VSA)-type questions of 2 marks each.
4. Section C has 6 Short Answer (SA)-type questions of 3 marks each.
5. Section D has 4 Long Answer (LA)-type questions of 5 marks each.
6. Section E has 3 source based/case based/passage based/integrated units of assessment (4 marks each) with sub parts.

Q. No	SECTION A (MCQ)								Marks
1.	If $x \equiv 4(mod7) then\ x \in$ _____								1
	A	$\{4, 11, 18, \dots\}$	**B**	$\{11, 18, 25 \dots\}$	**C**	$\{4, 8, 12, \dots\}$	**D**	$\{1, 8, 15 \dots\}$	
2.	$2^{102}(mod7) =$ _____								1
	A	0	**B**	3	**C**	2	**D**	1	
3.	$If\ A = \begin{pmatrix} x & 2 & 3 \\ y & 0 & -4 \\ -3 & z & 0 \end{pmatrix}\ and\ A\ is\ a\ skew\ symmetric\ matrix, then\ x + y + z =$ _								1
	A	0	**B**	1	**C**	2	**D**	-3	
4.	$The\ solution\ of\ the\ equation\ xdy - ydx = 0\ is$ _____								1
	A	$x - y = c$	**B**	$xy = c$	**C**	$\frac{x}{y} = c$	**D**	$x + y = c$	
5.	In what ratio does a grocer mix two varieties of pulses worth Rs.85 per kg and Rs.100 per kg respectively so as get a mixture worth Rs.92 per kg?								1
	A	8: 7	**B**	5: 2	**C**	15: 8	**D**	8: 9	

6.	The value of x if $A\ is\ a\ singular\ matrix, where\ A = \begin{pmatrix} 1 & 2 & 0 \\ 2 & 0 & x \\ 2 & 0 & 1 \end{pmatrix}$	1

	A	0	**B**	-1	**C**	2	**D**	1	

7.	The solution of inequality $\frac{x}{2}+\frac{x}{3}+\frac{x}{4} \leq 13$								1
	A	$x\epsilon[12,13]$	**B**	$x\epsilon[12,\infty)$	**C**	$x\epsilon(-\infty,12]$	**D**	$x\epsilon(-\infty,13]$	
8.	A and B are square matrices each of order 3 such that $\|A\| = -1\ and\ \|B\| = 3$. What is the value of $\|3AB\| =$ ____ ?								1
	A	-9	**B**	-18	**C**	-27	**D**	-81	
9.	If MC and AC represents marginal cost and average cost of producing x units of products respectively, then _____								1
	A	$\frac{d(AC)}{dx} = x(MC-AC)$	**B**	$\frac{d(AC)}{dx} = \frac{(MC-AC)}{x}$					
	C	$\frac{d(AC)}{dx} = x(AC-AC)$	**D**	$\frac{d(AC)}{dx} = \frac{(AC-MC)}{x}$					
10.	If $\int_0^k 3x^2dx = 64, then\ k =$ ____								1
	A	1	**B**	2	**C**	3	**D**	4	
11.	If $A = \begin{bmatrix} 1 & 2 \\ -3 & 0 \end{bmatrix}\ and\ B = \begin{bmatrix} 2 & 3 \\ -2 & 1 \end{bmatrix}\ then\ AB =$ ____								1
	A	$\begin{bmatrix} -2 & -5 \\ 6 & 9 \end{bmatrix}$	**B**	$\begin{bmatrix} 2 & 5 \\ 6 & 9 \end{bmatrix}$	**C**	$\begin{bmatrix} -2 & 5 \\ -6 & -9 \end{bmatrix}$	**D**	$\begin{bmatrix} 2 & -5 \\ 6 & 9 \end{bmatrix}$	
12.	Which of the following is not correct for a normal distribution?								1
	A	All normal curves are bell-shaped with points of inflection at $\mu \pm \sigma$							
	B	Mean and standard deviation of a Standard normal distribution is zero and one respectively.							
	C	The normal distribution function is discrete							
	D	The total area under normal curve is 1							
13	The average farm size of country A is 191 acres and for country B is 192 acres. Assume the data were obtained from two samples with standard deviations 38 and 12 acres and sample sizes of 10 and 8 respectively. The degree of freedom is _____.								1
	A	16	**B**	48	**C**	191	**D**	20	

14.	If the calculated value of $\|t\| < t_v(\alpha)$, then the null hypothesis is:	1
	A rejected **B** accepted **C** Cannot be determined **D** neither accepted nor rejected	
15.	For the given five values 15, 24, 18, 33, 42 the three years moving averages are:	1
	A 19, 22, 33 **B** 19, 25, 31 **C** 19, 30, 31 **D** 19, 25, 33	
16.	Mr. X takes a loan of Rs 2,00,000 with 10% annual interest rate for 5 years. EMI under Flat Rate system is _____	1
	A ₹7000 B ₹6000 C ₹5000 D ₹4000	
17.	At what rate converted semi-annually will the present value of a perpetuity of Rs 450 payable at the end of each 6 months be Rs 20,000?	1
	A 5% **B** 4% **C** 5.5% **D** 4.5%	
18.	The corner points of the feasible region determined by the system of linear constraints are (0, 0), (25, 15), (30, 5), (30, 0). Then Maximum of $z = 4x + 3y$ is at _____	1
	A (25, 15) **B** (30, 5) **C** (30, 0) **D** (0, 0)	
	ASSERTION-REASON BASED QUESTIONS In the following questions (19 and 20), a statement of assertion (A) is followed by a statement of Reason (R). Choose the correct answer out of the following choices. A) Both A and R are true and R is the correct explanation of A. B) Both A and R are true but R is not the correct explanation of A. C) A is true but R is false. D) A is false but R is true.	
19.	(A) For the curve $x^2 + y^2 = 25$, *the slope of tangent at* $(3, 4)$ *is* $-\frac{3}{4}$. (R) The slope of tangent at (x_1, y_1) *for a curve* $y = f(x)$ *is given by* $\frac{dy}{dx}$ *at* (x_1, y_1).	1
	A B C D	
20.	A) $\int_{-2}^{2} (x^3 + x + 1) = 0$ R) $\int_{-a}^{a} f(x) = 0$ *if* $f(-x) = -f(x)$.	1
	A B C D	

	SECTION B	
21.	Suppose that two cards are drawn from a deck of 52 cards. Let X be the number of aces obtained, find a) the probability distribution of the number of aces obtained b) E(X).	2
22.	Two pipes A and B can fill a tank in 24 minutes and 32 minutes respectively. If both the pipes are opened simultaneously, after how much time should B be closed so that the tank is full in 18 minutes? OR Solve: $\frac{3x}{5} - \frac{2x-1}{3} > 1$	2
23.	A and B can cover a 400m race in 44 seconds and 50 seconds respectively. When A finished the race, then at what distance from the finishing line?	2
24.	Evaluate: $\int_{-1}^{1} \frac{x^2}{1+e^x} dx$ OR	2
	Find the maximum profit that a company can make if the profit function is given by $p(x) = 41 - 24x - 18x^2$.	
25.	Express $A = \begin{pmatrix} 5 & 2 & 0 \\ -1 & 4 & 3 \\ 1 & 2 & -1 \end{pmatrix}$ as a sum of symmetric and skew symmetric matrices. OR Solve using Cramer's rule: 3x – 4y= -8 4x+3y = 31	2
	SECTION C	
26.	A shopkeeper has 1000 kg of wheat, part of which she sells at 18% gain and the rest at 28% gain. In total she gains 24 %. Find the quantity of wheat sold at 18% and 28%. **OR** A bottle is full of dettol. One-third of its dettol is taken away and an equal amount of water is poured into the bottle to fill it again. This operation is repeated three times. Find the final ratio of dettol to water in the bottle.	3
27.	The demand and supply functions under the pure market competition are $p_d = 16 - x^2$ and $p_s = 2x^2 + 4$ respectively, where p is the price and x is the quantity of the commodity. Find a) the price $p_0 and\ quantity\ q_0$. b) consumer surplus using integrals when the quantity is bought and sold at equilibrium.	3
28.	In a hurdle race, a player has to cross 10 hurdles. The probability that he will clear each hurdle is $\frac{5}{6}$. What is the probability that a) he will clear all the hurdles b) he will knock down fewer than 2 hurdles.	3

29.	The mean weekly sales of a four-wheeler were 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. (Use $t_{0\cdot005}$ = 1·729 for 19 d.f.)	3
30.	Karan invested ₹ 20,000 in a stock of a company for 6 years. The value of his investment at the end of each year is given below: Year 1: 22,000 | Year 2: ₹ 23,000 | Year 3: ₹ 23,300 | Year 4: ₹ 23,600 | Year 5: ₹ 24,400 | Year 6: ₹ 28,000 Calculate the CAGR of Karan's investment. (Use $1.4^{\frac{1}{6}} = 1.058$). OR An asset costs ₹ 4,50,000 with an estimated useful life of 5 years and a scrap value of ₹ 1,00,000. Using linear depreciation method, find the annual depreciation of the asset and construct a yearly depreciation schedule.	3
31.	Solve the following LPP graphically: Maximize z= 4x+y Subject to: $x \geq 0, y \geq 0, x + y \leq 50$ *and* $3x + y \leq 90$.	3
	SECTION D	
32.	A couple wishes to purchase a house for ₹ 10,00,000 with a down payment of ₹ 2,00,000. If they can amortize the balance at 9% per annum compounded monthly for 10 years, what is their monthly payment? What it he total interest? $[(1.0075)^{-120} = 0.40973]$	5
33.	Two schools A and B decided to award prizes to their students for three values Honesty (x), punctuality(y) and Obedience (z). School A decided to award a total of rupees 15000 for three values to 4, 3 and 2 students respectively, while school B decided to award Rs. 19000 for three values to 5,4 and 3 students respectively. If all the three prizes together amount to Rs. 5000, then represent the above situation by a matrix equation and form linear equation using matrix multiplication. Hence find the value of each prize. OR If $A = \begin{pmatrix} 3 & 2 & 0 \\ -1 & 4 & 3 \\ 1 & 2 & 1 \end{pmatrix}$ find $adjA$ *and hence show that* $A.adjA = \|A\|I$.	5
34.	A tank with rectangular base and rectangular sides, open at the top is to be constructed so that its depth is 4 m and volume is 64 cubic metre. If building of tank costs Rs 700 per sq. metres for the base and Rs 450 per square metre for sides. What is the cost of least expensive tank? OR Evaluate: $\int_1^2 \frac{x^2}{x^2+3x+2} dx$	5

<table>
<tr><td>35.</td><td>The following table relates to the tourist arrivals (in millions) during 2010 to 2016 in India:
<table>
<tr><td>2010</td><td>2011</td><td>2012</td><td>2013</td><td>2014</td><td>2015</td><td>2016</td></tr>
<tr><td>18</td><td>20</td><td>23</td><td>25</td><td>24</td><td>28</td><td>30</td></tr>
</table>
Fit a straight-line trend by the method of least squares. Hence estimate the expected number of tourists in the year 2017.</td><td>5</td></tr>
<tr><td></td><td>SECTION E- Case study-based questions</td><td></td></tr>
<tr><td>36.</td><td>There are 500 persons of age 55 years in a town. The chance that person aged 55 years will die within next 5 years is 1%.
Based on the above information, answer the following questions:
$(Given\ e^{-5} = 0.0067)$
i) Find mean and variance of the probability distribution function
ii) Find the probability that exactly 4 persons will die within next 5 years.
iii) a) Find the probability that at most 3 persons aged 55 will die within next 5 years.
OR
b) Find the probability that more than 3 persons aged 55 will die within next 5 years.</td><td>4</td></tr>
<tr><td>37.</td><td>An aero plane can carry a maximum of 200 passengers. A profit of ₹ 1500 is made on each business class ticket and a profit of ₹ 800 is made on each economy class ticket. The airline reserves at least 20 seats for executive class. However, at least 4 times as many passengers prefer to travel by economy class than by the executive class.
Base on the above information answer the following:
i) If x and y are the number of business class tickets and economics class tickets, then the write the expression for total profit.
ii) Write the constraint that relates the number of tickets.
iii) a) How many tickets of each type to be sold to get maximum profit?
OR
b) Find the maximum profit.</td><td>4</td></tr>
<tr><td>38.</td><td>A company is doing a sequence of payments of Rs. 40,000 at the end of every 6 months as a part of insurance payment and continuing forever, if money is worth 16% p.a. compounded semi-annually. Also, the company establishes a sinking fund to provide for the payment of ₹ 1,00,000 debt. maturing in 4 years in such a way that contributions to the fund are to be made at the end of every year.
Based on the above information answer the following:
i) Find the present value of the sequence of payments for the insurance
ii) What would be the present value if the payments for the insurance is done at the beginning of the period?
iii) a) Find the amount of each annual deposit towards the sinking fund if interest is 8% per annum.
OR
b) If the company pays ₹ 20,000 as annual deposit, what amount can be collected after 4 years at the rate of 8% p.a. compounded annually.
(Use: $1.08^4 = 1.3605$)</td><td>4</td></tr>
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