RYAN GROUP OF SCHOOLS
ACADEMIC YEAR 2022-23
CBSE, PRE-BOARD-2 EXAMINATION

STD : XII MARKS : 80

SUB : APPLIED MATHS TIME : 3 HRS.

General Instructions-

1. *This question paper contains five section 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 questions of 3 marks each.*

Section – D:

6. *It comprises of 4 LA type 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

All questions are compulsory, No internal choices are provided.

Q.1 In a classroom there is seating capacity of 50 students. The degree of freedom is

(a) 50 (b) 49 (c) 51 (d) None of these

Q.2 The corner points of the feasible region determined by the system of linear constraints are: (0, 10), (5, 5), (15, 15), (0, 20). Let $z = px + qy$, where $p, q > 0$. Condition on p and q so that the maximum of z occurs at both the points (15, 15) and (0, 20) is

(a) p=q (b) p=2q (c) q=2p (d) q=3p

Q.3 A loan is said to be ..... If each installment is used to pay interest and part of the principal.

(a) Amortized (b) Mature

(c) Discounted (d) Coupon Payment

Q.4 Find the value of x in the set {0, 1, 2, 3, 4, 5} such that $73583 \equiv x \pmod 6$.

(a) 1 (b) 3 (c) 5 (d) None of these

Q.5 Which is not a reason for sampling errors

(a) Faulty selection of samples

(b) Big size of sample

(c) Small size of sample

(d) Sample results have potential variability

Q.6 The point on the curve $y = 6x - x^2$ where the tangent is parallel to the line $4x - 2y - 1 = 0$ is:

(a) (2, 8) (b) (8, 2) (c) (6, 1) (d) (4, 2)

Q.7 A man can row a boat in still water at the rate of 4 km/hr. He finds that it takes him twice as long to row upstream of a river as to row downstream of the same river. Find the speed of the current of the river.

(a) $\frac{4}{3}$ km/hr (b) $\frac{3}{4}$ km/hr

(c) 0.25km/hr (d) $\frac{2}{3}$ km/hr

Q.8 X takes a loan of Rs.2,00,000 with 10% annual interest rate for 5 years. Calculate EMI under Flat Rate System.

(a) Rs. 2,000 (b) Rs. 6,000
(c) Rs. 5,000 (d) None of these

Q.9 A piece of machinery costing Rs.100,000 is expected to have a useful life of 5 years and scrap value Rs.20,000. The annual depreciation charge using the linear method of depreciation and the depreciation rate percent are.

(a) 16,000, 16% (b) 80,000, 20%
(c) 80,000, 50% (d) 16,000, 20%

Q.10 The demand of a product over 6 weeks is 90, 110, 105, 130, 85 and 102. The 3 month moving average is 'x' and x is defined as the average of latest 3 demands. The 5 month moving average is 'y' which is defined as average of latest 5 demands, then (x + y) is

(a) 202.70 (b) 105.67
(c) 212.07 (d) 180.67

Q.11 Selecting groups of people of population for estimating characteristics is called:

(a) Sampling (b) Perpetuity
(c) Biasness (d) Hypothesis

Q.12 Confidence level of sampling method gives its

(a) Accuracy (b) Uncertainty
(c) Margin of error (d) Certainty

Q.13 The ratio of milk and water in the mixture of water and milk is 4 : 3. If 6 litres of water is added to this mixture the ratio of milk and water becomes 8 : 7. What is the quantity of milk in the original mixture

(a) 12 litres (b) 48 litres
(c) 36 litres (d) None of these

Q.14 In a 500m race, A reaches the finish point in 20 seconds and B reaches in 25 seconds. By how much distance A beats B?

(a) 100m (b) 400m
(c) 20m (d) 500m

Q.15 Mr. X took a loan of Rs.2000 for 6 months. Lender deducts Rs.200 as interest while lending. Find the effective rate of interest charged by lender.

(a) 24.56% (b) 25.9%

(c) 23.46% (d) None of these

Q16) A machine makes car wheels and in a random sample of 26 wheels, the test statistics is found to be 3.07. As per the t-distribution test (of 5% level of significance), what can you say about the quality of wheels produced by the machine? (Use t_{25} (0.05 = 2.06)

(a) Superior quality (b) Inferior quality

(c) Same quality (d) Cannot say

Q.17 If $x_1, x_2, x_3, \ldots\ldots, x_n$ is the given annual time series, then 3-yearly moving average are

(a) $\frac{x_1+x_2+x_3}{3}, \frac{x_2+x_3+x_4}{3}, \frac{x_3+x_4+x_5}{3}$

..., which are placed against years 2, 3, 4, ... respectively

(b) $\frac{x_1+x_2+x_3}{3} \quad \frac{x_2+x_3+x_4}{3} \quad \frac{x_2+x_4+x_5}{3}$

..., which are placed against 1, 2, 4, ... respectively

(c) $\frac{x_1+x_3+x_5}{3} \quad \frac{x_2+x_4+x_5}{3} \quad \frac{x_1+x_2+x_4}{3}$

..., which are placed against 2, 3, 4 respectively

(d) None of the above

Q.18 How much money is needed to endure a series of lectures costing Rs.2500 at the beginning of each year indefinitely, if money is worth 3% compounded annually?

(a) 2500.33 (b) 83333.3

(c) 85555.3 (d) 85833.3

Q.19 Each of these contains two statements Assertion (A) and Reason (R). Each of the questions has four alternative choices, any one of the which is the correct answer. You

have to select one of the codes (a), (b), (c) and (d) given below.

Assertion (A) : A pair of dice is thrown 4 times. If getting a doublet is considered a success, then the probability of two successes is $\frac{25}{216}$.

Reason (R) : $P(X = r) = {}^nC_r\, p^{n-r}q^r$, where p is probability of success, $q = 1 - p$.

(a) A is true, R is true; R is a correct explanation of A.
(b) A is true, R is true; R is not a correct explanation of A.
(c) A is true; R is false
(d) A is false; R is true

Q.20 Each of these contains two statements Assertion (A) and Reason (R). Each of the questions has four alternative choices, any one of the which is the correct answer. You have to select one of the codes (a), (b), (c) and (d) given below.

Assertion (A) : If $\frac{1}{2}\left(\frac{3}{5}x + 4\right) \geq \frac{1}{3}(x-6)$, $x \in R$,

then $x \in [120, \infty)$.

Reason (R) : A solution of an inequation is the value(s) of the variable (s) that makes it a true statement.

(a) A is true, R is true; R is a correct explanation of A.
(b) A is true, R is true; R is not a correct explanation of A.
(c) A is true; R is false
(d) A is false; R is true

SECTION – B

All questions are compulsory, In case of internal choice, attempt any one question only.

Q.21 600g of jaggery syrup has 40% jaggery in it. How much jaggery should be added to make it 50% in the syrup?

OR

The ratio of speed of a motor boat and that of the current of water is 36 : 5. The boat goes certain distance along with the current in 5 hours 10 minutes. How much time will it take to come back?

Q.22 Kellogg is a new cereal formed of a mixture of bran and rice that contains at least 88 grams of protein and at least 36 milligrams of iron. Knowing that bran contains 80 grams of protein and 40 milligrams of iron per kilogram, and that rice contains 100 grams of protein and 30 milligrams of iron per kilogram, find the minimum cost of producing this new cereal if bran costs Rs.5 per kg and rice costs Rs.4 per kg. Formulate the LPP to minimize cost. Do not solve it.

Q.23 Vikas invested Rs.10000 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	Year 2	Year 3	Year 4	Year 5	Year 6
Rs.11000	Rs.11500	Rs.13000	Rs.11800	Rs.12200	Rs.14000

Calculating CAGR of his investment.

Q.24 Find x, y, z, t, if $2\begin{bmatrix} x & z \\ y & t \end{bmatrix} + 3\begin{bmatrix} 1 & -1 \\ 0 & 2 \end{bmatrix} = 3\begin{bmatrix} 3 & 5 \\ 4 & 6 \end{bmatrix}$

OR

If $A = \begin{bmatrix} 0 & a & 1 \\ -1 & b & 1 \\ -1 & c & 0 \end{bmatrix}$ is a skew-symmetric matrix, then find the value of $(a + b + c)^2$.

Q.25 Ravi invested Rs.3,50,000 in a fund. At the end of the year the value of the fund is Rs.4,37,500. What is the nominal rate of interest, if the market price is same at the end of the year?

SECTION – C

Q.26 $\int \frac{x^3}{x^4 + 3x^2 + 2}\, dx$

OR

The demand and supply functions for a commodity are $p_d = 56 - x^2$ and $p_s = 8 + \frac{x^2}{3}$. Find the consumer's surplus and producer's surplus at equilibrium price.

Q.27 Solve the differential equation

$x(e^{2y} - 1)\,dy + (x^2 - 1)\,e^y\,dx = 0$

OR

Form the differential equation of the family of hyperbolas having foci on x-axis and Centre at origin.

Q.28 Find the intervals in which the function $f(x) = 2x^3 - 15x^2 + 36x + 1$ is strictly increasing or decreasing. Also find the points on which the tangents are parallel to x-axis.

Q.29 Three schools A, B and C organized a mela for collecting funds for helping the rehabilitation of flood victims. They sold handmade fans, mats and plates from recycled material at a cost of Rs.25, Rs.100 and Rs.50 each respectively. The number of articles sold are given below:

Article/School	A	B	C
Hand-fans	40	25	35
Mats	50	40	50
Plates	20	30	40

Find the funds collected by each school separately by selling the above articles. Also, find the total funds collected for the purpose.

Q.30 Mahesh purchased a house from a company for Rs.700,000 and made a down payment of Rs.150,000. He repays the balance in 25 years by monthly installments at 9%. Compound monthly:

(i) What are monthly payments?

(ii) What is the total interest payment? (Given $(1.0075)^{-300} = 0.1062878338$)

Q.31 A machine costing Rs.200,000 has effective life of 7 years and its scrap value is Rs.30000. What amount should the company put into a sinking fund earning 5% per annum, so that it can replace the machine after its useful life? Assume that a new machine will cost Rs.300000 after 7 years.

SECTION – D

Q.32 Show that of all the rectangles of given area, the square has the smallest perimeter.

OR

Manufacturer can sell x items at a price of Rs. $(5 - \frac{x}{100})$ each. The cost price is Rs. $(\frac{x}{5} + 500)$. Find the number of items he should sell to earn maximum profit.

Q.33 A manufacturer has employed 5 skilled men and 10 semi-skilled men and makes two models A and B of an article. The making of one item of model A requires 2 hours work by a skilled man and 2 hours work by a semi-skilled man. One item of model B requires 1 hour by a skilled man and 3 hours by a semi-skilled man. No man is expected to work more than 8 hours per day. The manufacturers profit on an item of model A is Rs.15 and on an item of model B is Rs.10. How many of items of each model should be made per day in order to maximize daily profit? Formulate the above LPP and solve it graphically and find the maximum profit.

Q.34 The production of a soft drink company in thousands of litres during each month of a year is as follows:

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1.2	0.8	1.4	1.6	1.8	2.4	2.6	3.0	3.6	2.8	1.9	3.4

Calculate the five monthly moving averages and show these moving averages on a graph paper.

OR

Fit a straight line trend by the method of least square for the following data. Also, tabulate the trend value for the year 2010

Year	2004	2005	2006	2007	2008	2009	2010
Profit (Rs.'000)	114	130	126	144	138	156	164

Q.35 Let X denote the number of hours a person watches television during a randomly selected day. The probability that X can take the values x_i, has the following form, where k is some unknown constant.

$$P(X=x_i) = \begin{cases} 0.2, & \text{if } x_i=0 \\ kx_i, & \text{if } x_i=1 \text{ or } 2 \\ k(5-x_i), & \text{if } x_i=3 \\ 0 & \text{otherwise} \end{cases}$$

a) Find the value of k.

b) What is the probability that the person watches two hours of television on a selected day?

c) Calculate mathematical expectation.

d) Find variance and standard deviation of random variable X.

SECTION – E

Q.36 A diet is to contain 30 units of vitamin A, 40 units of vitamin B and 20 units of vitamin C. Three types of food F_1, F_2 and F_3 are available. One unit of Food F_1 contains 3 units of vitamin A, 2 units of vitamin B and 1 unit of vitamin C. One unit of Food F_2 contains 1 unit of vitamin A, 2 units of vitamin B and 1 unit of vitamin C. One unit of Food F_3 contains 5 units of vitamin A, 3 units of vitamin B and 2 units of vitamin C.

Based on the above information, answer the following questions:

(i) If the diet contains x units of Food F_1, y units of Food F_2 and z units of Food F_3. What is the matrix equation representing the above situation? **(1)**

(ii) If A is the coefficient matrix in above situation, then what is the value of |adj.A| ? **(1)**

(iii) What are the values of x, y, z in the given situation? **(2)**

OR

(iii) What is A.(adj.A)?

Q.37 An urn contains 25 balls of which 10 balls bear a mark X and remaining 15 bear a mark Y. A ball is drawn at random from the urn, its mark noted down and it is replaced. In this way 6 balls are drawn.

Based on the above information, answer the following questions:

(i) Find the probability that all balls will bear X mark. **(1)**

(ii) Find the probability that all balls will not bear X mark. **(1)**

(iii) Find the probability that atmost 2 balls will bear mark Y. **(2)**

OR

(iii) Find the probability that the number of balls with X mark and Y mark will be equal.

Q.38 A cistern has three pipes A, B and C. Pipe A and B can fill it in 5 h and 10 h respectively, while pipe C can empty the cistern in 30 h.

Based on the above information, answer the following questions.

(i) If the pipe A and B are opened, then find the time taken to fill the cistern. **(1)**

(ii) If all the pipes are opened, then find time taken to fill the cistern. **(1)**

(iii) If the pipe A and B are opened alternatively and pipe C is opened all the time, then find the time taken to fill the cistern. **(2)**

OR

(iii) When the cistern is empty, tap A is opened at 7:00 am and tap B is opened at 10:00 am. Both the taps are closed at 11:00 am. Tap C is opened at 3:00 pm, then the cistern will be empty at what time

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