Maths

Max Marks: 80

Time – 3 hrs

Instructions:

1. All questions are compulsory
2. Write answers of Section I and Section II in the same answerbook
3. Use of logarithemic table is allowed but use of Calculator is not allowed.
4. For L.P.P graph paper is not necessary, only rough sketch of graph is expected
5. Every new question should be answered on a new page.
6. For each multiple choice type of questions, it is mandatory to write the correct answer alongwith its alphabet.

Section : I

Q.1.A) Select and write the correct answer of the following multiple choice type of questions(1 mark each) (06)

(i) If A = $\begin{bmatrix} 2 & 3 \\ a & 6 \end{bmatrix}$ is a skew symmetric matrix then a= _____

(a) 6 (b) 3 (c) 2 (d) - 3

(ii) $\int \frac{x^2 \ dx}{\sqrt{x^3+2}}$ = _____

(a) $\frac{1}{3}\sqrt{x^3+2}+c$ (b) $\log(x^3+2)+c$ (c) $\frac{2}{3}\sqrt{x^3+2}+c$ (d) $2\sqrt{x^3+2}+c$

(iii) The function $y= 2x^3 - 6x^2 + 6x - 5$ $x \in R$ is _____

(a) Increasing for all $x \in R - \{1\}$
(b) Increasing for all $x \in R - \{0\}$
(c) Neither increasing nor decreasing
(d) Decreasing for all $x \in R - \{1\}$

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(iv) The order and degree of all the differential equation

$\sqrt{1+\frac{dx}{dy}} = \sqrt{\frac{dy}{dx}}$ are respectively _____

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

(v) The Area of the region bounded by x^2 = 16y and the lines y =1 and y=4 and the y axis lying in the first quadrant is _____

(a) 63 sq units (b) $\frac{3}{53}$ sq units (c) $\frac{56}{3}$ sq units (d) 63 sq units

(vi) $\int_2^5 \frac{\sqrt{x}}{\sqrt{x}+\sqrt{7-x}} dx$ = _____

(a) $\frac{5}{2}$ (b) $\frac{3}{2}$ (c) 3 (d) 7

Q.1.B) State whether the following statements are True or False (1 mark each) (03)

(i) The slope of the tangent to the curve y=f(x) at the point x=a on it is $f'(a)$

(ii) If $\int \frac{(x-1)}{(x+1)^2} (e^x) dx = e^x f(x) + c$ then $f(x) = \frac{1}{x+1}$

(iii) The integrating factor of the differential equation $(x+y)\frac{dy}{dx} = 1$ is e^{-y}

Q.1.C) Fill in the blanks: (1 mark each) (03)

(i) $p \vee \sim p \equiv t$ is called as _____ Rule

(ii) If $f'(x) = \frac{1}{x} + x$ and $f(1) = \frac{5}{2}$ then f(x) = _____

(iii) $y = ae^x + be^{-x}$ is the general solution of the differential equation_____

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Q.2.A) Attempt any two of the following: (3 marks each) (06)

(i) Write the negation of the statements
(a) All the stars are shining, if it is night.
(b) Ramesh is intelligent and he is hardworking
(c) An angle is a right angle if and only if it is of measure 90^0

(ii) Find $\frac{dy}{dx}$ if $y = \sqrt{\frac{(3x-4)^3}{(x+1)^4\ (x+2)}}$

(iii) Find the area of the ellipse $\frac{x^2}{4} + \frac{y^2}{25} = 1$

(given $\int \sqrt{a^2 - x^2}\ dx = \frac{x}{2}\sqrt{a^2 - x^2} + \frac{a^2}{2}\ \sin^{-1}\left(\frac{x}{a}\right) + c$ and $\sin^{-1}(1) = \frac{\pi}{2}$, $\sin^{-1}(0) = 0$)

Q.2.B) Attempt any two of the following: (4 marks each) (08)

(i) Show that the statement pattern $p \leftrightarrow q$ and $(p \rightarrow q) \wedge (q \rightarrow p)$ are logically equivalent using truth table.

(ii) If $x = \frac{4t}{1+t^2}$ $y = 3\left(\frac{1-t^2}{1+t^2}\right)$ then show that $\frac{dy}{dx} = \frac{-9x}{4y}$

(iii) Evaluate $\int e^{\sqrt{x}}\ dx$

Q.3.A) Attempt any two of the following questions: (3 marks each) (06)

(i) If $A = \begin{bmatrix} 2 & -3 \\ 3 & 5 \end{bmatrix}$ find the cofactor matrix of A and adj(A)

(ii) Mr.Pritesh orders x mobiles at a price $p = 2x + \frac{32}{x^2} - \frac{5}{x}$ How many mobiles should he order for the most economical deal?

(iii) Form the Differential equation by eliminating the arbitrary constants

$$y = c_2 + \frac{c_1}{x}$$

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Q.3.B) Attempt any one: (04)

(i) Find the inverse of the matrix A by transformation method

where A = $\begin{bmatrix} -3 & -1 & 1 \\ 0 & 0 & 1 \\ -15 & 6 & -6 \end{bmatrix}$

(ii) Evaluate $\int_2^3 \frac{x}{(x+2)(x+3)}$ dx

Q.3.C) Attempt any one of the following: (activity) (04)

(i) Complete the following activity

The demand function is p =400 - $\frac{q^2}{2}$

q^2 = 800- 2p

q = $\sqrt{800-2p}$

$\frac{dq}{dp}$ ☐ =

$\eta = (\frac{-q}{p})\ (\frac{dq}{dp})$

η = ☐

when p =200 η = ☐

since $0 < \eta < 1$ the demand is ☐

(ii) Complete the following activity

Y(1 + log x) $\frac{dx}{dy}$ - x logx =0

The variable seperable form of the differential equation is

☐ dx = $\frac{dy}{y}$

The general solution of the differential equation is

$\int$ ☐ dx = $\int \frac{dy}{y}$ + C

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The general solution of the Differential equation is

$\square$ = log y + c

When x = e and y = e^2 the particular solution of the differential equation is

$\square$ = log y + $\square$

SECTION II

Q.4.A) Select and write the correct answer of the following multiple choice type of questions (1 mark each) (06)

(i) The sum due is also called as _____

(a) Face value (b) present worth (c) cash value (d) true discount

(ii) (bxy) (byx) = _____

(a) v(x) (b) S.D(x) (c) r^2 (d) var (y)

(iii) In a sequencing problem, an optimal path is the one that minimizes _____

(a) Elapsed time (b) Idle time (c) Both a & b (d) cost

(iv) Laspeyre's price index number is given by

(a) $\frac{\mathcal{E}p_1q_0}{\mathcal{E}p_1q_1}$ x 100 (b) $\frac{\mathcal{E}p_1q_0}{\mathcal{E}p_0q_0}$ x 100 (c) $\frac{\mathcal{E}p_0q_0}{\mathcal{E}p_1q_1}$ x 100 (d) $\frac{\mathcal{E}p_1}{\mathcal{E}p_0}$ x 100

(v) The F(x) is a c.d.f of a discret r.v.x whose p.m.f is given by p(x) = k (4_{Cx}) for x = 0, 1, 2, 3, 4 and p(x) = 0 otherwise then F(5) = _____

(a) $\frac{1}{16}$ (b) $\frac{1}{8}$ (c) $\frac{1}{4}$ (d) 1

(vi) When x follows Poisson distribution with parameter m and if p(x=2) = p(x=3) then Mean = _____

(a) 3 (b) 2 (c) 4 (d) 0

Q4.B) State whether the following statements are true or false: (1 mark each) (03)

(i) If E(x) > V(x) then x follows poisson distribution.

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(ii) Dorbish – Bowley price index number is the arithmetic mean of laspeyres and paasche's index number.

(iii) To convert maximization type assignment problem into a minimization problem, the smallest element in the matrix is deducted from all elements of the matrix.

Q.4.C) Fill in blanks (1 mark each) (03)

(i) The difference between bankers discount and the true discount is called as _____

(ii) If bxy > 0 and byx < 0 then the data is _____

(iii)Walsh price index number is given by _____

Q.5.A) Attempt any two of the following questions: (3 marks each) (06)

(i) Age x yrs and blood pressure (y) of a group of 10 men

	x	y
Mean	50	140
Variance	150	165

And $\Sigma(x - \bar{x})(y - \bar{y}) = 1120$

Find the prediction of blood pressure of a man of age 40 yrs

(ii) Five different machines can do any of the five required jobs with different profits resulting from each assignment as shown below.

	Profit (in Rs.)				
Jobs\Machines	A	B	C	D	E
1	30	37	40	28	40
2	40	24	27	21	36
3	40	32	33	30	35
4	25	38	40	36	36
5	29	62	41	34	39

Find the optimum assignment schedule.

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(iii)In a cattle breeding firm it is prescribed that the food ration for one animal must contain 14,22,1 unit of nutrients A, B and C respectively. Two different kinds of fodder are available. Each unit weight of these two contains the following amount of these three nutrients.

Nutrient	Fodder 1	Fodder 2
A	2	1
B	2	3
C	1	1

The cost of Fodder 1 is Rs.3 per unit and that of Fodder 2 is Rs.2 per unit. Formulate the L.P.P to minimize the cost.

Q.5.B) Attempt any two of the following questions: (4marks each) (08)

(i) Given $\Sigma p_1 q_1$=300, $\Sigma p_0 q_1$ = 320, $\Sigma p_0 q_0$ =120 and Marshall-Edge worth price index number is 120. Find Laspeyre's price index number.

(ii) Five jobs are performed on machines M_1 and then on Machine M_2. Time taken in hours by each job on each machine is given below. Find the minimum total elapsed time and idle time of both machines

Machines/Jobs	1	2	3	4	5
M1	6	8	4	5	7
M2	3	7	6	4	16

(iii)Let x denote the sum of the numbers obtained on the upper face when a pair of dice are rolled. Find the variance of x.

Q.6.A) Attempt any two of the following questions (3 mark each) (06)

(i) If x is years of service and y is the monthly income in (Rs.1000/-) Find the income of a person when the number of years of service is 13 years.

X	11	7	9	5	8	6	10
Y	10	8	6	5	9	7	11

(ii) Solve the following LPP

Maximise $z = 13x + 9y$ subjected to $3x + 2y \leq 12$, $x + y \geq 4$, $x \geq 0$, $y \geq 0$

(iii)Obtain the trend values for the following data using 5 yearly moving averages

Year	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009
Prod in (ths)	10	15	20	25	30	35	40	45	50	55

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Q6.B)Attempt any one : (04)

(i) The percentage of girls enrollment to the total enrollment for the year 1960-2005 is given below:

Year	1960	1965	1970	1975	1980	1985	1990	1995	2000	2005
Percentage	0	3	3	4	4	5	6	8	8	10

Fit a trend line by the method of least square.

(ii) If $f(x) = kx(1-x)$ for $0 < x < 1$, $f(x) = 0$ otherwise
$f(x)$ is a p.d.f of x find

(a) k (b) $p(\frac{1}{4} < x < \frac{1}{2})$ (c) $p(x < \frac{1}{2})$

Q.6.C) Attempt anyone of the following (Activity): (04)

(i) The value of the property = Rs.7,60,000/-

Insured value = Rs.5,60,000/-

Rate of premium = $\frac{5}{8}$ % less 20%

Net premium = ☐

The property is damaged to 40% of the value

Loss= ☐

Claim = ☐

Loss the owner bears including the premium ☐ =

(ii)Face Value =Rs.4015/-

Rate of Simple Interest = 8%

Date of drawing bill = 19th January 2018

Period of the bill = 8 months

Nominal due date = ☐

Legal due date = ☐ Date of discounting = Feb 28, 2018

Number of days from the date of discounting to the legal due date= ☐

Banker discount ☐ =

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