Seat No. : _______________

JA-101

June-2022

B.B.A., Sem.-II

CC-112 : Business Mathematics

Time : 2 Hours] **[Max. Marks : 50**

Instructions :
(i) **All** questions in Section-**I** carry equal marks.
(ii) Attempt any **two** questions in Section-**I**.
(iii) Question **5** in Section-**II** is Compulsory.
(iv) Use of simple calculator is allowed.

1. (A) (i) Define the derivative of a function. Also state the rules of differentiation. **5**

(ii) Find the derivatives of the following function with respect to x. **5**

(a) $y = \log (10x^3 + 3x^2 + 8x + 1)$

(b) $y = \dfrac{e^{5x}}{x+1}$

(B) (i) The total cost function of a commodity with output x units is $C = x^2 + 4x + 4$. Find (a) Average cost (b) Marginal Cost **5**

(ii) The demand law for a commodity is $x = 2P - P^2$. Calculate the elasticity of demand at $P = 1$. **5**

2. (A) (i) If $y = a \cdot e^{mx} + b \cdot e^{-mx}$ prove that $\dfrac{d^2y}{dx^2} = m^2y$. **5**

(ii) Find the maximum and minimum values of the following function :
$f(x) = x^3 - 12x^2 - 144x + 10$ **5**

(B) (i) If $f(x, y) = x^3 + x^2y + xy^2 + y^3$, find $\dfrac{\partial f}{\partial x}, \dfrac{\partial^2 f}{\partial x^2}, \dfrac{\partial f}{\partial y}, \dfrac{\partial^2 f}{\partial y^2}$. **5**

(ii) The demand function of a commodity is $P = 50 - \dfrac{5}{2}x$. Determine demand and price for maximum revenue. **5**

3. (A) (i) Define the following terms : **5**

(a) Square matrix

(b) Diagonal matrix

(c) Column matrix

(d) Scalar matrix

(e) Zero matrix

(ii) If $A = \begin{bmatrix} 2 & 3 & -1 \\ 1 & 2 & 3 \\ 5 & 6 & 1 \end{bmatrix}$ and $B = \begin{bmatrix} 5 & 0 & 1 \\ 2 & 1 & 0 \\ 0 & 0 & 1 \end{bmatrix}$ find A + B and A – B. **5**

(B) (i) If $P = \begin{bmatrix} 1 & 2 \\ 0 & 1 \end{bmatrix}$, and $Q = \begin{bmatrix} 2 & -1 \\ 0 & 1 \end{bmatrix}$, verify that (PQ)' = Q'P'. **5**

(ii) If $A = \begin{bmatrix} 2 & 1 \\ 0 & 1 \end{bmatrix}$, verify that $A(\text{adj } A) = |A| I_2$. **5**

4. (A) (i) Find the simple interest on ₹ 800 for 3 years at 5% per annum. Also find the amount. **5**

(ii) What is an aggregate amount for ₹ 4,000 at 12% rate of Compound interest for 3 years if the interest is compounded every six months ?
$[(1.06)^6 = 1.418519]$ **5**

(B) (i) Find the present value of ₹ 2,000 p.a. for 14 years at 10% p.a. rate of interest. $[(1.1)^{-14} = 0.2632]$ **5**

(ii) If a sum of ₹ 5,000 is deposited with a Shroff at the end of every year for 10 years at 15% compound rate of interest. Find out the total amount of annuity at the end of 10 years. $[(1.15)^{10} = 4.0456]$ **5**

5. Answer the following : (Any **Ten**) **10**

(1) If $f(x) = x^9 - 8x^2 + 1$, then $f'(1) =$ ________.

(a) –7 (b) 3

(c) 7 (d) None

(2) When elasticity of demand is _______ 1, the demand is said to be relatively elastic.

(a) > (b) <

(c) = (d) None

(3) If $y = 3^x$, then $\frac{dy}{dx}$ = ________.

(a) 3^x (b) $3^x \cdot \log_e 3$

(c) $\log_e 3$ (d) None

(4) If $y = \frac{1}{x^7}$, then $\frac{dy}{dx}$ = ________

(a) $7x^6$ (b) $-7x^{-8}$

(c) x^{-7} (d) None

(5) If $Z = 3x + 9y$ then $\frac{\partial z}{\partial x}$ = ________.

(a) 3 (b) 9y

(c) 9 (d) None

(6) If $y = x^3 - 8x^2 + 9$ then $\frac{d^2y}{dx^2}$ = ________

(a) $3x^2 - 18x$ (b) $x^3 - 8x^2$

(c) $6x - 16$ (d) None

(7) The budget equation I = ________.

(a) $xPx + yPy$ (b) xPx

(c) yPy (d) None

(8) If $|A| = 0$, A^{-1} is possible.

(a) True (b) False

(9) If $A = \begin{bmatrix} -5 & 0 & 0 \\ 0 & -5 & 0 \\ 0 & 0 & -5 \end{bmatrix}$, the type of matrix is _______.

(a) Square (b) Diagonal

(c) Scalar (d) All

(10) If $A = \begin{bmatrix} 1 & 2 & 3 \\ 0 & 1 & 5 \end{bmatrix}$ then $(A')^1 =$ ________

(a) $\begin{bmatrix} 1 & 2 & 3 \\ 0 & 1 & 5 \end{bmatrix}$ (b) $\begin{bmatrix} 1 & 0 \\ 2 & 1 \\ 3 & 5 \end{bmatrix}$

(c) $\begin{bmatrix} 1 & 2 \\ 0 & 1 \end{bmatrix}$ (d) None

(11) If $x = [1\ \ 1\ \ 2]$ and $y = \begin{bmatrix} 0 \\ 1 \\ 1 \end{bmatrix}$, then $xy =$ _________.

(a) $\begin{bmatrix} 0 & 0 & 0 \\ 1 & 2 & 3 \\ 1 & 2 & 3 \end{bmatrix}$ (b) [3]

(c) [0 1 2] (d) None

(12) A money lender is called ________.

(a) Creditor (b) Debtor

(c) Amount (d) None

(13) What is the amount of, perpetual annuity of ₹ 60 at 6%. Compound interest per year ?

(a) ₹ 10 (b) ₹ 36

(c) ₹ 1000 (d) None

(14) The formula of annuity in case of Sinking fund is ________.

(a) $A = \frac{a}{i}\ [(1 + i)^n - 1]$ (b) $P = \frac{a}{i}\left[1 - \frac{1}{(1+i)^n}\right]$

(c) $A = (1 + i)\ \frac{a}{i}\ [(1 + i)^n - 1)]$ (d) None

(15) An annuity in which payments of installments are made at the end of each period then it is called ________.

(a) ordinary annuity (b) annuity immediate

(c) (a) & (b) (d) None