

**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)  $y = \frac{e^{5x}}{x+1}$
- (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  $\frac{d^2y}{dx^2} = m^2y$ . **5**
- (ii) Find the maximum and minimum values of the following function : **5**
- $f(x) = x^3 - 12x^2 - 144x + 10$
- (B) (i) If  $f(x, y) = x^3 + x^2y + xy^2 + y^3$ , find  $\frac{\partial f}{\partial x}, \frac{\partial^2 f}{\partial x^2}, \frac{\partial f}{\partial y}, \frac{\partial^2 f}{\partial y^2}$ . **5**
- (ii) The demand function of a commodity is  $P = 50 - \frac{5}{2}x$ . 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)  $xP_x + yP_y$  (b)  $xP_x$   
(c)  $yP_y$  (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  $(A^{-1})^{-1} =$  \_\_\_\_\_

(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