Total No. of Questions: 6 *Total No. of Printed Pages:3*

Enrollment No.....

Faculty of Commerce

End Sem (Even) Examination May-2022

CM3CO05 Business Mathematics

Programme: B.Com.(Hons.) Branch/Specialisation: Commerce

Duration: 3 Hrs. **Maximum Marks: 60**

Note: All questions are compulsory. Internal choices, if any, are indicated. Answers of Q.1 (MCQs) should be written in full instead of only a, b, c or d.

Q.1 i. If A and B are invertible matrices of the same order, then **1**

(a) $(AB)^{-1} = A^{-1}B^{-1}$ (b) $(AB)^{-1} = B^{-1}A^{-1}$

(c) $(AB)^{-1} = (BA)^{-1}$ (d) None of these

ii. The value of $\begin{vmatrix} 1 & \omega & \omega^2 \\ \omega & 1 & \omega^2 \\ \omega^2 & \omega & 1 \end{vmatrix}$ **1**

(a) 0 (b) 1 (c) ω (d) None of these

iii. De Morgan's law is- **1**

(a) $(A \cup B)' = A' \cap B'$ (b) $(A \cup B)' = A' \cup B'$

(c) $(A \cup B)' = A \cup B$ (d) None of these

iv. If ordered pairs *(x-1, y+3) = (2, x+4)* are equal then value of x and y are- **1**

(a) (3,4) (b) (4, 3) (c) (-3, 4) (d) None of these

v. Every constant function is- **1**

(a) Continuous somewhere (b) Not continuous

(c) Continuous everywhere (d) None of these

vi. For minima of a function *y=f(x)* at point *x=a* is- **1**

(a) $\frac{d^2y}{dx^2} > 0$ (b) $\frac{d^2y}{dx^2} < 0$ (c) $\frac{d^2y}{dx^2} = 0$ (d) None of these

vii. $\int_0^{\pi/2} cosxdx$=___. **1**

(a) 0 (b) 1 (c) -1 (d) 2

viii. $\int cotxdx$ =___. **1**

(a) logsinx+c (b) *logcosx+c* (c) $cosec^2x+c$ (d) secx+*c*

ix. The next term of the sequence *2, 4, 6, 8* is- **1**

(a) 10 (b) -10 (c) 5 (d) None of these

P.T.O.

x. Two numbers are respectively 20% and 50% more than a third number. The ratio of the two numbers is- **1**
(a) 2:3 (b) 4:5 (c) 6:7 (d) None of these

Q.2 i. Define diagonal matrix and identity matrix, with an example. **2**

ii. If $A = \begin{bmatrix} 1 & 2 & 4 \\ 3 & 4 & 5 \\ 4 & 2 & 2 \end{bmatrix}$ and $B = A = \begin{bmatrix} -1 & 2 & 1 \\ 4 & 5 & 6 \\ 3 & 2 & 2 \end{bmatrix}$ find the value of 2A+3B. **3**

iii. Find Inverse of matrix $A = \begin{bmatrix} 0 & 2 & 4 \\ 2 & 4 & 6 \\ 6 & 2 & 2 \end{bmatrix}$ **5**

OR iv. Solve the equations by cramer's rule *x+2y+3z=14, 3x+y+2z=11, 2x+3y+z=11* **5**

Q.3 i. If U = {1,2,3,4,5,6,7,8,9,10}, A = {2,3,4,5,6}, B = {1,5,6,7,8,9}. Find the following: **2**
(a) A-B (b) (A*U* B)'

ii. In a group of athletic teams in a college 21 are in basketball team, 26 in hockey team and 29 in football team. If 14 play basketball and hockey, 12 play basketball and football, 15 play hockey and football and 8 play all the three games, find the number of players there are in all. Also show this by venn diagram **8**

OR iii. A function *'f'* on a subset of real numbers is defined as:
$f(x) = \begin{cases} 2x+1, if\ 0 \le x \le 2 \\ x-2, if\ 2 \le x \le 5 \end{cases}$
Find the following:
(a) Domain of *f*
(b) the range of *f*
(c) whether the function is one-one or many type
(d) the value of *x* for which *f(x) = 1/2*

Q.4 i. Differentiate with respect to *x*- **3**
(a) *x.tanx* (b) $\frac{xsinx}{1+x}$

ii. Examine the function for maximum and minimum using second derivative test $y=x^3-x^2-9x+5$. Also find maximum and minimum value. **7**

OR iii. The total cost C*(x)* for output is given by $C(x)=4x+\frac{35}{2}$, Find the following: **7**
(a) Cost when output is four units
(b) Average cost when output is ten units
(c) Marginal Cost when output is three units

Q.5 i. Evaluate $\int \frac{(x^3-8)(x+1)}{x^2+2x+4} dx.$ **4**

ii. A factory's marginal cost function is $\frac{1}{100}x^2 - 2x + 120$, where *x* denotes the number of units produced per day. The factory has fixed costs of Rs. 1500 per day. Find the cost of producing *x* units per day. **6**

OR iii. Evaluate: (a) $\int_0^{\pi/2}(x+1)sinxdx$ (b) $\int_0^{\pi/4}(sinx+cosx)^2dx.$ **6**

Q.6 Attempt any two:

i. The sum of some terms of a G.P. is 315 whose first term and the common ratio are 5 and 2 respectively. Find the number of terms and the last term. **5**

ii. How many four letter words, with or without meaning, can be formed out of the letters of the word WONDER, if repetition of letters is not allowed. **5**

iii. Seats for Mathematics, Physics and Biology in a school are in the ratio 5 : 7 : 8. There is a proposal to increase these seats by 40%, 50% and 75% respectively. What will be the ratio of increased seats? **5**

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Q1. (i) (b) $(AB)^{-1} = B^{-1}A^{-1}$ 1 mark.

(ii) (a) 0. 1 mark

(iii) (a) $(A \cup B)' = A' \cap B'$ 1 mark

(iv) (a) (3,4) 1 mark.

(v) (c) Continuous everywhere 1 mark.

(vi) (a) $\frac{d^2y}{dx^2} > 0$ 1 mark.

1 mark.

(vii) (b) 1

1 mark.

(viii) (a) $\log \sin x + c$

(ix) (a) 10. 1 mark.

(x) (b) 4:5 1 mark.

Q2. (i) Diagonal Matrix :– A square matrix in which every element except the principal diagonal element is zero.

is called a Diagonal matrix.

e.g. $A = \begin{bmatrix} 2 & 0 \\ 0 & 3 \end{bmatrix}$ 1 mark.

Identity Matrix :— The Identity matrix I_n is a $n \times n$ square matrix with the main diagonal of 1's and all other elements are 0's.

$$I_2 = \begin{pmatrix} 1 & 0 \\ 0 & 1 \end{pmatrix}$$ 1 mark.

(ii) $2A = \begin{bmatrix} 2 & 4 & 8 \\ 6 & 8 & 10 \\ 8 & 4 & 4 \end{bmatrix}$, $3B = \begin{bmatrix} -3 & 6 & 3 \\ 12 & 15 & 18 \\ 9 & 6 & 6 \end{bmatrix}$ 2 mark

$$2A + 3B = \begin{bmatrix} -1 & 10 & 11 \\ 18 & 23 & 28 \\ 17 & 10 & 10 \end{bmatrix}$$ 1 mark.

(iii) $A^{-1} = \frac{\text{adj } A}{|A|}$ 1 mark

$$|A| = \begin{vmatrix} 0 & 2 & 4 \\ 2 & 4 & 6 \\ 6 & 2 & 2 \end{vmatrix} = -16$$ 1 mark.

$M_{11} = -4$ $M_{12} = -32$ $M_{13} = -20$

$M_{21} = -4$, $M_{22} = -24$ $M_{23} = -12$

$M_{31} = -4$ $M_{32} = -8$ $M_{33} = -4$ 1 mark

$C_{11} = -4$ $C_{12} = 32$ $C_{13} = -20$

$C_{21} = 4$ $C_{22} = -24$ $C_{23} = 12$

$C_{31} = -4$ $C_{32} = 8$ $C_{33} = -4$ 1 mark.

$$\text{adj } A = \begin{bmatrix} -4 & 4 & -4 \\ 32 & -24 & 8 \\ -20 & 12 & -4 \end{bmatrix}$$

$$A^{-1} = \frac{-1}{16}\begin{bmatrix} -4 & 4 & -4 \\ 32 & -24 & 8 \\ -20 & 12 & -4 \end{bmatrix}$$ 1 mark

(iv) $D = \begin{vmatrix} 1 & 2 & 3 \\ 3 & 1 & 2 \\ 2 & 3 & 1 \end{vmatrix} = 18$ 1 mark

$D_x = \begin{vmatrix} 14 & 2 & 3 \\ 11 & 1 & 2 \\ 11 & 3 & 1 \end{vmatrix} = 18$ 1 mark

$D_y = \begin{vmatrix} 1 & 14 & 3 \\ 3 & 11 & 2 \\ 2 & 11 & 1 \end{vmatrix} = 36$ 1 mark

$D_z = \begin{vmatrix} 1 & 2 & 14 \\ 3 & 1 & 11 \\ 2 & 3 & 11 \end{vmatrix} = 54$ 1 mark.

$x = D_x / D = 1$

$y = D_y / D = 2$

$z = D_z / D = 3$

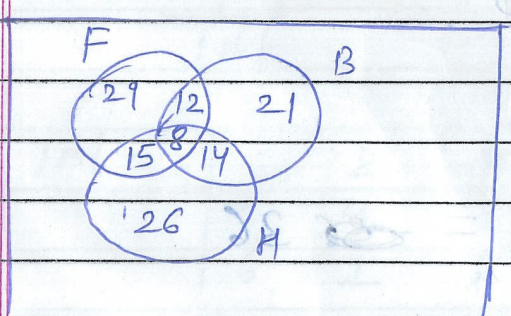
1 mark.

Q3. (i) (a) $A - B = \{2, 3, 4\}$ 1 mark

(b) $(A \cup B)' = \{10\}$ 1 mark.

(ii) B → Basketball, F → football.
H → Hockey.

$n(B) = 21$, $n(F) = 29$, $n(H) = 26$.
$n(B \cap H) = 14$, $n(B \cap F) = 12$, $n(H \cap F) = 15$
$n(B \cap H \cap F) = 8$. 2 Marks



3 Marks

$n(B \cup F \cup H) = n(B) + n(F) + n(H) - n(B \cap H) - n(B \cap F) - n(H \cap F) + n(B \cap H \cap F)$. 1 mark.

$= 21 + 29 + 26 - 14 - 12 - 15 + 8$ — 1 mark

$= 43$ — 1 mark

(iii) (a) Domain $= (0, 5)$ — 2 marks

(b) Range $= (0, 3)$ — 2 marks

(c) $\because f(0) = 1$ & $f(3) = 1$

$\therefore f$ is many type. — 2 marks

(d) $f(x) = \frac{1}{2}$

$\Rightarrow x - 2 = \frac{1}{2}$ — 1 mark

$\Rightarrow x = \frac{1}{2} + 2$

$\Rightarrow x = \frac{5}{2}$ — 1 marks

Q4 (i) (a) $y = x \tan x$.

$\frac{dy}{dx} = \frac{d}{dx}[f(x).g(x)] = g(x)\frac{d}{dx}f(x) + f(x)\frac{d}{dx}g(x)$ — 1 mark

$\Rightarrow \frac{d}{dx}(x \tan x) = \tan x \frac{d}{dx} x + x \frac{d}{dx} \tan x$ — $\frac{1}{2}$ mark

$= \tan x + x \sec^2 x.$ — 1 mark

(b) $\frac{d}{dx}\left(\frac{f(x)}{g(x)}\right) = \frac{g(x)\frac{d}{dx}f(x) - f(x)\frac{d}{dx}g(x)}{[g(x)]^2}$

$\frac{d}{dx}\left(\frac{x\sin x}{1+x}\right) = \frac{(1+x)\frac{d}{dx}(x\sin x) - (x\sin x)\frac{d}{dx}(1+x)}{(1+x)^2}$ — $\frac{1}{2}$ mark

$= \frac{(1+x)\left[\sin x \frac{d}{dx}x + x\frac{d}{dx}\sin x\right] - x\sin x}{(1+x)^2}$

$= \frac{(1+x)[\sin x + x\sin x] - x\sin x}{(1+x)^2}$ — 1 mark

(ii) $y = x^3 - x^2 - 9x + 5$

$\frac{dy}{dx} = 3x^2 - 2x - 9$ — 1 mark

$\frac{dy}{dx} = 0 \Rightarrow 3x^2 - 2x - 9 = 0$

$\Rightarrow x = \frac{2 \pm \sqrt{4+108}}{6}$

$\therefore x = \frac{2+\sqrt{112}}{6}, \frac{2-\sqrt{112}}{6}$ — 1 mark