**Roll No.** | | | | | | | | | | | | | **Total No. of Pages : 03**

**Total No. of Questions : 07**

**B.Sc.(IT) (2015 Batch) / BCA (2011 & Onwards) (Sem.–2)**

# MATHEMATICS – II

**Subject Code : BSIT/BSBC-202**

**Paper ID : [B1114]**

**Time : 3 Hrs.** **Max. Marks : 60**

**INSTRUCTIONS TO CANDIDATES :**

1. **SECTION-A is COMPULSORY consisting of TEN questions carrying TWO marks each.**
2. **SECTION-B contains SIX questions carrying TEN marks each and students have to attempt any FOUR questions.**

## SECTION-A

**1. Write briefly :**

a) Find the value of $x$ for which the matrix $\begin{pmatrix} 2+x & 3 & 4 \\ 1 & -1 & 2 \\ x & 1 & -5 \end{pmatrix}$ is a singular matrix.

b) If $A = \begin{pmatrix} 1 & -2 & 1 \\ 2 & 1 & 3 \end{pmatrix}$ and $B = \begin{pmatrix} 2 & 1 \\ 3 & 2 \\ 1 & 1 \end{pmatrix}$, then find $(AB)^T$, where $T$ stands for transpose.

c) If $A = \begin{pmatrix} 1 & 1 \\ 1 & 1 \end{pmatrix}$, then determine the matrix $A^{100}$.

d) For a certain frequency distribution which has been shown below, the arithmetic mean was found to be Rs.28.07.

| **Income (in Rs.)** | 15 | 20 | 25 | 30 | 35 | 40 |
|---|---|---|---|---|---|---|
| **No. of workers** | 8 | 12 | ? | 16 | ? | 10 |

If the total number of workers is 75, then find the missing frequencies.

e) Differentiate $\sec(\tan(\sqrt{x}))$ with respect to $x$.

f) Find the point of maxima of the function $f(x) = a(1 - \cos x)$, $a > 0$.

g) Obtain the value of the integral $\int_0^{\pi/2} x \sin x dx$.

h) Find the rank of the matrix $\begin{pmatrix} 2 & 1 & -1 \\ 0 & 3 & -2 \\ 2 & 4 & -3 \end{pmatrix}$.

i) State Simpson's I/3rd and 3/8th rule to evaluate $\int_a^b f(x)dx$.

j) If $\log_{10} 125 + \log_{10} 8 = x$, then find the value of $x$.

## SECTION-B

2. a) Use Cramer's rule to solve the system of equations :

$5x - 7y + z = 11$; $6x - 8y - z = 15$; $3x + 2y - 6z = 7$ 5

b) Find the Adjoint of the matrix $\begin{pmatrix} 3 & -3 & 4 \\ 2 & -3 & 4 \\ 0 & -1 & 1 \end{pmatrix}$ 5

3. a) Using the properties of determinants, prove that :

$$\begin{vmatrix} 1+a & 1 & 1 \\ 1 & 1+b & 1 \\ 1 & 1 & 1+c \end{vmatrix} = abc\left(\frac{1}{a}+\frac{1}{b}+\frac{1}{c}+1\right)$$ 5

b) Mr. Ravi purchased a house from Mr. Sham on credit. If the cash price of the house is Rs.50,000 and the rate of interest is 5% per annum compounded half yearly, find the amount, Ravi paid after a year and a half. 5

4. a) If $y = 3\cos(\log x) + 4\sin(\log x)$, then show that $x^2 \frac{d^2y}{dx^2} + x\frac{dy}{dx} + y = 0$ 5

b) Find two positive numbers whose sum is 15 and the sum of whose squares is minimum. 5

5. a) If $y = \sqrt{ax} + \frac{a^2}{\sqrt{ax}}$, then find the value of $\frac{dy}{dx}$ at $x = a$. 5

b) Evaluate the integral $\int_0^{\pi/2} \frac{\cos x}{(1+\sin x)(2+\sin x)} dx$ 5

6. a) Evaluate $\int_4^{5.2} \log_e x \, dx$ by using trapezoidal rule. 5

b) Differentiate the following functions *w.r.t. x*

i) $\tan^{-1} \frac{2x}{1-x^2}$ ii) $\frac{x - \cos x}{x + \cos x}$ 5

7. a) The life of bulbs produced by companies A and B are given as below :

| **Length of life (in hours)** | **Company A (No. of Lamps)** | **Company B (No. of Lamps)** |
|---|---|---|
| 500 - 700 | 5 | 4 |
| 700 - 900 | 11 | 30 |
| 900 - 1100 | 26 | 12 |
| 1100 - 1300 | 10 | 8 |
| 1300 - 1500 | 8 | 6 |

Test, the bulbs of which company are more consistent from the point of view of length of life. 6

b) Find the value of median of the following data : 4

| **Daily wages (Rs.)** | 10 | 5 | 7 | 11 | 8 |
|---|---|---|---|---|---|
| **Number of workers** | 15 | 20 | 15 | 18 | 12 |