**Roll No.** ⌷⌷⌷⌷⌷⌷⌷⌷⌷⌷⌷⌷⌷      **Total No. of Pages : 02**

**Total No. of Questions : 07**

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**BCA (2011 & Onward)**
**B.Sc.(IT) (2015 Batch)**     **(Sem.–1)**
## MATHEMATICS – I
**Subject Code : BSIT/BSBC-103**
**Paper ID : [B1110]**

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**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.**

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**SECTION-A**

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1. **Solve the following :**

   a) If A is the set of rational numbers and B = $\{x : x^2 - 4x + 2 = 0\}$ then find A $\cap$ B, A – B and B – A.

   b) Give an example of a relation which is both symmetric and transitive but not reflexive.

   c) Show that we can have A $\cap$ B = A $\cap$ C even if B $\neq$ C.

   d) Solve the recurrence relation of Fibonacci sequence.

   e) Define adjacency matrix of a relation with example.

   f) Prove that $p \vee q = \sim (\sim p \wedge \sim q)$.

   g) Over the universe of books, define the propositions B($x$) : $x$ has a blue cover, M($x$) : $x$ is a mathematics book, U($x$) : $x$ is published in the United States. Translate the following into words :

   i) $(\exists x)(M(x) \wedge \sim B(x))$

   ii) $(\forall x)(M(x) \wedge U(x) \rightarrow B(x))$

   h) Define Eulerian and Hamiltonian graphs.

   i) Write any two properties of binary tree.

   j) Define partition of a set with suitable example.

**SECTION-B**

2. a) Are the following arguments valid? If valid, construct a format proof, if not explain with the reason.

   If wages increase, then there will be inflation. The cost of living will not increase if there is no inflation. Wages will increase; therefore, the cost of living will increase.

   b) Prove that $(p \leftrightarrow q) \leftrightarrow r = p \leftrightarrow (q \leftrightarrow r)$ by the use of truth tables.

3. a) Partition the set $A = \{0,1,2,3,4,5\}$ with the minsets generated by $B_1 = \{0,2,4\}$, $B_2 = \{1,5\}$. How many different subsets of $A$ can be generated from $B_1$ and $B_2$?

   b) State and prove the DeMorgan's laws.

4. a) Prove by mathematical induction that $\dfrac{n^5}{5} + \dfrac{n^3}{3} + \dfrac{7n}{15}$ is a natural number for all $n \in$ N.

   b) Let $C(x) : x$ is cold blooded, $F(x) : x$ is a fish and $S(x) : x$ lives in the sea.

   i) Translate into formula : Every fish is cold blooded.

   ii) Translate into English : $(\exists x)[A(x) \wedge (\sim M(x))]$.

5. a) Let $R$ be a relation on the set $\{a_1, a_2, a_3, a_4\}$ defined by the matrix $\begin{bmatrix} 0 & 0 & 0 & 1 \\ 1 & 0 & 0 & 0 \\ 1 & 0 & 0 & 0 \\ 0 & 1 & 0 & 1 \end{bmatrix}$

   i) Find $M \times M$.

   ii) Draw the digraph of R $\times$ R.

   b) Consider the relation $r = \{(i, j) : |i - j| = 2\}$ on $\{1,2,3,4,5,6\}$

   i) Is $r$ reflexive?

   ii) Is $r$ symmetric?

   iii) Is $r$ transitive?

   iv) Draw the graph of $r$.

6. a) Prove that an undirected graph $G$ is connected if and only if $G$ contains a spanning tree.

   b) Prove Euler's formula for planar graphs.

7. a) Find the inverse of the matrix using Gauss Jordan Method $\begin{bmatrix} 1 & 2 & 3 \\ 0 & -2 & 6 \\ 0 & 0 & -3 \end{bmatrix}$

   b) Write the matrix $\begin{bmatrix} 7 & -3 & -3 \\ -1 & 1 & 0 \\ -1 & 0 & 1 \end{bmatrix}$ as a sum of symmetric and skew-symmetric matrices.