Total No. of Questions: 07

BCA (2011 & Onward) / B.Sc.(IT) (2015 & Onwards) (Sem. – 1)

MATHEMATICS – I

M Code: 10045

Subject Code: BSIT/BSBC-103

Paper ID: [B1110]

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. a) If A, B are two sets the prove that $B - A = B \cap A^c$.

   b) Find all the partitions of the set A = {a, b, c}.

   c) Let X = {1, 2, 3, 4, 5, 6, 7, 8, 9, 10}. The family{{1, 4, 8}, {3, 5, 9}, {2, 7}, {6, 10}} is a partition of X. Determine the equivalence relation corresponding to the above partition.

   d) Let B = {2, 3, 4, 6, 12, 36, 48} and S be the relation "divide" on B, Draw Hasse diagram of the relation S.

   e) Using truth table, prove that $p \rightarrow q = (\sim p) \vee q$.

   f) If p stands for the statement "I do not like chocolates" and q for the statement "I like ice-cream", then what does $\sim p \wedge q$ stands for?

   g) Show that the maximum number of edges in a simple graph with n vertices is $\frac{n(n-1)}{2}$

   h) Give an example of a graph that has

      a) Euler circuit but not Hamiltonian circuit.

      b) Hamiltonian circuit but not Euler circuit.

   i) Obtain the linear recurrence relation from the sequence defined by $S(K) = 5.2^K$.

   j) Solve the recurrence relation $a_n - 7a_{n-1} + 10a_{n-2} = 0$, given by $a_0 = 0$, $a_1 = 3$.

SECTION B

2. State and prove De Morgan's Laws for sets.

   For where $\frac{a}{b}, \frac{c}{d} \in Q$, where Q is the set of rational numbers, define a relation R as $\frac{a}{b} R \frac{c}{d}$ if and only if $ad = bc$. Show that R is an equivalence relation on Q.

3. a) Let A = {2, 3, 5, 8}, B = {4, 6, 16}, C = {1, 4, 5, 7}. Let R={(a, b) : a/b}and S {(b, c): b ≤ c } be relations from A to B and B to C. Find the composite relation S ∘ R. If L, M and N be the adjacency matrices of S ∘ R, R and S respectively. Then show that L = M.N.

   b) Check the validity of argument:

   If I work, I cannot study. Either I work or pass mathematics.

   I passed mathematics. Therefore, I study.

4. a) Over the universe of Books, define the proposition B(x): x has a blue cover, M(x): x is a mathematics book, U(x): x is published in United States and R(x, y): The bibliography of x includes y.

   Translate into words:

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

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

   iii) $(\exists x)(\sim B(x))$

   Express using quantifiers:

   iv) Every book with blue cover is a mathematics book.

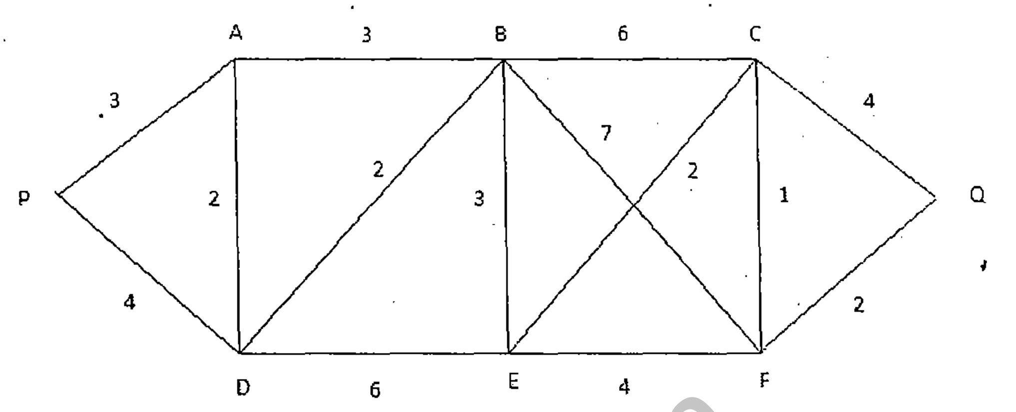
   v) There are mathematics books that are published outside the United States.

   vi) Not all books have bibliography.

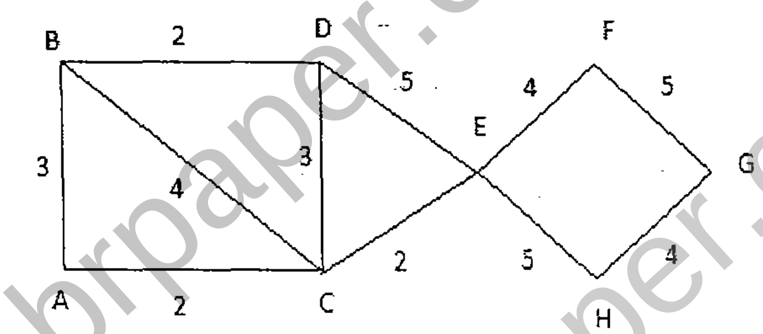
   b) Use the principle of mathematical induction to prove

   $1.3 + 2.4 + 3.5 + \ldots\ldots + n(n+2) = \frac{n(n+1(2n+7)}{6}$, for any natural number n.

5. Using Dijkstra's Algorithm, find shortest path from P to Q



6. a) Find the minimal spanning tree for the following weighted connected graph using Kruskal's Algorithm.



b) Solve S(K) - 8S(K - 1) + 16S(K - 2) = 0, where S(2) = 16, S(3) = 80.

7. a) Solve S(K) – 3S(K - 1) - 4S(K - 2) = 4^K.

b) Find inverse of the matrix $\begin{bmatrix} 1 & 1 & 1 \\ 1 & 2 & 5 \\ 1 & 3 & 4 \end{bmatrix}$