**B.Sc. (Honours) Examination, 2018**
**Semester-I**
**Computer Science**
**Course : BCSC-11 (Old)**
**(Discrete Structure)**
**(For Back Candidates)**

**Time : 3 Hours** **Full Marks : 40**

**Questions are of value as indicated in the margin**

Answer Question **No.1** and **any four** from the rest

1. Answer **any four** of the following : 4×2=8
   a) Define bijective mapping.
   b) Explain pigeonhole principle with example.
   c) State general statement of the principle of inclusion and exclusion.
   d) What is bipartite graph?
   e) Define Hamiltonian circuit with an example.
   f) What is *k*-chromatic graph?
2. a) Explain equivalence relation with an example.
   b) In a group of 52 tourists, everyone speaks Hindi or Bengali. There are 45 Hindi speakers and 28 Bengali speakers. How many tourists speak both Hindi and Bengali?
   c) Prove by mathematical induction that $n(n^2+5)$ is an integer multiple of 6 for all positive integers $n$. 3+2+3=8
3. a) Prove that a simple graph with $n$ vertices and $k$ components can have maximum $(n-k)(n-k+1)/2$ edges.
   b) Prove that a connected graph $G$ is an Euler graph if and only if all vertices of $G$ are of even degree. 4+4=8
4. a) Prove that a tree with $n$ vertices has $n-1$ edges.
   b) What is minimal spanning tree? Briefly explain Kruskal's algorithm with example to find minimal spanning tree in a graph. 3+(1+4)=8
5. a) What is rank and nullity of a graph? Write down the relation between them.
   b) What are Kuratowski's two graphs?
   c) Prove that a connected graph with $n$ vertices and $e$ edges has $e-n+2$ regions. 2+1+2+3=8
6. a) Explain Modus Ponens and Modus Tollens rules of inference, with examples.
   b) Solve the following recurrence relation:
   $F_n = F_{n-1} + F_{n-2}$ with $n \geq 2$ and $F_0 = F_1 = 1$. 2+1+5=8
7. Write short notes on **any two** of the following : 2×4=8
   a) Hasse diagram
   b) Konigsberg bridge problem
   c) Arbitrarily traceable graph
   d) Adjacency matrix vs. adjacency list.

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