(i) Printed Pages : 4   Roll No. ....

(ii) Questions   : 7   Sub. Code : | 1 | 0 | 5 | 7 | 1 |
                              Exam. Code : | 5 | 0 | 0 | 2 |

Bachelor of Arts (FYUP) 2nd Semester

(2055)

DISCRETE MATHEMATICS

Paper–Discrete Mathematics

Time Allowed : Three Hours]   **[Maximum Marks : 68**

Note :— Do **FOUR** questions in all, including Q. No. 1, and by selecting **ONE** question from each of the three units.

1. (a) Let R be the relation defined on the set of Natural numbers $\mathbb{N}$ as R = {(a, b) : a, b $\in \mathbb{N}$ and 2a + b = 18}. Find the domain and range of relation R.

   (b) Write the power set of A = {1, {4}}.

   (c) Let f : $\mathbb{R} \to \mathbb{R}$ defined by f(x) = x^2. Prove that f is not injective.

   (d) Write the first seven terms of Fibonacci recurrence relation $f_{n-1} + f_{n-2} = f_n$, where $f_0 = 0$, $f_1 = 1$.

(e) Draw a simple graph with 8 vertices such that each vertex has degree 3.

(f) Define a complete Bipartite graph $k_{4,5}$.

(g) Write the statement of Four Color Theorem in graph theory.

$$2 \times 7 = 14$$

UNIT—I

2. (a) In a class of 70 students, 45 have taken course in Java and 33 in Python and 10 neither Java nor Python. Find number of students who have taken both languages.

(b) Let $f : \mathbb{R} \to \mathbb{R}$ be defined by $f(x) = 2x + 1$, where $\mathbb{R}$ is the set of Real Numbers. Prove that f is a bijective function and hence find inverse of f. $\qquad 9 \times 2 = 18$

3. (a) Solve the recurrence relation given by

$$s_{n+2} + s_{n+1} - 12s_n = 0, n \geq 0 \text{ satisfying the initial conditions}$$
$$s_0 = 1 \text{ and } s_1 = 1.$$

(b) By finding generating function of sequence s_n, find the solution of recurrence relation :

$$s_{n+2} - 7s_{n+1} + 12s_n = 0 \text{ given that } s_0 = 2 \text{ and } s_1 = 5.$$

$$9 \times 2 = 18$$

UNIT—II

4. (a) A graph G has 21 edges, 3 vertices of degree 4 and all other vertices are of degree 3. Find the number of vertices in G.

(b) Prove that a connected graph with at least two vertices has an Euler circuit if and only if each of its vertices has even degree.

$9 \times 2 = 18$

5. (a) How many edges are there in an undirected graph with 12 vertices each of degree 8 ?

(b) A salesman must travel from city to city to sell his product. The following table shows the distance between various cities. Find the solution of traveling salesman problem to minimize the total distance of the tour by Assignment method :

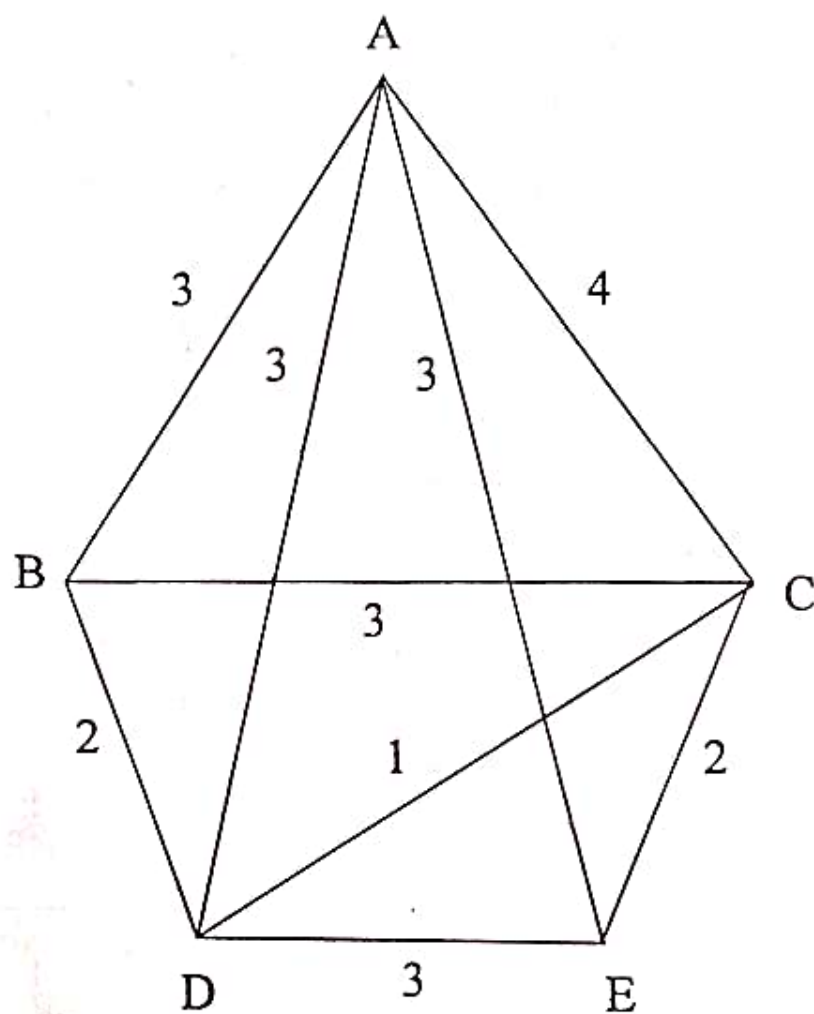| From City \ To City	A	B	C	D	E
A	0	40	24	30	200
B	40	0	25	300	30
C	24	25	0	26	26
D	30	300	26	0	40
E	200	30	26	40	0

$9 \times 2 = 18$

UNIT—III

6. (a) State and prove Euler's formula on connected planar simple graph.

(b) Prove that every tree with n vertices has at least two vertices of degree one, where n ≥ 2. $9 \times 2 = 18$

7. (a) A graph G is connected if and only if it has a spanning tree.

(b) Find minimal spanning tree of weighted graph using Prim's algorithm by starting from A.

$9 \times 2 = 18$