Reg.No.						

Bansilal Ramnath Agarwal Charitable Trust's
VISHWAKARMA INSTITUTE OF TECHNOLOGY, PUNE – 411037.
(An Autonomous Institute Affiliated to Savitribai Phule Pune University)

Examination: ESE

Year: F.Y. **Branch**: Common to ALL

Subject: Discrete Mathematics **Subject Code: ES 1030**

Max. Marks: 60 **Total Pages of Question Paper:**

Day & Date: Wednesday, 31st May 2023 **Time**:

Instructions to Candidate

1. All questions are compulsory.
2. Neat diagrams must be drawn wherever necessary.
3. Figures to the right indicate full marks.

Q. N.	CO No	BT* No	Question Statement	Max marks
Q. 1.	**1**		**Attempt the following**	**10**
(A)			**Three compulsory bits** on Algebraic Properties of Sets / Power set / Definition of relation / Representations of relation (Matrix , digraph) / Properties of relation (reflexive, symmetric etc) / Equivalence relation / Partial order relation / Hasse diagram / Lattice	
(B)				
(C)				
Q. 2.	**2**		**Attempt the following**	**10**
(A)			**Three or Four compulsory bits** on Principle of Mathematical Induction / Permutation / Combinations / Binomial coefficients / Equivalence relation / Partial order relation / Hasse diagram / Lattice	
(B)				
(C)				
(D)				
Q. 3.	**3**		**Attempt the following**	**8**
(A)			**Two / Three compulsory bits** on Definition of divisibility / Properties of divisibility / congruence / properties of congruence /Greatest common divisor / Euclidean Algorithm / solution of linear congruences / Chinese remainder theorem	
(B)				
(C)				
Q. 4.	**4**		**Attempt any Two of the following**	**10**
(A)			Infinite series- Testing of convergence / Modeling of recurrence relations / Solution of recurrence relation by method of substitution (iteration) / Solution of recurrence relation by characteristic equation / Solution of recurrence relation by generating function	
(B)				
(C)				
Q. 5.	**5**		**Attempt any Three of the following**	**12**
(A)			Definition of graph / Hand shaking Lemma / Matrix representation of graph / Degree of a vertex / Undirected graph / Directed graph / In and out degree / Types of graph : Complete, Simple, Regular, Bipartite , Planer, Eulerian, Hamiltonian / Simple path, path, circuit /Connected graph / Isomorphism / Subgraph / Spanning subgraph / Tree /Properties of tree / spanning tree	
(B)				
(C)				
(D)				
(E)				
Q. 6.	**6**		**Attempt any Two of the following**	**10**
(A)			Inclusion-Exclusion Principle / Shortest path algorithm (Dijkstra's algorithm) / application of trees in counting / applications of counting in real life.	
(B)				
(C)				

CO Statements:
CO1: understand and evaluate sets, relations, functions, number system,
CO2: identify and use operations on sets, relations, functions, combinatorial identities, Advanced counting techniques.
CO3: analyze and interpret the concepts of number theory-divisibility, prime number, modulo arithmetic, congruence and number theorems
CO4: construct and solve recurrence relations
CO5: understand and apply terminology of graph theory, types of graphs, matrices associated with graphs, trees.
CO6: translate a physical problem into a mathematical model, find solution of the model by selecting and applying suitable mathematical method

***Blooms Taxonomy (BT) Level No:**
1. Remembering; 2. Understanding; 3. Applying; 4. Analyzing; 5. Evaluating; 6. Creating