**Description of Course CSE 103**

**PART A: General Information**

| **1** | **Course Title** | : DISCRETE MATHEMATICS |
| --- | --- | --- |
| **2** | **Type of Course** | : THEORY |
| **3** | **Offered to** | : DEPARTMENT OF CSE |
| **4** | **Pre-requisite Course(s)** | : NONE |

**PART B: Course Details**

1. **Course Content (As approved by the Academic Council)**

Sets, functions, sequences, sums; Relations and partial ordered sets; Mathematical logic: propositional calculus and predicate calculus; Mathematical reasoning and proof techniques: induction; Counting: permutations, combinations, principles of inclusion and exclusion, generating functions; Discrete probability; Recurrence relations and recursive algorithms; Graph theory: graphs, paths, and trees; Introduction to number theory and algebraic structures.

1. **Course Objectives**

The students are expected to:

i. study the concept and relevant tools of mathematical logic and reasoning

ii. learn how to apply different proof techniques to prove propositions

iii. learn how to do counting and enumeration through combinatorial analysis

iv. develop problem solving and modeling skills using discrete structures (e.g., graphs)

1. **Knowledge required**

**Technical**

* None

**Analytical**

* Basic Mathematics (HSC Level)

1. **Course Outcomes (COs)**

| **CO No.** | **CO Statement**  After undergoing this course, students should be able to: | **Corresponding PO(s)\*** | **Domains and Taxonomy level(s)\*\*** | **Delivery Method(s) and Activity(-ies)** | **Assessment Tool(s)** |
| --- | --- | --- | --- | --- | --- |
| CO1 | **understand** and **apply** the theory, constructs and concepts of mathematical logic and reasoning and **derive** proof using those | - | C3 | Lecture, exercise | Class Tests or Assignments and Final Exam |
| CO2 | Combinatorically **analyze** various counting problems | - | C5 | Lecture, exercise | Class Tests or Assignments and Final Exam |
| CO3 | **Analyze** problems and **develop** models thereof using discrete structures | - | C5 | Lecture, exercise | Class Tests or Assignments and Final Exam |

**\*Program Outcomes (POs)**

PO1: Engineering knowledge; PO2: Problem analysis; PO3: Design/development of solutions; PO4: Investigation; PO5: Modern tool usage; PO6: The engineer and society; PO7: Environment and sustainability; PO8: Ethics; PO9: Individual work and teamwork; PO10: Communication; PO11: Project management and finance; PO12: Life-long learning.

**\*\*Domains**

**C-Cognitive**: C1: Knowledge; C2: Comprehension; C3: Application; C4: Analysis; C5: Synthesis; C6: Evaluation

**A-Affective**: A1: Receiving; A2: Responding; A3: Valuing; A4: Organizing; A5: Characterizing

**P-Psychomotor**: P1: Perception; P2: Set; P3: Guided Response; P4: Mechanism; P5: Complex Overt Response; P6: Adaptation; P7: Organization

1. **Mapping of Knowledge Profile, Complex Engineering Problem Solving and Complex Engineering Activities**

| **COs** | **K1** | **K2** | **K3** | **K4** | **K5** | **K6** | **K7** | **K8** | **P1** | **P2** | **P3** | **P4** | **P5** | **P6** | **P7** | **A1** | **A2** | **A3** | **A4** | **A5** |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| CO1 |  | √ |  |  |  |  |  |  | √ |  |  |  |  |  |  |  |  |  |  |  |
| CO2 |  | √ |  |  | √ |  |  |  | √ |  |  |  |  |  |  |  |  |  |  |  |
| CO3 |  | √ |  |  | √ | √ |  |  | √ | √ |  |  |  |  |  |  |  |  |  |  |

**K-Knowledge Profile:**

**K1:** A systematic, theory-based understanding of the natural sciences applicable to the discipline; **K2:** Conceptually based mathematics, numerical analysis, statistics and the formal aspects of computer and information science to support analysis and modeling applicable to the discipline; **K3:** A systematic, theory-based formulation of engineering fundamentals required in the engineering discipline; **K4:** Engineering specialist knowledge that provides theoretical frameworks and bodies of knowledge for the accepted practice areas in the engineering discipline; much is at the forefront of the discipline; **K5:** Knowledge that supports engineering design in a practice area; **K6:** Knowledge of engineering practice (technology) in the practice areas in the engineering discipline; **K7:**Comprehension of the role of engineering in society and identified issues in engineering practice in the discipline: ethics and the engineer’s professional responsibility to public safety; the impacts of engineering activity; economic, social, cultural, environmental and sustainability; **K8:** Engagement with selected knowledge in the research literature of the discipline

**P-Range of Complex Engineering Problem Solving:**

**P1:** Cannot be resolved without in-depth engineering knowledge at the level of one or more of K3, K4, K5, K6 or K8 which allows a fundamentals-based, first principles analytical approach; **P2:** Involve wide-ranging or conflicting technical, engineering and other issues; **P3:** Have no obvious solution and require abstract thinking, originality in analysis to formulate suitable models; **P4:** Involve infrequently encountered issues; **P5:** Are outside problems encompassed by standards and codes of practice for professional engineering; **P6:** Involve diverse groups of stakeholders with widely varying needs; **P7:** Are high level problems including many component parts or sub-problems

**A-Range of Complex Engineering Activities:**

**A1:** Involve the use of diverse resources (and for this purpose resources include people, money, equipment, materials, information and technologies); **A2:** Require resolution of significant problems arising from interactions between wide-ranging or conflicting technical, engineering or other issues; **A3:** Involve creative use of engineering principles and research-based knowledge in novel ways; **A4:** Have significant consequences in a range of contexts, characterized by difficulty of prediction and mitigation; **A5:** Can extend beyond previous experiences by applying principles-based approaches

1. **Lecture/ Activity Plan**

| **Week** | **Lecture Topics** | **Corresponding CO(s)** |
| --- | --- | --- |
| Week 1 | Introduction, Motivation; propositional calculus | CO1 |
| Week 2 | propositional calculus (cont.), predicate calculus | CO1 |
| Week 3 | predicate calculus (cont.), Mathematical reasoning and proof techniques | CO1 |
| Week 4 | Mathematical reasoning and proof techniques, Sets, Basic Counting | CO1 |
| Week 5 | Graph Theory: graphs, paths, and trees | CO3 |
| Week 6 | Tree, Tree Property, Traversal Relation | CO3 |
| Week 7 | Function | CO1 |
| Week 8 | Relation | CO2, CO3 |
| Week 9 | Algebraic structures | CO2, CO3 |
| Week 10 | Number theory | CO1 |
| Week 11 | Discrete Probability | CO2 |
| Week 12 | Sequences, Sums, Recurrence relations | CO2, CO3 |
| Week 13 | Recursive algorithms | CO2, CO3 |
| Week 14 | Advanced Counting (Counting by mapping, generating functions) | CO1 |

1. **Assessment Strategy**

* Class Attendance: Class attendance will be recorded in every class.
* Class Tests/Assignments/Projects: There will be a minimum of 4 (four) Class Tests/Assignments/Projects, out of which the best 3 (three) will be considered in final evaluation.
* Final exam: A comprehensive Final exam will be held at the end of the semester as per the institutional ordinance.

1. **Distribution of Marks**

Attendance: 10 %

Class Tests/Assignments/Projects: 20%

Final Exam: 70%

Total: 100%

1. **Textbook/ Reference**
   1. Keneth. H. Rosen, “Discrete mathematics and its applications”, Tata McGraw- Hill Publishing Company, New Delhi
   2. Susanna S. Epp, “Discrete mathematics and its applications”, Brooks/Cole-Thomas Learning, USA.