هيئة تقويم التعليم والتدريب
Education & Training Evaluation Commission

اعتماد NCAAA T4 2020

# Course Specifications

| | |
|---|---|
| **Course Title:** | Discrete Mathematics |
| **Course Code:** | MH 121 |
| **Program:** | CS/IT |
| **Department:** | Basic Sciences and Humanities |
| **College:** | College of Computer and Information Sciences |
| **Institution:** | Majmaah University |

جامعة المجمعة
Majmaah University
كلية علوم الحاسب والمعلومات
College of computer and information Sciences

## Table of Contents

## A. Course Identification

| |
|---|
| **1. Credit hours: 3(3, 0, 1)** |
| **2. Course type**<br>**a.** University ☐ College ☑ Department ☐ Others ☐<br>**b.** Required ☑ Elective ☐ |
| **3. Level/year at which this course is offered: Level 2** |
| **4. Pre-requisites for this course** (if any)**: None** |
| **5. Co-requisites for this course** (if any)**: None** |

**6. Mode of Instruction** (mark all that apply)

| No | Mode of Instruction | Contact Hours | Percentage |
|---|---|---|---|
| 1 | **Traditional classroom** | 40 | **100%** |
| 2 | **Blended** | | |
| 3 | **E-learning** | | |
| 4 | **Distance learning** | | |
| 5 | **Other** | | |

**7. Contact Hours** (based on academic semester)

| No | Activity | Contact Hours |
|---|---|---|
| 1 | **Lecture** | **30** |
| 2 | **Laboratory/Studio** | |
| 3 | **Tutorial** | **10** |
| 4 | **Others** (specify) | |
| | **Total** | |

## B. Course Objectives and Learning Outcomes

**1. Course Description**

The course presents a set of mathematical facts and how to apply them for logical and mathematical thinking. Topics include Logic and set theory, Proof Strategy, Mathematical and Structural Induction, Types of relations and set partition, Partial Ordering, Integers and Algorithms, Complexity of Algorithms, Congruencies, Representation of Integers, Principles of Counting, Permutations, Combinations and Graph Theory.

**2. Course Main Objective**

1. Students will be able to explain and apply the basic methods of discrete (non-contiguous) mathematics in Computer Science.
2. Use logical notation to define and reason about fundamental mathematical concepts such as sets, relations, functions, and integers.
3. Evaluate elementary mathematical arguments and identify fallacious reasoning (not just fallacious conclusions).
4. Synthesize induction hypotheses and simple induction proofs.
5. Prove elementary properties of modular arithmetic and explain their applications in Computer Science, for example, in cryptography and hashing algorithms.

6. Explain and apply the knowledge of graph theory required for the Computer Science.
7. Derive closed-form and asymptotic expressions from series and recurrences for growth rates of processes.
8. Calculate numbers of possible outcomes of elementary combinatorial processes such as permutations and combinations. Calculate probabilities and discrete distributions for simple combinatorial processes; calculate expectations.

**3. Course Learning Outcomes**

| | CLOs | Aligned PLOs |
|---|---|---|
| 1 | **Knowledge and Understanding** | |
| 1.1 | | |
| 1.2 | | |
| 1…. | | |
| **2** | **Skills :** | |
| 2.1 | CLO 1: Evaluate logical expressions and perform the basic operations on sets. | S5 |
| 2.2 | CLO 2: Use the direct method, the contrapositive method, the contradiction method, and the mathematical induction to write a rigorous mathematical proof. | S5 |
| 2.3 | CLO 3: Apply logical reasoning to solve a variety of problems. | S5 |
| 2.4 | CLO 4: Apply a wide range of principles of discrete mathematics, such as problem solving, good thinking, choice of algorithm, and mathematical proofs. | S5 |
| 2.5 | CLO 5: Interact with life problems using different methods of thinking and problem solving | S5 |
| **3** | **Values:** | |
| 3.1 | | |
| 3.2 | | |
| 3… | | |

## C. Course Content

| No | List of Topics | Contact Hours |
|---|---|---|
| 1 | Simple and compound statements, Logical connectives, Truth tables, Basic logic laws, Applications of Logic | 3 |
| 2 | Operations on sets, Basic laws of set theory, Cartesian product of sets | 3 |
| 3 | Proof Strategy, Direct Method, the Contrapositive Method, the ,Contradiction Method | 3 |
| 4 | Mathematical Induction and Structural Induction | 3 |
| 5 | Basic definitions on relations, Binary relations and their types | 4 |
| 6 | Equivalence relation and set partition, Partial Ordering | 4 |
| 7 | Further Applications and examples Equivalence relation and set partition, Partial Ordering | 4 |

| | | |
|---|---|---|
| 8 | Algorithms, Examples of Algorithms, Complexity of Algorithms, Recursive Definitions, Recursive Algorithms, Integers and Division, The Division Algorithm, Integers Algorithms, The Euclidean Algorithm, | 4 |
| 9 | .Congruencies, Representation of Integers, Applications | 4 |
| 10 | Principles of Counting: The Basics of Counting, The Pigeonhole Principle, | 4 |
| 11 | Introduction to Graphs, Representation of Graphs. Paths and Cycles, Euler and Hamilton Paths, Shortest-Path Algorithms | 4 |
| **Total** | | 40 |

## D. Teaching and Assessment

### 1. Alignment of Course Learning Outcomes with Teaching Strategies and Assessment Methods

| Code | Course Learning Outcomes | Teaching Strategies | Assessment Methods |
|---|---|---|---|
| **1.0** | **Knowledge and Understanding** | | |
| 1.1 | | | |
| 1.2 | | | |
| 1.. | | | |
| **2.0** | **Skills** | | |
| 2.1 | CLO 1: Evaluate logical expressions and perform the basic operations on sets. | Classroom Teaching | Quiz, Home assignment, Mid-Exam, Final Exam |
| 2.2 | CLO 2: Use the direct method, the contrapositive method, the contradiction method, and the mathematical induction to write a rigorous mathematical proof. | Classroom Teaching | Quiz, Home assignment, Mid-Exam, Final Exam |
| 2.3 | CLO 3: Apply logical reasoning to solve a variety of problems. | Classroom Teaching | Quiz, Home assignment, Mid-Exam, Final Exam |
| 2.4 | CLO 4: Apply a wide range of principles of discrete mathematics, such as problem solving, good thinking, choice of algorithm, and mathematical proofs. | Classroom Teaching | Quiz, Home assignment, Mid-Exam, Final Exam |
| 2.5 | CLO 5: Interact with life problems using different methods of thinking and problem solving | Classroom Teaching | Quiz, Home assignment, Mid - Exam, Final Exam |
| **3.0** | **Values** | | |
| 3.1 | | | |
| 3.2 | | | |
| 3… | | | |

### 2. Assessment Tasks for Students

| # | Assessment task* | Week Due | Percentage of Total Assessment Score |
|---|---|---|---|
| **1** | Attendance and Class participation | Week 1 to 10 | 5% |
| **2** | Quiz 1 | Week 3 | 10% |

| # | Assessment task* | Week Due | Percentage of Total Assessment Score |
|---|---|---|---|
| | | | |
| 3 | Assignment 1 | Week 4 | 10% |
| 4 | Midterm | Week 6 | 20% |
| 5 | Assignment 2 | Week 7 | 5% |
| 6 | Quiz 2 | Week 9 | 10% |
| 7 | Final Exam | Week 11 | %40 |
| 8 | | | |

***Assessment task** (i.e., written test, oral test, oral presentation, group project, essay, etc.)

## E. Student Academic Counseling and Support

**Arrangements for availability of faculty and teaching staff for individual student consultations and academic advice :**

- Each student is allotted to an academic advisor for guidance and counseling.
- Available for a minimum of 2 hours per week/course, as communicated to the students.
- The student also contacts through social networking websites / Blackboard/ Email for advice and consultations

## F. Learning Resources and Facilities

### 1.Learning Resources

| | |
|---|---|
| **Required Textbooks** | Discrete Mathematics and Its Applications, K. Rosen, 7th Edition McGraw-Hill, ISBN 978-0-07-338309-5, 2012. |
| **Essential References Materials** | Journey into Discrete Mathematics (AMS/MAA Textbooks) by Owen D. Byer (Author), Deirdre L. Smeltzer (Author), Kenneth L. Wantz (Author), American Mathematical Society, ISBN-10: 1470446960, ISBN-13: 978-1470446963, 2018 |
| **Electronic Materials** | https://ocw.vu.edu.pk/Videos.aspx?cat=Mathematics&course=MTH202<br>https://ocw.mit.edu/courses/electrical-engineering-and-computer-science/6-042j-mathematics-for-computer-science-fall-2010/video-lectures/ |
| **Other Learning Materials** | Blackboard, Class notes |

### 2. Facilities Required

| Item | Resources |
|---|---|
| **Accommodation** (Classrooms, laboratories, demonstration rooms/labs, etc.) | Classroom |
| **Technology Resources** (AV, data show, Smart Board, software, etc.) | PC or Laptop with Windows/Linux, Smart Board, Projector |

| Item | Resources |
|---|---|
| **Other Resources**<br>(Specify, e.g. if specific laboratory equipment is required, list requirements or attach a list) | Internet Connection |

## G. Course Quality Evaluation

| Evaluation Areas/Issues | Evaluators | Evaluation Methods |
|---|---|---|
| Final Exam Answer Scripts Verification | Peer faculty members | Review |
| Course Feedback | Students | Survey |
| | | |

**Evaluation areas** (e.g., Effectiveness of teaching and assessment, Extent of achievement of course learning outcomes, Quality of learning resources, etc.)
**Evaluators** (Students, Faculty, Program Leaders, Peer Reviewer, Others (specify)
**Assessment Methods** (Direct, Indirect)

## H. Specification Approval Data

| | |
|---|---|
| **Council / Committee** | |
| **Reference No.** | |
| **Date** | |