MODULE DESCRIPTION FORM

Module Information					
Module Title	Discrete numerical mathematics			**Module Delivery**	
Module Type	Optional			☑ Theory ☑ Lecture ☐ Lab ☑ Tutorial ☐ Practical ☐ Seminar	
Module Code	COE321				
ECTS Credits	5				
SWL (hr/sem)	125				
Module Level	2		**Semester of Delivery**	3	
Administering Department	Artificial Intelligence Eng.		**College**	College of Engineering	
Module Leader	Sarmad Kadhim Alkhfaji		**e-mail**	sarmad.kazem@alayen.edu.iq	
Module Leader's Acad. Title	Asst. Lec.		**Module Leader's Qualification**	Msc	
Module Tutor	ZAINAB ABDULKADHIM NAJM		**e-mail**	Zainab.AbdulKadhim@alayen.edu.iq	
Peer Reviewer Name			**e-mail**	Hasnaa.Mohammad@alayen.edu.iq	
Scientific Committee Approval Date	27/9/2025		**Version Number**	1.0	

Relation with other Modules			
Prerequisite module	COE226	**Semester**	4
Co-requisites module	NONA	**Semester**	

Module Aims, Learning Outcomes and Indicative Contents	
Module Objectives	Set theory. - Logical relationship. -Logical operations on sets. - Counting methods. -Methods of proof. - Algorithms. -Computational complexity of algorithms. - Mathematical deduction. -Repetitive. - Series. -Shapes and trees. - Directed graph. -Undirected graph. - Adjacency matrices. Graph algorithms and their applications.

<table>
<tr><td rowspan="4">Module Learning Outcomes</td><td rowspan="1">Knowledge</td><td>A2</td><td>A2.1: Define the fundamental concepts of set theory, logical relationships, and logical operations on sets as they relate to computational structures
A2.2: Demonstrate the ability to apply repetitive and series structures in algorithmic design and system modeling
A2.3: 1. Apply the principles of set theory and logical relationships to represent and analyze computer systems and digital circuits.
2. Apply logical operations on sets to model computational structures and data relationships.</td></tr>
<tr><td rowspan="2">Skills</td><td>B1</td><td>B1.1 Function efficiently as an individual
B1.2 Function as a member of multidisciplinary and multicultural teams</td></tr>
<tr><td>B2</td><td>B2.1 Communicate effectively – graphically with a range of audiences using contemporary tools.
B2.2 Communicate verbally and in writing with a range of audiences using contemporary tools.</td></tr>
<tr><td>Ethics</td><td>C1</td><td>C2.1 Recognize professional and ethical responsibility.
C1.2 Adhere and respect diversity.</td></tr>
<tr><td>Indicative Contents</td><td colspan="3">Indicative content includes the following.
Unit 1: Set Theory and Logic
Contents:
Set theory – Definition, types of sets, and operations on sets – Logical relationships – Logical operations on sets – Laws of logic and set identities.
[8 hours]

Unit 2: Counting Methods and Proof Techniques
Contents:
Counting principles – Permutations and combinations – The pigeonhole principle – Methods of proof (direct, indirect, and contradiction) – Mathematical deduction and reasoning.
[8 hours]

Unit 3: Algorithms and Computational Complexity
Contents:
Definition and structure of algorithms – Algorithmic flow and repetitive processes – Series and recurrence relations – Computational complexity of algorithms – Big-O notation and performance analysis.
[8 hours]
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	Unit 4: Trees and Graph Theory Contents: **Introduction to shapes and trees – Properties and types of trees – Directed and undirected graphs – Graph representations – Adjacency matrices.** **[6 hours]** **---** **Unit 5: Graph Algorithms and Applications Contents:** **Graph traversal algorithms (DFS, BFS) – Shortest path algorithms (Dijkstra, Floyd-War shall) – Minimum spanning trees – Applications of graphs in networks, computer architecture, and optimization.** **[6 hours]**

Learning and Teaching Strategies

Strategies	• Presentations • Discussions • Tutorial and graphics • Problem solving • Brain storming • Research and reporting • Problem Solving • Report & discussion assessment

Student Workload (SWL)

Structured SWL (h/sem)	78	**Structured SWL (h/w)**	5.2
Unstructured SWL (h/sem)	72	**Unstructured SWL (h/w)**	4.8
Total SWL (h/sem)	150		

Delivery Plan (Weekly Syllabus)

المنهاج الاسبوعي النظري

	Material Covered	LOs
Week 1	**Set theory.-**	
Week 2	**Logical relationship.-Logical operations on sets.-**	A2, B1, B2, C1
Week 3	**Counting methods.-Methods of proof.**	A2, B1, B2, C1
Week 4	**Algorithms. -Computational complexity of algorithms.**	A2, B1, B2, C1
Week 5	**Mathematical deduction. -Repetitive.**	A2, B1, B2, C1
Week 6	**Repetitive.**	A2, B1, B2, C1
Week 7	**Series. -Shapes and trees.**	A2, B1, B2, C1

Week 8	**Directed graph.**	A2, B1, B2, C1
Week 9	**Undirected graph. -**	A2, B1, B2, C1
Week 10	**Mid -term EXAM**	A2
Week 11	**Adjacency matrices**	A2, B1, B2, C1
Week 12	**Graph algorithms and their applications.**	A2, B1, B2, C1
Week 13	**Change of Bases and Normal Forms**	A2, B1, B2, C1
Week 14	**Rubric Exam** **Preparatory week before the final Exam**	A2, B1, B2, C1

Module Evaluation

تقييم المادة الدراسية

		Time/Number	Weight (Marks)	Week Due	Relevant Learning Outcome
Formative assessment	**Quizzes**	2	10% (10)	5 and 10	A2
	Assignments	2	10% (10)	2, 4,6,8,10,12 and 14	A2
	Projects /				
	Report	1	10% (10)	13	A2,B1,B2
Summative assessment	**Midterm Exam**	1hr	10% (10)	7	A2
	Final Exam	3hr	50% (50)	15	A2
Total assessment			100% (100 Marks)		

Delivery Plan (Weekly Lab. Syllabus) المنهاج الاسبوعي للمختبر	
	Material Covered
Week 1	
Week 2	
Week 3	

Learning and Teaching Resources مصادر التعلم والتدريس		
	Text	**Available in the Library?**
Required Texts	Mazumder, Numerical Method's fo Mazumder, Numerical Method's far Partial Differential Equations, Finite Difference and Finite Volume Methods, science direct, 2016. Hamning, Richard. Numerical methods far scientists and engineers. Courier Corporatian, 2012..	Yes
Recommended Texts	1. "Discrete Mathematics and Its Applications" – Kenneth H. Rosen 2. "Discrete Mathematics" – Richard Johnsonbaugh	No
Websites	https://eng.alayen.edu.iq//colleges/e/42	

Grading Scheme مخطط الدرجات				
Group	**Grade**	التقدير	**Marks (%)**	**Definition**
Success Group (50 - 100)	**A - Excellent**	امتياز	90 - 100	Outstanding Performance
	B - Very Good	جيد جدا	80 - 89	Above average with some errors
	C - Good	جيد	70 - 79	Sound work with notable errors
	D - Satisfactory	متوسط	60 - 69	Fair but with major shortcomings
	E - Sufficient	مقبول	50 - 59	Work meets minimum criteria
Fail Group (0 – 49)	**FX – Fail**	راسب (قيد المعالجة)	(45-49)	More work required but credit awarded
	F – Fail	راسب	(0-44)	Considerable amount of work required

Note: Marks Decimal places above or below 0.5 will be rounded to the higher or lower full mark (for example a mark of 54.5 will be rounded to 55, whereas a mark of 54.4 will be rounded to 54. The University has a policy NOT to condone "near-pass fails" so the only adjustment to marks awarded by the original marker(s) will be the automatic rounding outlined above.