

COURSE SYLLABUS
(Training level: Undergraduate)

Vietnamese Course Title: Toán rời rạc

English Course Title: Discrete Mathematics

Course Code: DEM231

Major: Information technology

Training Program: Bachelor; Engineer.

Version: 2021

1. General Information

- Number of credits: 03 (Theory: 03; Practice: 0)

- Types of Knowledge:

General Education		Basic core courses		Major core courses		Concentration courses		Others
Required <input type="checkbox"/>	Optional <input type="checkbox"/>			Information technology; Software Engineering				
		Required <input type="checkbox"/>	Optional <input type="checkbox"/>	Required <input checked="" type="checkbox"/>	Optional <input type="checkbox"/>	Required <input type="checkbox"/>	Optional <input type="checkbox"/>	

- Pre-requisite: Advanced Math (MAT140), Programming Techniques (KTL122)

- Co-requisite: None

- Facility Requirements: Having a projector in the classroom.

- Practice Room: None

2. Time Allocated

Total: 54 Periods	Theory: 32 Periods
	Discussion/ Group Presentation: 18 Periods/0
	Assignment/ Essay/ Practice: 0
	Tests: 03 + Theory: Number of Tests: 03 Periods: 04
	Self-Study: 90 Periods
	Other Activities: 0

3. Departments in Charge: Faculty Information Technology

4. Lecturer's Information

No.	Lecturer name	Phone number	Email	Note
1	Ph.D Vu Vinh Quang	0913286676	vvquang@ictu.edu.vn	Leader
2	MSc. Nguyen Hien Trinh	0987562055	nhtrinh@ictu.edu.vn	Member

No.	Lecturer name	Phone number	Email	Note
3	MSc. Nguyen Thi Tuyen	0988808459	nttuyen@ictu.edu.vn	Member
4	MSc. Doan T. Bich Ngoc	0987944381	dtbngoc@ictu.edu.vn	Member
5	MSc. Nguyen Thi Oanh	0981368808	ntoanh@ictu.edu.vn	Member
6	MSc. Dinh Khanh Linh	0977102556	dklinh@ictu.edu.vn	Member
7	Ph.D Nguyen Dinh Dung	0915212787	nddung@ictu.edu.vn	Member

5. Facility Requirements: Having a projector in the classroom.

6. Course Description:

The course equips students with knowledge and skills to represent information and process information in computers, with a major focus on studying discrete objects and processing algorithms on these objects.

The knowledge provided to students includes 4 main contents: Propositional algebra presents basic concepts and operations on logical propositions; Combination theory revolves around 4 basic problems: counting problem, enumeration problem, existence problem, optimization problem; Graph theory focuses on discrete structures synthesized from practical problems and algorithms on graphs; Finally, the content of instructions for installing algorithms has been approached in the above contents to improve programming skills for students when solving practical problems.

7. Objectives

Objectives	Description	PLOs	Competency Level
G1	Knowledge of propositional algebra, canonical and normative forms, methods of proof, recursion, combinatorics, unions, and permutations.	1.3	2
	Knowledge of graphs, graph search algorithms, shortest path algorithms, minimum spanning trees, programming skills and algorithmic thinking.	1.3	2
G2	Methods of solving propositional logic problems, combinatorial problems, and problems on graphs commonly encountered in practice	4.3	3
	Some real world problems are modeled on discrete structures.	4.3	3

8. Learning Outcomes

Objectives	CLOs	Description of CLOs	PLOs	Proficiency level
G1	G1.1	Understand the knowledge of propositional algebra, canonical and normative forms, proof methods, recursion, combinatorics, unions, and permutations.	1.3	2
	G1.2	Understand the knowledge of graph theory, graph search algorithm, shortest path algorithm, minimum spanning tree algorithm.	1.3	2
G2	G2.1	Apply knowledge of propositional algebra, canonical forms, combinatorial problems to	4.3	3

Objectives	CLOs	Description of CLOs	PLOs	Proficiency level
		apply to solving real-world problems.		
	G2.2	Apply models on discrete structures, especially graph models to apply and solve some real-world problems.	4.3	3

9. Scientific Ethics

Actively attend theoretical classes in class, do exercises assigned by the lecturer, fully participate in discussion hours in the spirit of improving self-discipline, self-control and completing regular tests. All acts of cheating in learning and assessment will be according to regulations.

10. Detailed Contents

Period	Contents	References	CLOs	Competency Level	Teaching Methodology	Assessment Methodology
	Chapter 1. Propositional Algebra					
1-5	A/ Content of classroom learning: 1.1. Proposition concept. 1.2. Mathematical operations on propositions. 1.3. Standard forms.	[1], [2], [3]	G1.1	2	Presentation; Give and solve problems	Evaluation by comments
	B/ Contents of self-study: (6) Exercises: mathematical operations on propositions; find normal form	[2], [4]	G2.1	3	Self-Study	Motivational assessment/ Combined with Attendance assessment
	Chapter 1. Propositional Algebra <i>(Continue)</i>					
6-8	A/ Content of classroom learning: 1.4. Predicate logic. 1.5. Argument rules. 1.6. Proven methods.	[1], [2], [3]	G1.1 G2.1	2 3	Presentation; Give and solve problems	Evaluation by comments
	B/ Contents of self-study: (6) Exercise: Rules of Argument; proof methods.	[2], [4]	G1.1 G2.1	2 3	Self-Study	Motivational assessment/ Combined with Attendance assessment
9-11	Discussion 1: Propositional logic - Summary of knowledge Chapter 1. - Exercise Chapter 1.	[2], [4]	G1.1 G2.1	2 3	Discussion groups; Give and solve problems	Evaluation by comments
12	Periodic Test No. 1		G1.1 G2.1	2 3		Evaluation by the score
13-15	Chapter 2. Combination theory					

Period	Contents	References	CLOs	Competency Level	Teaching Methodology	Assessment Methodology
	A/ Content of classroom learning: 2.1. Sets and operations on sets. 2.2. Algorithm concept and algorithm complexity. 2.3. Recursive Algorithm.	[2], [5]	G1.1	2	Presentation; Give and solve problems	Evaluation by comments
	B/ Contents of self-study: (6) Exercise: operations on sets; recursive algorithm.	[2], [5]	G1.1 G2.1	2 3	Self-Study	Motivational assessment/ Combined with Attendance assessment
16-17	Chapter 2. Combination theory (Continue)					
	A/ Content of classroom learning: 2.4. Counting problems and basic principles.	[2], [5]	G1.1	2	Presentation; Give and solve problems	Evaluation by comments
	B/ Contents of self-study: (6) Exercise: Counting problems and basic principles.	[2], [5]	G2.1	3	Self-Study	Motivational assessment/ Combined with Attendance assessment
18-20	Discussion 2: Recursive Algorithms; Counting problem.	[2], [5]	G1.1 G2.1	2 3	Discussion groups; Give and solve problems	Evaluation by comments
21-24	Chapter 2. Combination theory (Continue)					
	A/ Content of classroom learning: 2.5. The enumeration problem and the backtracking algorithm. 2.6. The problem exists. 2.7. Optimization problem.	[2], [5]	G1.1	2	Presentation; Give and solve problems	Evaluation by comments
	B/ Contents of self-study: (6) Exercise: Enumeration problem and backtracking algorithm	[2], [5]	G2.1	3	Self-Study	Motivational assessment/ Combined with Attendance assessment
25-27	Discussion 3: - Exercises Chapter 2. - Programmatically install some enumeration algorithms.	[2], [5]	G1.1 G2.1	2 3	Discussion groups; Give and solve problems	Evaluation by comments
28	Periodic Test No.2		G1.1 G2.1	2 3		Evaluation by the score
29-31	Chapter 3. Graph Theory					
	A/ Content of classroom learning: 3.1. Some basic concepts. 3.2. Graph description methods. 3.3. Graph traversal methods (BFS, DFS).	[1], [2], [3]	G1.2	2	Presentation; Give and solve problems	Evaluation by comments

Period	Contents	References	CLOs	Competency Level	Teaching Methodology	Assessment Methodology
	B/ Contents of self-study: (6) Exercise: Methods for traversing graphs.	[2], [4], [5]	G2.2	3	Self-Study	Motivational assessment/ Combined with Attendance assessment
	Chapter 3. Graph Theory (Continue)					
32-34	A/ Content of classroom learning: 3.4. Some special types of graphs. - Eulerian graph. - Hamilton graph. - The Flor algorithm determines the Euler cycle.	[1], [2], [3]	G 1.2	2	Presentation; Give and solve problems	Evaluation by comments
	B/ Contents of self-study: (6) Exercise: Euler Graph and Hamiltonian Graph.	[2], [4], [5]	G2.2	3	Self-Study	Motivational assessment/ Combined with Attendance assessment
35-37	Discussion 4: - Some applications of special graphs. - Display graphs on the computer. - Programming and installing BFS, DFS and Flor algorithms.	[1], [2], [3]	G1.2 G2.2	2 3	Discussion groups; Give and solve problems	Evaluation by comments
	Chapter 3. Graph Theory (Continue)					
38-39	A/ Content of classroom learning: 3.5. Algorithms to find the shortest path: Dijkstra, Dijkstra extended, Floyd.	[1], [2], [3]	G1.2 G2.2	2 3	Presentation; Give and solve problems	Evaluation by comments
	B/ Contents of self-study: (6) Exercise: Algorithm to find the shortest path.	[2], [4], [5]	G1.2 G2.2	2 3	Self-Study	Motivational assessment/ Combined with Attendance assessment
40-42	Discussion 5: - Some practical problems refer to the problem of finding the shortest path. - Programmatically install some algorithms to find the shortest path: Dijkstra, extended Dijkstra, Floyd.	[1], [2], [3]	G1.2 G2.2	2 3	Discussion groups; Give and solve problems	Evaluation by comments
	Chapter 3. Graph Theory (Continue)					
43-45	A/ Content of classroom learning: 3.6. Smallest tree and frame tree. 3.6.1. Trees and basic properties of trees. 3.6.2. Apply BFS and DFS algorithms to find the spanning tree of the graph.	[2], [5]	G1.2 G2.2	2 3	Presentation; Give and solve problems	Evaluation by comments

Period	Contents	References	CLOs	Competency Level	Teaching Methodology	Assessment Methodology
	B/ Contents of self-study: (6) Exercise: Frame tree of a graph.	[2], [4], [5]	G2.2	3	Self-Study	Motivational assessment/ Combined with Attendance assessment
46-48	Chapter 3. Graph Theory (Continue)					
	A/ Content of classroom learning: 3.6.3. The smallest frame tree - Problem statement. - Kruskal algorithm. - Prim's algorithm.	[1], [2], [3]	G1.2	2	Presentation; Give and solve problems	Evaluation by comments
	B/ Contents of self-study: (6) Exercise: Minimum spanning tree.	[2], [4], [5]	G1.2 G2.2	2 3	Self-Study	Motivational assessment/ Combined with Attendance assessment
49-51	Discussion 6: - Some practical problems are reduced to the problem of finding the smallest spanning tree. - Programmatically install the algorithm to find the smallest spanning tree.	[1], [2], [3]	G1.2 G2.2	2 3	Discussion groups; Give and solve problems	Evaluation by comments
52-53	Periodic Test No.3		G1.2 G2.2	2 3		Evaluation by the score
54	Summary knowledge	[1]- [5]	G1.1 G1.2 G2.1 G2.2	2 2 3 3	Presentation	Evaluation by comments

11. Student Assessment: 10 Score Scale.

11.1 Test Plan:

No.	Content	Time (Period)	CLOs	Proficiency level	Assessment methods	Assessment tools	Weight %
Attendance							
Regular Test Score							
1	Chapter 1	12	G1.1 G2.1	2 3	Written	Periodic Test No. 1	10
2	Chapter 2	28	G1.1 G2.1	2 3	Written	Periodic Test No.2	10
3	Chapter 2, 3	52, 53	G1.2 G2.2	2 3	Written	Periodic Test No.3	10
Final exam							60
	Chapter 1, 2, 3		G1.1 G1.2 G2.1 G2.2	2 2 3 3	Oral test	Final Examination	60

CLOs	Contents			Test Method			
	Periods 1-12	Periods 13-28	Periods 29-54	Written assessment I	Written assessment II	Written assessment II	End of Course exam (Question and Answer)
G1.1	x	x		x	x		x
G1.2			x			x	x
G2.1	x	x		x	x		x
G2.2			x			x	x

11.2 Assessment Rubrics

* Rubric 1: Attendance

Criteria assessment	Weight (%)	Very good (8.5-10)	Good (7.0-8.4)	Average (5.5-6.9)	Below average (4.0-5.4)	Poor (0-3.9)
Full participation in classes	80	Full attendance	Absence from 1-9% of periods	Absence from 10-15% of periods	Absence from 16-20% of periods	Absence 20% of periods (Exam ban)
Activeness in lessons, self-study	20	Very actively participate in exercises, ask questions, discuss, Complete assignments	Quite actively participate in asking questions, discussing, doing exercises	Less actively participating in asking questions, discussing, doing exercises.	It takes a teacher's influence to ask questions, discuss, and do exercises.	Only attend class but do not actively participate in asking questions, discussing, doing exercises

* **Rubric 2: Periodic Test No.1** (Allotted time: 50 minutes; Method: written; Total of Questions: 02; Score Scale: 10)

Evaluation Criteria		Weight (%)	Quality Level Description				
Question	CLOs		Very good (8,5-10 point)	Good (7,0-8,4 point)	Average (5,5-6,9 point)	Below average (4,0-5,4 point)	Poor (0-3.9 point)
1	G1.1 G2.1	40	Beautiful, clear presentation. The content of good settlement 90-100% of the requirements set out	Clearly presented. Content of 70 to less than 90 % of the requirements set out	Presentation is relatively clear. The content is from 50 to less than 70% of the requirements set out	The presentation is not clear. The content is resolved from 40 to less than 50% of the requirements set out	The presentation is not clear. Content of handling less than 40% of the requirements set out
2	G1.1 G2.1	60	Beautiful, clear presentation. The content of good settlement 90-100% of the requirements set out	Clearly presented. Content of 70 to less than 90 % of the requirements set out	Presentation is relatively clear. The content is from 50 to less than 70% of the requirements set out	The presentation is not clear. The content is resolved from 40 to less than 50% of the requirements set out	The presentation is not clear. Content of handling less than 40% of the requirements set out

*** Rubric 3: Periodic Test No.2** (Allotted time: 50 minutes; Method: written; Total of Questions: 01; Score Scale: 10)

Evaluation Criteria		Weight (%)	Quality Level Description				
Question	CLOs		Very good (8,5-10 point)	Good (7,0-8,4 point)	Average (5,5-6,9 point)	Below average (4,0-5,4 point)	Poor (0-3.9 point)
1	G1.1	50	Beautiful, clear presentation. The content of good settlement 90-100% of the requirements set out	Clearly presented. Content of 70 to less than 90 % of the requirements set out	Presentation is relatively clear. The content is from 50 to less than 70% of the requirements set out	The presentation is not clear. The content is resolved from 40 to less than 50% of the requirements set out	The presentation is not clear. Content of handling less than 40% of the requirements set out
2	G2.1	50	Beautiful, clear presentation. The content of good settlement 90-100% of the requirements set out	Clearly presented. Content of 70 to less than 90 % of the requirements set out	Presentation is relatively clear. The content is from 50 to less than 70% of the requirements set out	The presentation is not clear. The content is resolved from 40 to less than 50% of the requirements set out	The presentation is not clear. Content of handling less than 40% of the requirements set out

*** Rubric 4: Periodic Test No.3** (Allotted time: 100 minutes; Method: written; Total of Questions: 02; Score Scale: 10)

Evaluation Criteria		Weight (%)	Quality Level Description				
Question	CLOs		Very good (8,5-10 point)	Good (7,0-8,4 point)	Average (5,5-6,9 point)	Below average (4,0-5,4 point)	Poor (0-3.9 point)
1	G1.2 G2.2	50	Beautiful, clear presentation. The content of good settlement 90-100% of the requirements set out	Clearly presented. Content of 70 to less than 90 % of the requirements set out	Presentation is relatively clear. The content is from 50 to less than 70% of the requirements set out	The presentation is not clear. The content is resolved from 40 to less than 50% of the requirements set out	The presentation is not clear. Content of handling less than 40% of the requirements set out
2	G1.2 G2.2	50	Beautiful, clear presentation. The content of good settlement 90-100% of the requirements set out	Clearly presented. Content of 70 to less than 90 % of the requirements set out	Presentation is relatively clear. The content is from 50 to less than 70% of the requirements set out	The presentation is not clear. The content is resolved from 40 to less than 50% of the requirements set out	The presentation is not clear. Content of handling less than 40% of the requirements set out

*** Rubric 5: Final Examination**

- Method: Oral.

- Allotted time: 60 minutes.

- Total of Questions: 4 Questions/ 1 Examination (10 Score Scale; In which, extended question: 2 points).

Evaluation Criteria		Weight (%)	Quality Level Description				
Question	CLOs		Very good	Good	Average	Below average	Poor
			(8,5-10 point)	(7,0-8,4 point)	(5,5-6,9 point)	(4,0-5,4 point)	(0-3.9 point)
1	G1.1 G2.1	25	The content of the work is well solved 90-100% of the requirements set out. The way students explain clearly and reasonably	The content of the work is 70 % less than 90 % of the requirements set out. Students explain clearly and reasonably	The content of the work is from 50 to less than 70% of the requirements set out. Students explain clearly and reasonably	The content of the work is from 40 to less than 50% of the requirements set out. Students explain clearly and reasonably	The content of the settlement is less than 40% of the requirements set out. Students do not explain the content they did.
2	G1.1 G2.1	20					
3	G1.2 G2.2	35					
4	G1.1 G1.2 G2.2	20	A good answer 90-100% of the requirements of the teacher's question	Answer correctly from 70 to less than 90 % of the requirements on the question of the teacher	Answer correctly from 50 to less than 70 % of the requirements on the question of the teacher	Answer correctly from 40 to less than 50 % of the requirements on the question of the teacher	Answer less than 40% according to the question of the teacher

12. Reading List

A. Main Syllabus

[1] K.H. Rosen, *Discrete math and applications in informatics*, KHKT, 1999.

[2] Department of Computer Science and Technology - Faculty of Information Technology (2021), *Lectures on Discrete Mathematics*, For internal circulation only in Thai Nguyen University of Information and Communication Technology.

B. References

[3] Do Duc Giao, *Discrete mathematics*, Hanoi National University, 1999.

[4] Nguyen To Thanh, Nguyen Duc Nghia, *Discrete math*, Hanoi University of Technology, 1997.

[5] Kenneth H. Rosen (2011), *Discrete Mathematics and Its Applications*, 7th ed. McGraw-Hill Education.

13. 1st Approval Date: September 6th, 2021

14. Competent Authority Approval: Thai Nguyen University of Information and Communication Technology

Vice Rector



Ph.D Do Dinh Cuong

Dean



Ph.D Nguyen Hai Minh

Head of Department



Ph.D Nguyen Dinh Dung

Composer Team




Vu Vinh Quang

Nguyen Hien Trinh 

Nguyen Thi Tuyen 

Doan Thi Bich Ngoc 

Nguyen Thi Oanh 

Dinh Khanh Linh 

Nguyen Dinh Dung 