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<tr><td>THAI NGUYEN UNIVERSITY
UNIVERSITY OF INFORMATION AND COMMUNICATION TECHNOLOGY</td><td>**SOCIALIST REPUBLIC OF VIET NAM**
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COURSE SYLLABUS

(Training level: Undergraduate)

Vietnamese Course Title: Thông tin di động.

English Course Title: Mobile Communications.

Course Code: NMOC331.

Major: Electronics – Telecommunication Engineering Technology

Training Program: Bachelor and Engineer of Electronics – Telecommunication Engineering Technology.

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 course		Others
Required ☐	Optional ☐	Requied ☐	Optional ☐	Required ☐	Optional ☐	Required ☑	Optional ☐	Alternative Course of Graduation Thesis ☐

- Required course: None

- Pre-requisite: Digital Communications

- Co-requisite: None

2. Time Allocated

Total: 54 periods	Theory: 33 Periods
	Discussion/ Group Presentation: 18 Periods
	Assignment/ Essay/ Practice: 0/0/0
	Number of Tests: 03 Number of Theory Tests: 3 Periods: 3 Number of Practice Tests: 0

	Self-Study: 105 Periods
	Other Activities: 0

3. Departments in Charge: Department of Electronic and Telecommunication - Faculty of Electronics and Communications Technology.

4. Lecturer's Information

No.	Lecturer name	Phone number	Email	Note
1	MSc.Nguyen Ngoc Duong	0356112621	nnduong@ictu.edu.vn	Leader
2	MSc.Do Van Quyen	0949834131	dvquyen@ictu.edu.vn	Member
3	MSc.Pham Van Ngoc	0915900226	pvngoc@ictu.edu.vn	Member

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

6. Course Description:

Mobile communication is a course in the specialized knowledge block. The course provides students with basic knowledge about mobile communication systems in the world that have been deployed in Vietnam. Through the course, students are equipped with knowledge about basic design of cellular communication systems, knowledge of GSM mobile communication systems, knowledge of orthogonal codes and spread spectrum techniques, knowledge of architecture and characteristics of mobile communication systems that have been deployed in practice - 3G, 4G, 5G networks. Thereby, students gain the background knowledge to learn more specialized subjects such as designing and optimizing mobile networks ... helping students gain skills and knowledge to be able to work at businesses in the field of mobile communication after graduation.

7. Objectives

Objectives	Description	PLOs	Competency Level
G1	Ability to apply professional knowledge in analysis and design of mobile communication systems.	1.5.2	3
G2	Critical thinking to detect and solve technical problems in the field of mobile communication.	4.1	4

8. Learning Outcomes

Objectives	CLOs	Description of CLOs	PLOs	Proficiency level
G1	G1.1	Apply knowledge of the basic design of cellular communication systems to the design and management of cells in mobile networks.	1.5.2	3
	G1.2	Apply knowledge of GSM and 3G mobile communication systems to the construction, operation and management of mobile communication systems.	1.5.2	3
	G1.3	Apply knowledge of orthogonal codes and spread spectrum techniques to noise management and performance enhancement for mobile communication systems.	1.5.2	3
G2	G2.1	Analyze the issues of architecture, transmission channels... in 4G, 5G mobile networks.	4.1.1	4
	G2.2	Analyze technical solutions to improve service quality, ensure security ... in 4G, 5G mobile networks.	4.1.2	4

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
1, 2, 3	**Chapter 1: Basics of Cellular Mobile Systems Design**					

Period	Contents	References	CLOs	Competency Level	Teaching Methodology	Assessment Methodology
	A/In-class teaching content: (3) 1.1. Overview of Mobile Communications. 1.2. Cells and frequency allocation 1.3. Co-channel interference and system capacity	[1] [3] [5]	G1.1	3	Presentation	Evaluation by comments
	B/ Self-study content:*(6)* • Read more about the learned content. • Do the assigned homework.	[1] [3] [5]	G1.1	3	Self-study	Motivational assessment/ Incorporating due diligence
4, 5, 6	**Chapter 1: Basics of Cellular Mobile Systems Design (continue)**					
	A/In-class teaching content: (3) 1.4. Adjacent channel interference and channel allocation scheme 1.5. Frequency reuse 1.6. Channelization and handover strategy	[1] [3] [5]	G1.1	3	Presentation	Evaluation by comments
	B/ Self-study content:*(6)* Do the exercises in Chapter 1	[3]	G1.1	3	Self-study	Motivational assessment/ Incorporating due diligence

Period	Contents	References	CLOs	Competency Level	Teaching Methodology	Assessment Methodology
7, 8, 9	**Chapter 1: Basics of Cellular Mobile Systems Design (continue)**					
	A/In-class teaching content: (3) 1.7. Trunks and service levels 1.8. Increase the capacity of the cellular system 1.9. Balanced technical basis 1.10. Diversification technique	[1] [3] [5]	G1.1	3	Presentation	Evaluation by comments
	B/ Self-study content:*(6)* - Do the exercises in Chapter 1 - Prepare discussion content.	[1] [3]	G1.1	3	Self-study	Motivational assessment/ Incorporating due diligence
10, 11, 12	**Chapter 1: Basics of Cellular Mobile Systems Design (continue)**					
	A/In-class teaching content: (3) **Discussion 1:** - Problems in the design of cellular communication systems.	[1] [3] [5]	G1.1	3	Student groups present and discuss according to the plan under the supervision of the lecturer	Evaluation by comments

Period	Contents	References	CLOs	Competency Level	Teaching Methodology	Assessment Methodology
	B/ Self-study content:*(6)* Review knowledge in chapter 1.	[1] [3] [5]	G1.1	3	Self-study	Motivational assessment/ Incorporating due diligence
13, 14, 15	**Chapter 2: The GSM Mobile Communication System**					
	A/In-class teaching content: (3) **- Periodic Test No.1**	[1] [3] [5]	G1.1	3	Written test	Evaluation by score
	2.1. GSM system architecture 2.2. Geographical structure of GSM network 2.3. Radio Architecture 2.4. Types of channels in GSM	[1] [3] [5]	G1.2	3	Presentation	Evaluation by comments
	A/In-class teaching content: (3) • Read more about the learned content .	[1] [3] [5]	G1.2	3	Self-study	Motivational assessment/ Incorporating due diligence
16, 17, 18	**Chapter 2: The GSM Mobile Communication System (continue)**					

Period	Contents	References	CLOs	Competency Level	Teaching Methodology	Assessment Methodology
	A/In-class teaching content: (3) 2.5. Frame structure 2.6. Signaling in GSM 2.7. Calls in GSM 2.8. Handover in GSM 2.9. Signal processing in GSM	[1] [3] [5]	G1.2	3	Presentation	Evaluation by comments
	B/ Self-study content:*(6)* • Read more about the learned content .	[1] [3] [5]	G1.2	3	Self-study	Motivational assessment/ Incorporating due diligence
	Chapter 2: The GSM Mobile Communication System (continue)					
19, 20, 21	A/In-class teaching content: (3) 2.10. General packet radio system architecture GPRS 2.11. Types of channels in GPRS network 2.12. Mobile Management GPRS 2.13. Numbering system in mobile network	[1] [3] [5]	G1.2	3	Presentation	Evaluation by comments

Period	Contents	References	CLOs	Competency Level	Teaching Methodology	Assessment Methodology
	B/ Self-study content:*(6)* • Read more about the learned content • Prepare discussion content.	[1] [3] [5]	G1.2	3	Self-study	Motivational assessment/ Incorporating due diligence
22, 23, 24	**Chapter 2: The GSM Mobile Communication System (continue)**					
	A/In-class teaching content: (3) **Discussion 2:** - Compare GSM and GPRS systems.	[1] [3] [5]	G1.2	3	Student groups present and discuss according to the plan under the supervision of the lecturer	Evaluation by comments
	B/ Self-study content:*(6)* Review knowledge in chapter 2.	[1] [3] [5]	G1.2	3	Self-study	Motivational assessment/ Incorporating due diligence
25, 26, 27	**Chapter 3: Orthogonal codes and spread spectrum techniques**					

Period	Contents	References	CLOs	Competency Level	Teaching Methodology	Assessment Methodology
	A/In-class teaching content: (3) 3.1. Pseudo-random sequence (PN) 3.2. Orthogonal code 3.3. Overview of spread spectrum techniques 3.4. Multi-carrier spread spectrum system	[1] [3] [4]	G1.3	3	Presentation	Evaluation by comments
	B/ Self-study content:*(6)* • Read more about the learned content. • Do the exercises in Chapter 3 • Prepare discussion content.	[1] [3] [4]	G1.3	3	Self-study	Motivational assessment/ Incorporating due diligence
28, 29, 30	**Chapter 3: Orthogonal codes and spread spectrum techniques (continue)**					
	A/In-class teaching content: (3) **Discussion 3:** - Spread spectrum techniques.	[1] [3] [4]	G1.3	3	Student groups present and discuss according to the plan under the supervision of the lecturer	Evaluation by comments
	B/ Self-study content:*(6)* • Review knowledge in chapter 3.	[1] [3] [4]	G1.3	3	Self-study	Motivational assessment/ Incorporating due diligence

Period	Contents	References	CLOs	Competency Level	Teaching Methodology	Assessment Methodology
	Chapter 4: The 3G-UMTS Mobile Communication System					
31,32, 33	A/In-class teaching content: (3) 4.1. General introduction 4.2. Architecture of 3G-UMTS System. 4.3. Physical, Transport and Logical Channels in WCDMA	[1] [3] [4]	G1.2 G1.3	3 3	Presentation	Evaluation by comments
	B/ Self-study content:(6) • Read more about the learned content. Review knowledge in chapter 2,3,4.	[1] [3] [4]	G1.2 G1.3	3 3	Self-study	Motivational assessment/ Incorporating due diligence
34,35, 36	**Chapter 4: The 3G-UMTS Mobile Communication System (continue)**					
	A/In-class teaching content: (3) **- Periodic Test No.2**	[1] [3] [4]	G1.2 G1.3	3 3	Written test	Evaluation by score
	4.4. UMTS network interface 4.5. Power control 4.6. Transfer control 4.7. Set up calls in UMTS	[1] [3] [4]	G1.2 G1.3	3 3	Presentation	Evaluation by comments

Period	Contents	References	CLOs	Competency Level	Teaching Methodology	Assessment Methodology
	B/ Self-study content:*(6)* • Read more about the learned content. • Prepare discussion content.	[1] [3] [4]	G1.2 G1.3	3 3	Self-study	Motivational assessment/ Incorporating due diligence
37, 38, 39	**Chapter 4: The 3G-UMTS Mobile Communication System (continue)**					
	A/In-class teaching content: (3) **Discussion 4:** - Problems in the 3G mobile communication syste	[1] [3] [4]	G1.2 G1.3	3 3	Student groups present and discuss according to the plan under the supervision of the lecturer	Evaluation by comments
	B/ Self-study content:*(6)* Read more about the learned content .	[1] [3] [4]	G1.2 G1.3	3 3	Self-study	Motivational assessment/ Incorporating due diligence
40, 41, 42	**Chapter 5: Advanced mobile communication systems**					

Period	Contents	References	CLOs	Competency Level	Teaching Methodology	Assessment Methodology
	A/In-class teaching content: (3) 5.1. 4G network architecture 5.2. Protocol Architecture 5.3. Service quality 5.4. E-UTRAN network interfaces 5.5. Channels in 4G	[2] [3] [6]	G2.1 G2.2	4 4	Presentation	Evaluation by comments
	B/ Self-study content:*(6)* • Read more about the learned content • Prepare discussion content.	[2] [3] [6]	G2.1 G2.2	4 4	Self-study	Motivational assessment/ Incorporating due diligence
	Chapter 5: The Advanced mobile communication systems (continue)					
43, 44, 45	A/In-class teaching content: (3) **Discussion 5:** - Problems in 4G mobile communication system	[2] [3] [6]	G2.1 G2.2	4 4	Student groups present and discuss according to the plan under the supervision of the lecturer	Evaluation by comments
	B/ Self-study content:(7) • Read more about the learned content. Review knowledge in chapter 5.	[2] [3] [6]	G2.1 G2.2	4 4	Self-study	Motivational assessment/ Incorporating due diligence

Period	Contents	References	CLOs	Competency Level	Teaching Methodology	Assessment Methodology
46, 47, 48	**Chapter 5: The Advanced mobile communication systems (continue)**					
	A/In-class teaching content: (3) 5.6. Overview of 5G network architecture 5.7. 5G core network architecture 5.8. 5G RAN Architecture	[2] [3] [6]	G2.1 G2.2	4 4	Presentation	Evaluation by comments
	B/ Self-study content:(7) • Read more about the learned content ● Review knowledge in chapter 5	[2] [3] [6]	G2.1 G2.2	4 4	Self-study	Motivational assessment/ Incorporating due diligence
49, 50, 51	**Chapter 5: The Advanced mobile communication systems (continue)**					
	A/In-class teaching content: (3) **- Periodic Test No.3**	[2] [3] [6]	G2.1 G2.2	4 4	Written	Evaluation by score
	5.9. Cloud RAN Architecture (C-RAN) 5.10. Security in 5G mobile communication system	[2] [3] [6]	G2.1 G2.2	4 4	Presentation	Evaluation by comments

Period	Contents	References	CLOs	Competency Level	Teaching Methodology	Assessment Methodology
	B/ Self-study content: (7) Prepare discussion content.	[2] [3] [6]	G2.1 G2.2	4 4	Self-study	Motivational assessment/ Incorporating due diligence
52, 53, 54	**Chapter 5: The Advanced mobile communication systems (continue)**					
	A/In-class teaching content: (3) **Discussion 6:** - Core techniques used in the 5G mobile communication system.	[2] [3] [6]	G2.1 G2.2	4 4	Student groups present and discuss according to the plan under the supervision of the lecturer	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						Rubric 1	6
Discussion			G1.1 G1.2 G1.3 G2.1 G2.2	3 3 3 4 4	Comment and mark	Rubric 2	6
Regular Test Score							**18**
1	Chapter 1	13	G1.1	3	Written	Rubric 3	6
2	Chapter 2,3, 4	34	G1.2 G1.3	3 3	Written	Rubric 4	6

3	Chapter 5	49	G2.1 G2.2	4 4	Written	Rubric 5	6
Final exam							**70**
	Chapter 1, 2, 3, 4, 5.		G1.1 G1.2 G1.3 G2.1 G2.2	3 3 3 4 4	Multiple choice question	Rubric 6	

CLOs	Contents					Test Method			
	Periods 1-12	Periods 13-24	Periods 25-30	Periods 31-39	Periods 40-54	Written Assessment I	Written Assessment II	Written Assessment III	Final exam Multiple choice question
G1.1	x					x			x
G1.2		x		x			x		x
G1.3			x	x			x		x
G2.1					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)
Level of participation in classes.	70	Full attendance	Missing from 1-9% of the periods	Missing from 10-15% of the periods	Missing from 16-20% of the periods	Missing from 20% of periods (ban from taking a test)
Activeness in lessons, self-study	30	Very actively participating in asking question, Complete the homework fully	Quite actively participating in asking questions and doing homework	Less actively participating in asking questions and doing homework	The teacher's Influence is required to ask questions, discuss, and do homework.	Only attend classes but do not actively participate in asking questions, discussing, doing homework

* Rubric 2: Group Discussion

Groups are assigned topics and present their results in groups.

Evaluation criteria			Quality Level Description				
Criteria	CLOs	Weight (%)	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)
Reporting contents of topics in the field of mobile communication	G1.1 G1.2 G1.3	40	Meet 90-100% of the requirements, including extensions and references	Meet 80-90% of the requirements, including extensions and references	Meet 70-80% of the requirements	Meet 50-60% of the requirements	Meet below 50% of the requirements
Answer questions about the content of the report	G2.1 G2.2	30	Answer all the questions correctly	Answer 2/3 the questions correctly	Answer 1/2 the questions correctly	Answer more 1/3 the questions correctly	Answer below 1/3 the questions correctly
Level of participation	G1.1 G1.2 G1.3	30	100% of members participate in implementation /presentation	~ 80% of members participate in implementation/ presentation	~ 60% of members participate in implementation/presentation	50% of members participate in implementation/presentation	Below 50% of members participate in implementation/presentation

*Rubric 3: Periodic Test No.1 *(Allotted time: 1 period; Form: Written; Total of questions: 2; Score Scale: 10)*

Evaluation criteria			Quality Level Description				
Question	CLOs	Weight (%)	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 (Proficiency level 2)	50	Beautiful and clear presentation. Content that solves 90-100% about problems relating to cell, interference, frequency reuse	Clearly presented. Content that addresses 70 to less than 90% about problems relating to cell, interference, frequency reuse	The presentation is relatively clear. Content that addresses between 50 and less than 70% about problems relating to cell, interference, frequency reuse	The presentation is not clear. Content that addresses between 40 and less than 50% about problems relating to cell, interference, frequency reuse	The presentation is not clear. Content that resolves less than 40% about problems relating to cell, interference, frequency reuse
2	G1.1 (Proficiency level 3)	50	Beautiful and clear presentation. Content that solves 90-100% about system capacity, trunking and service level issues...	Clearly presented. Content that addresses 70 to less than 90% about system capacity, trunking and service level issues...	The presentation is relatively clear. Content that addresses between 50 and less than 70% about system capacity, trunking and service level issues...	The presentation is not clear. Content that addresses between 40 and less than 50% about system capacity, trunking and service level issues...	The presentation is not clear. Content that resolves less than 40% about system capacity, trunking and service level issues...

*Rubric 4: Periodic Test No.2 *(Allotted time: 1 period; Form: Written; Total of questions: 2; Score Scale: 10)*

Evaluation criteria			Quality Level Description				
Question	CLOs	Weight (%)	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	50	Beautiful and clear presentation. Content that	Clearly presented. Content that addresses 70 to less than 90% about	The presentation is relatively clear. Content that addresses	The presentation is not clear. Content that addresses	The presentation is not clear. Content that resolves less

Evaluation criteria			Quality Level Description				
Question	CLOs	Weight (%)	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)
			solves 90-100% about GSM, 3G network problems	GSM, 3G network problems	between 50 and less than 70% about GSM, 3G network problems	between 40 and less than 50% about GSM, 3G network problems	than 40% about GSM, 3G network problems
2	G1.3	50	Beautiful and clear presentatio. Content that solves 90-100% about problems of orthogonal codes and spread spectrum techniques	Clearly presented. Content that addresses 70 to less than 90% about problems of orthogonal codes and spread spectrum techniques	The presentation is relatively clear. Content that addresses between 50 and less than 70% about problems of orthogonal codes and spread spectrum techniques	The presentation is not clear. Content that addresses between 40 and less than 50% about problems of orthogonal codes and spread spectrum techniques	The presentation is not clear. Content that resolves less than 40% about problems of orthogonal codes and spread spectrum techniques

*Rubric 5: Periodic Test No.3 *(Allotted time: 1 period; Form: Written; Total of questions: 2; Score Scale: 10)*

Evaluation criteria			Quality Level Description				
Question	CLOs	Weight (%)	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	G2.1	50	Beautiful and clear presentation. Content that solves 90-100% about 4G network problems	Clearly presented. Content that addresses 70 to less than 90% about 4G network problems	The presentation is relatively clear. Content that addresses between 50 and less than 70% about 4G network problems	The presentation is not clear. Content that addresses between 40 and less than 50% about 4G network problems	The presentation is not clear. Content that resolves less than 40% about 4G network problems
2	G2.2	50	Beautiful and clear presentation. Content that solves 90-	Clearly presented. Content that addresses 70 to less than 90% about	The presentation is relatively clear. Content that addresses	The presentation is not clear. Content that addresses	The presentation is not clear. Content that resolves less

		100% about 5G network problems	5G network problems	between 50 and less than 70% about 5G network problems	between 40 and less than 50% about 5G network problems	than 40% about 5G network problems

*Rubric 6: Final Examination *(Allotted time: 60 minutes; Form: Multiple choice question; Total of questions: 50; Score Scale: 10)*

No.	Contents	CLOs	Ability scale			Number of questions
			Understand	**Apply**	**Analyze**	
1	Chapter 1: Basics of Cellular Mobile Systems Design	G1.1	4	5	0	9
2	Chapter 2: The GSM Mobile Communication System	G1.2	4	5	0	9
3	Chapter 3: Orthogonal codes and spread spectrum techniques	G1.3	4	3	0	7
4	Chapter 4: The 3G-UMTS Mobile Communication System	G1.2	3	4	0	7
		G1.3	1	1	0	2
5	Chapter 5: The Advanced mobile communication systems	G2.1	2	3	3	8
		G2.2	3	2	3	8
Tổng			**21**	**23**	**6**	**50**
Tỉ lệ %			**42%**	**46%**	**12%**	**100%**

12. Reading List
A. Main Syllabus
[1]. Nguyen Van Duc, Tran Quang Vinh, Do Trong Tuan (2020), *Mobile Communications,* HUST Publishing House.
[2]. Nguyen Pham Anh Dung (2019), *4G LTE and 5G Mobile Communications*, Information and Communications Publishing House.
B. References
[3]. Nguyen Pham Anh Dung (2010), *Roadmap for 3G to 4G*, Information and Communications Publishing House.
[4]. Pham Cong Hung (2007), *Mobile Communications*, Science and Technics Publishing House.
[5]. Stefania Sesia (2011)*, LTE – UMTS Long Term Evolution from Theory to practice,* Second Edition, John Wiley & Sons.
C. Software: None
13. First approval date: September 5th, 2021
14. Competent Authority Approval: University of Information and Communication Technology

Vice Rector	Dean	Head of Department	Composer Team
			Nguyen Ngoc Duong
		PhD.Pham Thanh Nam	

PhD. Do Dinh Cuong   PhD. Vu Chien Thang   Do Van Quyen

Pham Van Ngoc