KINGDOM OF SAUDI ARABIA
Technical and Vocational Training Corporation
Director General for Curricula

المملكة العربية السعودية
المؤسسة العامة للتدريب التقني والمهني
الإدارة العامة للمناهج

الخطط التدريبية للكليات التقنية
Training Plans for Colleges of Technology

CURRICULUM FOR

Department
Telecommunication Engineering

Major
Telecom Technology

الخطة التدريبية في قسم

هندسة الاتصالات

تخصص

الاتصالات

A Bachelor's Degree

Semesters
1439H - 2018

Index

Program Description

The goal of the program is to provide trainees with a high-quality applications-oriented undergraduate education based on state-of-the-art technological equipment associated with Telecommunication Engineering. This goal is achieved through several objectives such as continuing to update specific courses in the program to ensure relevance to the latest industrial changes, supporting the development of appropriate computer facilities, promoting the integration of advanced technology in all courses, and encouraging professional growth. The program is designed to satisfy the educational needs of the Saudi Council of Engineers by providing a climate that fosters self-awareness, personal growth, and a desire for lifelong learning.

Trainees completing a major in Telecommunication Engineering receive a strong foundation in signals and systems, communication theory, electromagnetics, digital communication, and object oriented programming. Trainees have the opportunity to select additional elective courses in two semesters. Although electromagnetics remain important, one of the newest and fastest growing areas is in the application of computers for simulation and control systems.

The manufacturers of telecommunication need telecom engineers who are familiar with magnates and signal controls, both traditional and computer-controlled. The telecom industry provides and controls the signals, communication, microwave, and wireless equipment required to effectively communicate homes, businesses, and industries. Telecom engineers design digital communication systems and modifications to existing telecom systems that generate and use large amounts of signals required for distribution networks that are economical, safe, and functional.

Graduates of the Telecommunication Engineering major understand, design, analyze, and work effectively in industrial settings utilizing product/process control systems and telecom systems. Graduates are working in telecom companies, telecom manufacturing, signal processing, utilities, telecom equipment, sales, manufacturing and testing, and a host of other diverse industries.

The program curriculum includes magnetics and wireless systems; digital circuits and systems; programmable logic controllers and automated control systems; cellular systems and industry practices; object oriented programming; telecom system and communication theory and Graduation Project. The faculty core courses provide the opportunity to improve writing skills. Mathematics and physics provide the background to help learn the telecom course material.

The bachelor degree program in Telecommunication Engineering allows a plan that will necessarily be highly structured during four semesters.. The program has 77 credit hours divided into obligatory courses and elective courses.

The Theoretical and Practical Tests and Graduation Projects Determine Learning Outcomes and Trainee Levels for each program.

The training courses contain a theoretical part and a practical part. The practical part is tested as a practical test and the theoretical part is a theoretical test with different evaluation methods

The Bachelor Degree Graduate gets the seventh level in the Saudi Arabian Qualifications Framework (SAQF).

Admission Requirements: The applicant must have a diploma in Telecommunications.

Brief Description

Course Name	Engineering project Managements	Course Code	GNRL402	Credit Hours	3
Description	This course is designed to give the trainee a basic knowledge of the role of engineers in management of organizations. Managerial functions related to production, inventory and human resources. Project planning and control. Case studies pertaining to engineering problems..				

Course Name	Engineering Economy	Course Code	GNRL405	Credit Hours	2
Description	This course gives the trainee a basic knowledge about the Fundamentals of engineering economy. Time value of money. Evaluation of alternatives. Replacement and retention analysis. Break even analysis. Depreciation methods. Basics of inflation..				

Course Name	Statistics and Probability	Course Code	STAT 303	Credit Hours	3
Description	The purpose of this course is to give the trainee a basic knowledge of descriptive statistics with graphical summaries. Basic concepts of probability and its engineering applications. Commonly used distributions for discrete and continuous random variables. Confidence intervals. Hypothesis testing. Correlation and simple linear regression.				

Course Name	Structured Computer Programming	Course Code	TCOM 323	Credit Hours	3
Description	This course is designed to give the trainee a basic knowledge on introduction to computers. Simple algorithm and flowcharts. Solving engineering and mathematical problems using a mathematically-oriented programming language. Programming concepts: I/O, assignment, conditional loops, functions and subroutines. Programming selected numerical and non-numerical problems of mathematical and engineering nature				

Course Name	Electrical Systems and Circuits	Course Code	TCOM 435	Credit Hours	3
Description	This course gives the trainee a basic knowledge about the Resonance circuits. Magnetically-coupled circuits. Op-amp circuits. Transient analysis via the conventional and Laplace methods. Fourier analysis with applications to circuits. Two-port networks.				

Course Name	Electronics II	Course Code	TCOM 333	Credit Hours	3
Description	This course is designed to give the trainee a basic knowledge of feedback in amplifiers. Frequency response of amplifier. Operational amplifiers: design and applications as linear and non-linear analog building blocks, adders, subtractors, differentiator, integrators, analog simulation, and active filters. Logarithmic and exponential amplifiers, precision converters, analog multipliers, wave-shapers, sinusoidal and square wave oscillators.				

Course Name	Analytical Methods in Engineering	Course Code	TCOM 334	Credit Hours	3
Description	The purpose of this course is to give the trainee a basic knowledge of continuous time (CT) and discrete time (DT) signals. signal transform and signal processing systems with their properties and practical examples. The contents of this course include signal p=operations, convolution operation, Fourier, Laplace and z-transforms, and the introduction of the MATLAB software with some computer simulation examples.				

Course Name	Communication Theory	Course Code	TCOM 465	Credit Hours	3
Description	This course gives the trainee a deep understanding of Autocorrection function and spectral density. Random signal theory: Continuous and discrete random variables, transformation of random variables, stationary random processes, time average and ergodicity, power spectral density of stationary random processes. Signal-to-noise ratio and probability of error. Noise equivalent bandwidth. Optimum receivers. Pulse detection and matched filters. Signal distortion in transmission and equalization. Noise in linear and exponential modulation. PCM systems: Uniform and no Uniform quantization, noise in PCM, DPCM and DM. Nose in pulse modulation.				

Course Name	Analytical Methods in Engineering	Course Code	TCOM 334	Credit Hours	3
Description	This course is designed to give the trainee a basic knowledge of Linear algebra: metrics and determinants, eigenvalues and eigenvectors. Complex analysis: complex arithmetic, complex algebra, differentiation and integration in the complex plane and residue analysis. Graphs theory.				

Course Name	Electromagnetics	Course Code	TCOM 404	Credit Hours	4
Description	The purpose of this course is to give the trainee a basic knowledge of Electrostatic fields. Poisson and Laplace equations. Steady Electric Current. Steady Magnetic Field. Time-varying electric and magnetic fields. Maxwell equations.				

Course Name	Object-oriented Programming	Course Code	TCOM 424	Credit Hours	3
Description	The purpose of this course is to give the trainee a basic knowledge of Objects-oriented programming: classes, objects and methods. Object-oriented design. Simple data structures. Best programming practices (structured coding. Documentation, testing and debugging).				

Course Name	Digital Communication	Course Code	TCOM 468	Credit Hours	3
Description	This course is concerned with the Sampling theorem, PCM, bandpass digital modulation methods (ASK, FSK and PSK), noise analysis and error probability, digital filters, and digital and discrete-time signal processing, Z transform, digital filter design in frequency domain, digital matched filters, interference and jamming, effects of sampling errors, modern digital modulation methods, chirp modulation, spread spectrum.				

Course Name	Graduation Project	Course Code	TCOM 490	Credit Hours	4
Description	The course presents major topics in Selection of topics: literature review; project design planning, arranging data collection, and experimental work. Experimental work and data collection or field study. Data processing analysis and results. Preparation of the first draft of final report. Presentation of the project.				

Course Name	Principles of Automatic Control	Course Code	TCOM 412	Credit Hours	3
Description	The course includes introduction to control systems with examples from fields. Transfer functions and block diagram algebra. Stability analysis (Routh-Hurwitz and Nyquist). Design of Control Systems using Bode diagrams and root locus technique.				

Course Name	Information Theory and Coding	Course Code	TCOM 466	Credit Hours	3
Description	The purpose of the project is to make the final year trainee acquainted with Information theory is concerned with the fundamental limits of communication. What is the ultimate limit to data compression? e.g. how many bits are required to represent a music source.What is the ultimate limit of reliable communication over a noisy channel, e.g. how many bits can be sent in one second over a line..				

Course Name	Antenna Theory	Course Code	TCOM 443	Credit Hours	3
Description	This course is designed to give the trainee a basic knowledge of Radiation and Antenna Fundamentals. Linear Antennas, Current distribution, Short dipoles And Monopoles/2 dipoles, radiation resistance and gain, longer dipoles, folded dipoles. Antenna Arrays. Aperture Antennas. Special types of antennas. Traveling wave antennas, loop antennas. Frequency independent antennas, helical Antennas, corner reflector, lenses. Space Wave Propagation. Ground Wave Propagation. Tropospheric waves. Ionospheric waves.				

Course Name	Digital Signal Processing	Course Code	TCOM 473	Credit Hours	3
Description	This course aims to make the trainee aware of the basic principles of Discrete time signals and systems, Fourier analysis of discrete-time and systems-Fast Fourier transform-Digital Filter Design-Computer Applications-Advanced Topics.				

Course Name	Digital Design	Course Code	TCOM 474	Credit Hours	3
Description	The purpose of this course is to give the trainee a basic knowledge of Analysis and synthesis of gate networks. Elements of minimization techniques. Synthesis using NAND and NOR gates. Analysis of sequential networks. Synthesis of pulse-mode and fundamental mode sequential networks. Flow tables and State diagrams. Hazards. Use of MSI and LSI in the implementation of combinational and sequential circuits.				

Course Name	Wireless Communication Systems	Course Code	TCOM 469	Credit Hours	3
Description	This course introduces fundamental technologies for wireless communications. It addresses the following topics: review of modulation techniques, wireless channel modeling, multiple access schemes, cellular communications, diversity techniques, equalization, channel coding, selected advanced topics such as OFDM, cognitive radio, cooperative communications, space time coding, and smart antenna systems				

Course Name	Advanced Communication Systems	Course Code	TCOM 442	Credit Hours	3
Description	The purpose of this course is to enable the trainee to be familiar with the Detailed description of at least three out of the following systems. Radio broadcasting Systems. TV and Video Systems. Radar Systems. Microwave Links, Telephony, Telegraphy and Telex systems. Satellite Communication Systems. Optical Communication Systems. Aircraft and Ship navigational systems				

Course Name	Special Topics in communication	Course Code	TCOM 467	Credit Hours	3
Description	The purpose of this course is to give the trainee a basic knowledge of Selected topic to develop the skills and knowledge in a given field after the official approval from the faculity.				

Study Plan

Sixth Semester								
No.	Course Code	Course Name	Pre. Req	No. of Units				
				CRH	L	P	T	CTH
1	MATH 301	Mathematics (1)		3	2	2	0	4
2	PHYS 301	Physics		3	2	2	0	4
3	ENGL 301	English Language (1)		3	3	0	1	4
4	TCOM 323	Structured Computer Programming		3	2	2	0	4
5	GNRL 402	Engineering Project Management		3	3	0	0	3
Total				15	12	2	5	19
CRH:Credit Hours **L**:Lecture **P**:Practical **T**:Tutorial **CTH**:Contact Hours								

Seventh Semester								
No.	Course Code	Course Name	Pre. Req	No. of Units				
				CRH	L	P	T	CTH
1	STAT 303	Statistics and Probability		3	3	0	1	4
2	TCOM 333	Electronics II		3	2	2	0	4
3	TCOM 334	Analytical Methods in Engineering	MATH 301	3	3	0	1	4
4	GNRL405	Engineering Economy		2	2	0	0	2
5	MATH 381	Engineering Math	MATH 301	4	3	0	2	5
Total				15	13	2	4	19
CRH:Credit Hours **L**:Lecture **P**:Practical **T**:Tutorial **CTH**:Contact Hours								

Eighth Semester								
No.	Course Code	Course Name	Pre. Req	No. of Units				
				CRH	L	P	T	CTH
1	ENGL302	English Language (2)	ENGL301	3	3	0	1	4
2	TCOM435	Electrical Systems and Circuits	MATH 381	3	2	2	0	4
3	TCOM 375	Signals And Systems	MATH 381	3	3	0	1	4
4	TCOM465	Communication Theory	STAT 303	3	3	0	1	4
5	MATH 302	Mathematics (2)	MATH301	3	2	2	0	4
6	TCOM 460	Cellular Mobile Communication	TCOM 333	3	3	0	0	3
Total				18	17	2	5	23

CRH:Credit Hours **L**:Lecture **P**:Practical **T**:Tutorial **CTH**:Contact Hours

Ninth Semester								
No.	Course Code	Course Name	Pre. Req	No. of Units				
				CRH	L	P	T	CTH
1	TCOM 424	Object Oriented Programming	TCOM 323	3	2	2	1	5
2	TCOM 468	Digital Communication	MATH 381	3	3	0	1	4
3	TCOM 404	Electromagnetics	MATH 381	4	4	0	0	4
4	TCOM***	Elective1		3	3	0	1	4
5	TCOM 469	Wireless Communication Systems	TCOM 334	3	3	0	0	3
Total				16	15	2	3	20

CRH:Credit Hours **L**:Lecture **P**:Practical **T**:Tutorial **CTH**:Contact Hours

Tenth Semester								
No.	Course Code	Course Name	Pre. Req	No. of Units				
				CRH	L	P	T	CTH
1	TCOM 412	Principle of Automatic Control	MATH 301	3	2	2	0	4
2	TCOM***	Elective2		3	3	0	1	4
3	TCOM***	Elective3		3	3	0	1	4
4	TCOM 490	Graduation Project		4	2	4	0	6
Total				13	10	6	2	18

CRH:Credit Hours **L**:Lecture **P**:Practical **T**:Tutorial **CTH**:Contact Hours

Total Number of Semesters Credit Units	CRH	L	P	T	CTH
	77	67	14	19	99
Total of training Hours 16 * 99	1584				

Elective Courses

Elective Courses 1								
No.	Course Code	Course Name	Pre. req	No. of Units				
				CRH	L	P	T	CTH
1	TCOM 466	Information Theory and Coding	TCOM 323 & TCOM465	3	3	0	1	4
2	TCOM 467	Special Topics in Communication		3	3	0	1	4
CRH:Credit Hours **L**:Lecture **P**:Practical **T**:Tutorial **CTH**:Contact Hours								

Elective Courses 2								
No.	Course Code	Course Name	Pre. req	No. of Units				
				CRH	L	P	T	CTH
1	TCOM 473	Digital Signal Processing	TCOM 375	3	3	0	1	4
2	TCOM 474	Digital Design	TCOM 375	3	3	0	1	4
CRH:Credit Hours **L**:Lecture **P**:Practical **T**:Tutorial **CTH**:Contact Hours								

Elective Courses 3								
No.	Course Code	Course Name	Pre. req	No. of Units				
				CRH	L	P	T	CTH
1	TCOM 442	Advanced Communication Systems	TCOM 468	3	3	0	1	4
2	TCOM 443	Antenna Theory II	TCOM 468	3	3	0	1	4
CRH:Credit Hours **L**:Lecture **P**:Practical **T**:Tutorial **CTH**:Contact Hours								

Courses Detail Description

Department	Telecommunication Engineering	Major	Telecommunication
Course Name	Structured Computer Programming	Course Code	TCOM 323
Prerequisites	-	Credit Hours CRH	3 CTH 4 (L 2 P 2 T 0)

CRH: Credit Hours L: Lecture P: Practical T: Tutorial CTH: Contact Hours

Course Description :
Introduction to computers. Simple algorithm and flowcharts. Solving engineering and mathematical problems using a mathematically-oriented programming language. Programming concepts: I/), assignment, conditional loops, functions and subroutines. Programming selected numerical and non-numerical problems of mathematical and engineering nature.

Topics:

- An Overview of MATLAB
- Numeric, Cell, and Structure Arrays.
- User-Defined Functions.
- Basics of Programming: Algorithms.

Experiments: If applicable, it will support the course topics.

References : W.J. Palm III, Introduction to MATLAB 7 for Engineers, McGraw-Hill International Edition, 2005.

Detailed of Theoretical Contents		
No.	**Contents**	**Hours**
1	Engineering Problems and the Need for Computer Solutions	4
2	An Overview of MATLAB 1. MATLAB Interactive Sessions 2. Menus and the Toolbar 3. Arrays, Files, and Plots 4. Script Files and the Editor/Debugger 5. The MATLAB Help System 6. Problem-Solving Methodologies	6
3	Numeric, Cell, and Structure Arrays 1. One- and Two-Dimensional Numeric Arrays 2. Multidimensional Numeric Arrays 3. Element-by-Element Operations 4. Matrix Operations 5. Polynomial Operations Using Arrays 6. Cell Arrays 7. Structure Arrays	6
4	User-Defined Functions 1. Elementary Mathematical Functions 2. User-De ned Functions 3. Additional Function Topics 4. Working with Data Files	6
5	Basics of Programming: Algorithms 1. Program Design and Development	10

	2. Relational Operators and Logical Variables 3. Logical Operators and Functions 4. Conditional Statements 5. for Loops, while Loops 6. The switch Structure 7. Debugging MATLAB Programs 8. Applications to Simulation	
Textbook	• W.J. Palm III, Introduction to MATLAB 7 for Engineers, McGraw-Hill International Edition, 2005.Theraja "Electrical Engineering"	

Details of Practical Contents		
No.	**Contents**	**Hours**
1.	• Starting MATLAB • Session • Variables • Argument • Scalar • Precedence	2
2.	• Tab and Arrow keys • Deleting and Clearing • Prede and Constants • Complex Number Operations • Formatting Command	4
3.	• Menu and toolbar • The desktop Menus • Arrays, Files and Plots • Script Files and the Editor/Debugger • The MATLAB help system	4
4.	• Row Vector, Column Vector • Transpose • Matrix • Array Size • Empty Array	4
5.	• Multidimensional Numeric Arrays • Element-by-Element Operations • Array Addition and Subtraction • Vectorized Functions	4
6.	• Matrix Operations • Vector-Matrix Multiplication • Polynomial Operations Using Arrays • Cell Arrays	4
7.	• Working with Data Files • Importing Spreadsheet Files	2
8.	• Structure chart • Flowchart	4

	• Relational Operators and Logical Variables • Logical Operators and Functions • Conditional Statements	
9.	• for Loops • Using an Array as a Loop Index • Implied Loops • while Loops • The switch structure	4

Textbook:	• W.J. Palm III, Introduction to MATLAB 7 for Engineers, McGraw-Hill International Edition, 2005.

Textbooks	• W.J. Palm III, Introduction to MATLAB 7 for Engineers, McGraw-Hill International Edition, 2005.

Department	Telecommunication Engineering	Major	Telecommunication
Course Name	Electrical Systems and Circuits	Course Code	TCOM 435
Prerequisites	MATH 381	Credit Hours CRH	3 CTH 4 (L 2 P 2 T 0)

CRH: Credit Hours L: Lecture P: Practical T: Tutorial CTH: Contact Hours

Course description :

This course is designed to give the student a basic knowledge of Resonance circuits. Magnetically-coupled circuits. Op-amp circuits. Transient analysis via the conventional and Laplace methods. Fourier analysis with applications to circuits. Two-port networks.

Topics :

- Operational Amplifier.
- Magnetically Coupled Circuits.
- The Laplace Transform.
- Fourier Transform

Experiments: If applicable, it will support the course topics.

References :

- J. W Nilsson, and S. Riedel, Electric Circuits, 9th ed., Addison Wesley, 2010

Details of Theoretical Contents		
No.	**Contents**	**Hours**
1.	Operational Amplifiers 1. Operational Amplifier Terminals 2. Terminal Voltages and Currents 3. The Inverting-Amplifier Circuit 4. The Summing-Amplifier Circuit 5. The Noninverting-Amplifier Circuit 6. The Difference-Amplifier Circuit	2
2.	Magnetically Coupled Circuits 1. The Inductor 2. The Capacitor 3. Series-Parallel Combinations of Inductance and Capacitance 4. Mutual Inductance 5. A Closer Look at Mutual Inductance	4
3.	Frequency Response 1. Some Preliminaries 2. Low-Pass Filters 3. High-Pass Filters 4. Bandpass Filters 5. Bandreject Filters	4
4.	The Laplace Transform 1. Definition of the Laplace Transform 2. The Step Function 3. The Impulse Function 4. Functional Transforms 5. Operational Transforms 6. Applying the Laplace Transform	4

	7. Inverse Transforms 8. Poles and Zeros of F(s) 9. Initial- and Final-Value Theorems	
5.	Applications of Laplace Transforms 1. Circuit Elements in the s Domain 2. The Transfer Function 3. The Transfer Function in Partial Fraction Expansions 4. The Transfer Function and the Convolution Integral 5. The Transfer Function and the Steady-State Sinusoidal Response 6. he Impulse Function in Circuit Analysi	4
6.	Fourier Series 1. Fourier Series Analysis: An Overview 2. The Fourier Coefficients 3. The Effect of Symmetry on the Fourier Coefficients 4. An Alternative Trigonometric Form of the Fourier Series	4
7.	Fourier Transform 1. The Derivation of the Fourier Transform 2. The Convergence of the Fourier Integral 3. Using Laplace Transforms to Find Fourier Transforms 4. Fourier Transforms in the Limit 5. Some Mathematical Properties 6. Operational Transforms 7. Circuit Applications 8. Parseval's Theorem	6
8.	Two-Port Networks 1. The Terminal Equations 2. The Two-Port Parameters 3. Analysis of the Terminated Two-Port Circuit 4. Interconnected Two-Port Circuits	4
Textbook:	• J. W Nilsson, and S. Riedel, Electric Circuits, 9th ed., Addison Wesley, 2010	

Details of Practical Contents		
No.	**Contents**	**Hours**
1.	Operational Amplifier	4
2.	Magnetically Coupled Circuits	4
3.	Frequency Response	4
4.	The Laplace Transform	6
5.	Applications of Laplace Transforms	6
6.	Fourier Series	4
7.	Two-Port Networks	4

Textbook:	• J. W Nilsson, and S. Riedel, Electric Circuits, 9th ed., Addison Wesley, 2010

Textbooks	• J. W Nilsson, and S. Riedel, Electric Circuits, 9th ed., Addison Wesley, 2010

Department	Telecommunication Engineering	Major	Telecommunication						
Course Name	Electronics II	Course Code	TCOM 333						
Prerequisites	-	Credit Hours CRH	3		CTH	4			
			L	2	P	2	T	0	

CRH: Credit Hours L: Lecture P: Practical T: Tutorial CTH: Contact Hours

Course description :

The purpose of this course is to give the student a basic knowledge of Feedback in amplifiers. Frequency response of amplifier. Operational amplifiers: design and applications as linear and non-linear analog building blocks, adders, subtractors, differentiator, integrators, analog simulation, and active filters. Logarithmic and exponential amplifiers, precision converters, analog multipliers, wave-shapers, sinusoidal and square wave oscillators.

Topics :

- Ideal Op Amp Analysis.
- Non-Ideal Op Amp Characteristics
- Active Filters Design
- Transfer Function Design

Experiments: If applicable, it will support the course topics.

References :

- A.S. Sedra, and K.C. Smith, Microelectronic Circuits, 6th Ed., Oxford University Press, 2009
- M.H. Rashid, Microelectronic Circuits: Analysis and Design, 2nd Ed., 2011

Details of Theoretical Contents		
No.	**Contents**	**Hours**
1.	**Amplifiers** • Signal Amplification • Amplifier circuit symbol • Voltage gain • Power gain in decibels • The amplifier power supplies • Amplifier saturation • Nonlinear transfer characteristics and biasing • Symbol convention	4
2.	**Circuit Models for Amplifiers** • Voltage amplifiers • Cascaded amplifiers • Other amplifiers types	6
3.	**Frequency Response of Amplifiers** • Measuring the amplifier frequency response • Amplifier bandwidth • Evaluating the frequency response of amplifiers • Single-time-constant networks • Classification of amplifiers based on frequency response	8
4.	**Filter Transmission, Types and Specification** • Filter Transmission • Filter Types	6

	• Filter Specfication • The filter transfer function	
5.	**First-Order and Second-Order Filter Function** • First order filters • Second order Filters • Second order active filters based on the two intergrator loop topology • Derivative of the two integrator loop biquad	8
Textbook:	• A.S. Sedra, and K.C. Smith, Microelectronic Circuits, 6th Ed., Oxford University Press, 2009 • M.H. Rashid, Microelectronic Circuits: Analysis and Design, 2nd Ed., 2011	

Details of Practical Contents		
No.	**Contents**	**Hours**
1.	**Amplifiers**	4
2.	Amplifier saturation	4
3.	Voltage amplifiers	4
4.	Cascaded amplifiers	4
5.	Measuring the amplifier frequency response	2
6.	Filter Transmission	4
7.	First order filters	4
8.	Second order Filters	4
9.	Second order active filters based on the two intergrator loop topology	2
Textbook:	• A.S. Sedra, and K.C. Smith, Microelectronic Circuits, 6th Ed., Oxford University Press, 2009 M.H. Rashid, Microelectronic Circuits: Analysis and Design, 2nd Ed., 2011	

Textbooks	• A.S. Sedra, and K.C. Smith, Microelectronic Circuits, 6th Ed., Oxford University Press, 2009 • M.H. Rashid, Microelectronic Circuits: Analysis and Design, 2nd Ed., 2011

Department	Telecommunication Engineering	Major	Telecommunication						
Course Name	Communication Theory	Course Code	TCOM465						
Prerequisites	STAT 303	Credit Hours CRH	3	CTH	4				
			L	3	P	0	T	1	

CRH: Credit Hours L: Lecture P: Practical T: Tutorial CTH: Contact Hours

Course description :

This course gives the trainee a deep understanding of Autocorrection function and spectral density. Random signal theory: Continuous and discrete random variables, transformation of random variables, stationary random processes, time average and ergodicity, power spectral density of stationary random processes. Signal-to-noise ratio and probability of error. Noise equivalent bandwidth. Optimum receivers. Pulse detection and matched filters. Signal distortion in transmission and equalization. Noise in linear and exponential modulation. PCM systems: Uniform and no Uniform quantization, noise in PCM, DPCM and DM. Nose in pulse modulation.

Topics :

This includes the following:

- Review of Fourier Analysis and Linear System Theory.
- Correlation and Spectral Density.
- Sampling and Pulse Modulation.\
- Review of Probability and Random Variables.
- Random Signals and Noise.
- Noise in Analog Modulation
- Baseband Digital Transmission
- Digitization Techniques for Analog Messages and Networks

Experiments: If applicable, it will support the course topics.

References :

- A. B. Carlson, P. B. Crilly, and J. C. Rutledge, Communication Systems: An Introduction to Signals and Noise in Electrical Communication, 5th ed., McGraw-Hill, 2009.

Details of Theoretical Contents		
No.	**Contents**	**Hours**
1.	**Review of Fourier Analysis and Linear System Theory**	4
2.	**Signal and Spectra:** • Line Spectra and Fourier • Fourier Transforms and Continuous Spectra • Time and Frequency Relation • Convolution • Impulses and Transforms in Limit	8
3.	**Sampling and Pulse Modulation:** • Sampling Theory and Practice • Pulse-Amplitude Modulation • Pulse-Time Modulation	8
4.	**Review of Probability and Random Variables** • Probability and Sample space • Random Variables and Probability	8

	• Statistical Average • Probability Models	
5.	**Random Signals and Noise** • Random Processes • Random signals • Noise • Baseband Signal Transmission with Noise • Baseband Pulse Transmission with Noise	8
6.	**7. Noise in Analog Modulation** • Bandpass Noise • Linear CW Modulation with Noise • Exponential CW Modulation with Noise • Comparison of CW Modulation Systems • Phase-Lock Loop Noise Performance • Analog Pulse Modulation with Noise	8
8.	**Baseband Digital Transmission** • Digital Signals and Systems • Noise and Errors • Bandlimited Digital PAM Systems • Synchronization techniques	8
9.	**Digitization Techniques for Analog Messages and Networks** • Pulse-Code Modulation • OCM with Noise • Delta Modulation and Predictive • Digital Audio Recoding • Digital Multiplexing • Computer networks	12
Textbook:	• A. B. Carlson, P. B. Crilly, and J. C. Rutledge, Communication Systems: An Introduction to Signals and Noise in Electrical Communication, 5th ed., McGraw-Hill, 2009.	

Textbooks	• A. B. Carlson, P. B. Crilly, and J. C. Rutledge, Communication Systems: An Introduction to Signals and Noise in Electrical Communication, 5th ed., McGraw-Hill, 2009.

Department	Telecommunication Engineering	Major	Telecommunication						
Course Name	Signal and Systems	Course Code	TCOM 371						
Prerequisites	MATH 381	Credit Hours CRH	3			CTH		4	
			L	3	P	0	T	1	

CRH: Credit Hours L: Lecture P: Practical T: Tutorial CTH: Contact Hours

Course description :

The purpose of this course is to give the trainee a basic knowledge of continuous time (CT) and discrete time (DT) signals. signal transform and signal processing systems with their properties and practical examples. The contents of this course include signal p=operations, convolution operation, Fourier, Laplace and z-transforms, and the introduction of the MATLAB software with some computer simulation examples.

Topics :

- Continuous Time and Discrete Time Signals
- Transformation of the Independent Variables
- Exponential and Sinusoidal Signals
- Contiguous Time and Discrete time Systems
- Discrete Time LTI Systems: The convolution Sum
- Continuous Time LTI system: The Convolution Integral
- Fourier Series of LTI Systems to Complex Exponentials
- Convergence of the Fourier Series
- Properties of Continuous Time Fourier Series

Experiments: If applicable, it will support the course topics.

References :

- Signals and Systems, (2nd Edition) , Alan V. Oppenheim.2016

Details of Theoretical Contents		
No.	**Contents**	**Hours**
1.	**Continuous Time and Discrete Time Signals:** • Example and Mathematical Representation • Signal Energy and Power	4
2.	**Transformation of the Independent Variables** • Examples of Transformations of the Independent variable • Parodic Signals • Even and Odd Signals	8
3.	**Exponential and Sinusoidal Signals** • Continuous Time Complex Exponential and Sinusoidal Signals • Discrete Time Unit Impulse and Unit Step Sequences • Periodicity Properties of Discrete Time Complex Exponential	8
4.	**Continuous Time and Discrete time Systems** • Simple Examples of Systems • Interconnections of systems • Systems with and without memory • Invertibility and inverse Systems • Causality • Stability	8
5.	**Discrete Time LTI Systems: The convolution Sum** • The Representation on Discrete-Time Signals in Terms of Impulses	8

	• The Discrete Time Unit Impulse Response and the Convolution-sum representation of LTI systems •	
6.	**Continuous Time LTI system: The Convolution Integral** • The Representation of Continuous-Time Signals in Term of Impulses • The Continuous-Time Unit-Impulse Response and the Convolution Integral Representation of LTI systems	4
7.	**Fourier Series of LTI Systems to Complex Exponentials** • Linear Combinations of Harmonically Related Complex Exponential • Determination of the Fourier Series Representation of a Continuous-Time Periodic Signal	8
8.	**Convergence of the Fourier Series**	4
9.	**Properties of Continuous Time Fourier Series** • Linearity • Time Shifting • Time Scaling • Time Reversal • Multiplication • Conjugation and Conjugate Symmetry •	8
10.	**Fourier Series Representation of Discrete-Time Periodic signals** • Linear Combinations of Harmonically Related complex • Determination of the Fourier Series Reorientation of a Periodic Signal	4
Textbook:	• Signals and Systems, (2nd Edition) , Alan V. Oppenheim.2016	

Textbooks	• Signals and Systems, (2nd Edition) , Alan V. Oppenheim.2016

Department	Electrical Engineering	Major	Electrical						
Course Name	Cellular Mobile Communication	Course Code	TCOM 465						
Prerequisites	-	Credit Hours CRH	3	CTH	4				
			L	3	P	0	T	1	

CRH: **Credit Hours** L: **Lecture** P: **Practical** T: **Tutorial** CTH: **Contact Hours**

Course description :

This course has been designed to provide a comprehensive approach towards the designing of cellular mobile communication systems. It begins with the basic cellular system modeling and then proceeds towards characterization and modeling of radio fading channels and other design aspects of a complete cellular system.

Topics :

1.Introduction to Wireless Communication Systems
2. Modern Wireless Communication Systems
3. Multiple Access Techniques for Wireless Communications
4. 1G and 2G Cellular Communication Systems
5. 3G Cellular Communication Systems
6. Cellular Concept and System Design Fundamentals
7. Handoff Management
8. Channel Assignment Management and Trunking Concept
9. Mobile Radio Propagation – Large Scale Fading
10. Mobile Radio Propagation – Small Scale Fading
11. Cellular Mobile Channel Models
12. MIMO Communication Systems
13. Introduction to Wireless Systems and Standards: GSM, IS-95B, WCDMA/CDMA2000
14. ITU Requirements and architecture of 4G Cellular Standard
15. Introduction to 4G Cellular System: LTE-Advanced/ WiMAX-Advanced

Experiments: If applicable, it will support the course topics.

References :

- A. Molisch, *Wireless Communications*, John Wiley & Sons, 2006
- J. David Parsons, *Mobile Radio Propagation Channel*, John Wiley & Sons, 2000
- IEEE Transactions/Letters on "Vehicular Technology, Communications, Wireless Communications, Antenna Propagation, Signal Processing".

Details of Theoretical Contents		
No.	**Contents**	**Hours**
1.	**Introduction to Wireless Communication Systems** Applications and Requirements of Wireless Services Types of Services Requirements for the Services Technical Challenges of Wireless Communications Multipath Propagation Spectrum Limitations Noise- and Interference-Limited Systems	8
2.	**GSM – Global System for Mobile Communications** • System Overview • The Air Interface • Logical and Physical Channels • Synchronization • . Coding • Equalizer • Circuit-Switched Data Transmission Establishing a Connection and Handover	12

3.	**IS-95 and CDMA 2000** • Air Interface • Frequency Bands and Duplexing • Spreading and Modulation • Coding • Spreading and Modulation • Logical and Physical Channels • Handover	16
4.	**WCDMA/UMTS.** • System Overview • Air Interface • Physical and Logical Channels • Spreading and Modulation • Physical-Layer Procedures	12
5.	**3GPP Long-Term Evolution** • System • Physical Layer • Logical and Physical Channels • General Aspects of Control Signals Associated with PUSCH • Physical Layer Procedures • Handover • Glossary for LTE	16

Textbook:	• A. Molisch, *Wireless Communications*, John Wiley & Sons, 2006 • J. David Parsons, *Mobile Radio Propagation Channel*, John Wiley & Sons, 2000 • IEEE Transactions/Letters on "Vehicular Technology, Communications, Wireless Communications, Antenna Propagation, Signal Processing".

Textbooks	• A. Molisch, *Wireless Communications*, John Wiley & Sons, 2006 • J. David Parsons, *Mobile Radio Propagation Channel*, John Wiley & Sons, 2000 • IEEE Transactions/Letters on "Vehicular Technology, Communications, Wireless Communications, Antenna Propagation, Signal Processing".

Department	Telecommunication Engineering	Major	Telecommunication						
Course Name	Principle of Automatic Control	Course Code	TCOM 412						
Prerequisites	MATH 301	Credit Hours CRH	3	CTH	4				
			L	2	P	2	T	0	

CRH: **Credit Hours** L: **Lecture** P: **Practical** T: **Tutorial** CTH: **Contact Hours**

Course description :

The course includes four main topics in the field of automatic control: Introduction to control systems with examples from fields. Transfer functions and block diagram algebra. Stability analysis (Routh-Hurwitz and Nyquist). Design of Control Systems using Bode diagrams and root locus technique.

Topics :

- Control System Terminology.
- Linear Systems and Differential Equations.
- Frequency Response.
- Stability.

Experiments: if applicable it will support the course topics.

References :

- M. Ogata " Modern Control Engineering " Last edition Prentice Hall
- B C Nakra Theory and Applications of Automatic Controls
- Robert E. King Computational Intelligence in Control Engineering
- Pao C. Chau Process Control: A First Course with MATLAB

Details of Theoretical Contents		
No.	**Contents**	**Hours**
1.	**Control System Terminology:** Block diagram fundamentals, Transfer functions, Closed-loop control, Open-loop control (Feedback systems), Block-diagram algebra, Servomechanisms, Regulators.	6
2.	**Linear Systems and Differential Equations:** Equation of physical systems, Ordinary differential equations, Linearity, Superposition, Causality, Solution of linear constant coefficient ordinary differential equations (1st order and 2nd order),	8
3.	**Frequency Response:** The Laplace transform and its inverse, Properties of Laplace transform, Application of Laplace transform to the solution of linear constant coefficient ordinary deferential equations, Frequency response function, Bode magnitude and phase plots, Straight line approximation, Plant identification.	8
4.	**Stability:** Definitions of stability, The root locus method, The Hurwitz-Routh stability criterion, The Nyquist criterion, Performance and Robustness, The design of control system (proportional control, lag-compensator, lead-compensator).	10
Textbook:	• M. Ogata " Modern Control Engineering " Last edition Prentice Hall • B C Nakra Theory and Applications of Automatic Controls	

	• Robert E. King Computational Intelligence in Control Engineering • Pao C. Chau Process Control: A First Course with MATLAB

Details of Practical Contents		
No.	**Contents**	**Hours**
1.	**Familiarization:** Analog unit check , Display the test waveforms, Display the speed of response of the motor.	2
2.	**Motor, Tachogenerator & Brake Characteristics:** Steady-state characteristics, S.S.C- Brake load, Transient Response of motor, Motor time constant.	4
3.	**Feedback Polarity & The Influence of Gain:** Feedback Polarity, Input & Output Rotation Directions step Response.	2
4.	**Velocity Feedback :** Simple Velocity Feedback.	2
5.	**Unstable Systems:** Additional time constant, Unstable systems.	2
6.	**Speed Control Systems:** Closed-loop Speed Control Systems.	4
7.	**Introduction to 3-Term Control**: Derivative Measurement, Op. Amp. Integrator, 3- Term Controller Test.	2
8.	**Application of 3-Term Control:** Proportional + Derivative (P+D) Control, Elimination of following error elimination of disturbance, Response to output loading.	2
9.	**Single Amplifier Control Circuits: (P+D control & P+I Control**): Importance of resistor in Amplifier Feedback, Single Amp. Amp. 3-Term control.	4
10.	**Transient Velocity Feedback and Derivative Feed**	2
11.	**Transfer Functions and Closed-loop:**	2

	(Frequency Response of Time Constant, Freq. Response of Integrator, Closed-loop System Experimental, and Oscillation.	
12.	**Application of Frequency Response Methods**: Time constant, Motor Transfer, Proportional & Derivative Control, Integral Control, Velocity (Tacho-generator) Control.	4
Textbook:	M. Ogata " Modern Control Engineering " Last edition Prentice Hall	

Textbooks	• M. Ogata " Modern Control Engineering " Last edition Prentice Hall • B C Nakra Theory and Applications of Automatic Controls • Robert E. King Computational Intelligence in Control Engineering • Pao C. Chau Process Control: A First Course with MATLAB

Department	Electrical Engineering	Major	Telecommunication						
Course Name	Digital Communication	Course Code	TCOM 468						
Prerequisites	MATH 381	Credit Hours CRH	3	CTH	4				
			L	3	P	0	T	1	

CRH: **Credit Hours** L: **Lecture** P: **Practical** T: **Tutorial** CTH: **Contact Hours**

Course description :

This course is concerned with the Sampling theorem, PCM, bandpass digital modulation methods (ASK, FSK and PSK), noise analysis and error probability, digital filters, and digital and discrete-time signal processing, Z transform, digital filter design in frequency domain, digital matched filters, interference and jamming, effects of sampling errors, modern digital modulation methods, chirp modulation, spread spectrum.

Topics :

- Baseband Modulation
- Baseband demodulation and detection
- BandPass modulation/demodulation and detection
- Channel coding

Experiments: If applicable, it will support the course topics.

References :

- Walter A.T., "Integrated Digital Electronics", Prentice-Hall, Inc.
- Albert P.M.," Digital Computer Electronics", an Introduction to Microprocessors", McGraw-Hill, Inc.
- Charles A.H., "Electronic Circuits Digital & Analog", John Wiley & Sons, Inc.

Details of Theoretical Contents		
No.	**Contents**	**Hours**
1.	**Review of PCM** How the PCM signal is generated (Sampling, Quantizing & Encoding)	4
2.	**Baseband Modulation** Waveform Representation of Binary Digits, PCM Waveform Types, Spectral Attributes of PCM Waveforms, Bits per PCM Word and Bits per Symbol, M-ary Pulse Modulation Waveforms	8
3.	**Intersymbol Interference (ISI)** Pulse Shaping to Reduce ISI, Two Types of Error-Performance Degradation, Demodulation/Detection of Shaped Pulses,	8
4.	**Correlative Coding** Duobinary Signaling, Duobinary Decoding, Preceding, Duobinary Equivalent Transfer Function, Comparison of Binary with Duobinary Signaling, Poly binary Signaling,	4
5.	**Equalization** Channel Characterization, Eye Pattern, Equalizer Filter Types, Preset and Adaptive Equalization, Filter Update Rate,	4
6.	**Detection of Binary Signals (Matched filter)** Optimal detection in white Gaussian noise, Matched Filtering	4
7.	**Digital Bandpass Modulation Techniques** Phasor Representation of a Sinusoid, Phase Shift Keying, Frequency Shift Keying, Amplitude Shift Keying, Amplitude Phase Keying, Waveform Amplitude Coefficient,	4
8.	**Coherent Detection of Bandpass signals** Coherent Detection of PSK, Sampled Matched Filter, Coherent Detection of Multiple Phase Shift Keying, *Coherent Detection of FSK*,	4
9.	**Noncoherent Detection** Detection of Differential PSK, Binary Differential PSK Example, Noncoherent Detection of FSK, Required Tone Spacing for Noncoherent Orthogonal FSK,	4

10.	**M-ary Signaling and Performance** Ideal Probability of Bit Error Performance, M-ary Signaling, Vectorial View of MPSK Signaling, BPSK and QPSK Have the Same Bit Error Probability, Vectorial View of MFSK Signaling,	4
11.	**Channel Coding:** Parity Check Codes, Linear Block Codes	4
12.	**Channel Coding: Cyclic Codes** Algebraic Structure of Cyclic Codes, Binary Cyclic Code Properties, Encoding in Systematic Form, Circuit for Dividing Polynomials, Systematic Encoding with an (n - k)-Stage Shift Register, Error Detection with an (n - k)-Stage Shift Register,	8
13.	**Convolutional Encoding** Connection Representation, State Representation and the State Diagram, The Tree Diagram, The Trellis Diagram,	4
Textbook:	• B. Sklar, Digital Communications: Fundamentals and Applications. 2nd Ed., Prentice-Hall, 2001. (17th printing, 2009)	

Department	Telecommunication Engineering	Major	Telecommunication						
Course Name	Wireless Communication Systems	Course Code	TCOM 469						
Prerequisites	TCOM 334	Credit Hours CRH	3			CTH	4		
			L	3	P	0	T	1	

CRH: **Credit Hours** L: **Lecture** P: **Practical** T: **Tutorial** CTH: **Contact Hours**

Course description :

This course introduces fundamental technologies for wireless communications. It addresses the following topics: review of modulation techniques, wireless channel modeling, multiple access schemes, cellular communications, diversity techniques, equalization, channel coding, selected advanced topics such as OFDM, cognitive radio, cooperative communications, space time coding, and smart antenna systems

Topics :

The course covers the following topics:

- Propagation Modeling I & II
- Capacity of Wireless Channels
- Digital Communication over Fading Channels
- Diversity Techniques
- MIMO Systems
- Adaptive Modulation and Multicarrier Communication Systems
- Optical Wireless Communication
- Cognitive Radio Systems.

Experiments: If applicable, it will support the course topics.

References :

- Wireless Communications, A. Goldsmith, Cambridge, 2005

Details of Theoretical Contents		
No	**Contents**	**Hours**
1.	**Introduction to Wireless Communication Systems & Networks** History of Wireless Communication, current wireless systems, wireless spectrum, standards	4
2.	**Propagation Modeling I: Narrowband Fading models** Autocorrelation, Cross correlation, Power spectral density, Envelop and power distribution, Level crossing rate and average fade duration, Finite state Marcov Channels	8
3.	**Propagation Modeling II: Wideband Fading Models** Power delay profile, Coherence bandwidth, Doppler power spectrum and Channel Coherence Time, Transforms for autocorrelation and Scattering functions	4
4.	**Capacity of Wireless Channels** Capacity in AWGN, Capacity of flat-fading Channels, Capacity of frequency-Selective fading Channels	8
5.	**Digital Communication over Fading Channels** AWGN Channel, Alternate Q-function representation, Fading, Doppler spread, InterSymbol interference	4
6.	**Diversity Techniques** Overview about fading problem, Definition and requirements of diversity, Orthogonal Transmit Diversity (OTD), Space-Time (S-T) Diversity Space-Frequency (S-F), Diversity Space-Time-Frequency (S-T-F) Diversity, Open Loop Transmit Diversity (for 3G), Closed Loop Transmit Diversity (for 3G), Diversity Combining techniques	8

7.	**MIMO Systems** Electronic Scanning of Arrays, Electronic Scanning of Arrays, Electronic Scanning of Arrays, Electronic Scanning of Arrays, Electronic Scanning of Arrays, Electronic Scanning of Arrays, Electronic Scanning of Arrays, Electronic Scanning of Arrays	8
8.	**Adaptive Modulation and Multicarrier Communication Systems** Electronic Scanning of Arrays, Electronic Scanning of Arrays, Electronic Scanning of Arrays, Electronic Scanning of Arrays, Electronic Scanning of Arrays, Electronic Scanning of Arrays	8
9.	**Optical Wireless Communication** *Electromagnetic spectrum*, Historical Overview and current, Existing and Envisioned application areas	8
10.	**Cognitive Radio Systems** Introduction, historical of cognitive radio, useful definitions, Classification of spectrum management models, Use scenarios	4
Textbook:	• Wireless Communications, A. Goldsmith, Cambridge, 2005	

Department	Telecommunication Engineering	Major	Telecommunication						
Course Name	Antenna Theory II	Course Code	TCOM 443						
Prerequisites	TCOM 468	Credit Hours CRH	3	CTH	4				
			L	3	P	0	T	1	

CRH: **Credit Hours** L: **Lecture** P: **Practical** T: **Tutorial** CTH: **Contact Hours**

Course description :

The purpose of this course is to give the student a basic knowledge of Radiation and Antenna Fundamentals. Linear Antennas, Current distribution, Short dipoles And Monopoles/2 dipoles, radiation resistance and gain, longer dipoles, folded dipoles. Antenna Arrays. Aperture Antennas. Special types of antennas. Traveling wave antennas, loop antennas. Frequency independent antennas, helical Antennas, corner reflector, lenses. Space Wave Propagation. Ground Wave Propagation. Tropospheric waves. Ionospheric waves

Topics :

The course contains four main topics:

- The Hertzian Dipole
- Antenna Radiation Characteristics
- Half-Wave Dipole Antenna
- Aperture Antennas
- Antenna Arrays.

Experiments: If applicable, it will support the course topics.

References :

- **:** F. Ulaby, Fundamentals of Applied Electromagnetics, 6th Media Edition, Prentice-Hall, 2010.

Details of Theoretical Contents		
No	**Contents**	**Hours**
1.	**The Hertzian dipole** Far-Field Approximation, Power Density	8
2.	**Antennas radiation characteristics** Antenna Pattern, Beam Dimensions, Antenna Directivity, Antenna Gain, Radiation Resistance	8
3.	**Dipole antenna** Directivity of λ/2 Dipole, Radiation Resistance of A./2 Dipole, Quarter-Wave Monopole Antenna, Dipole of arbitrary length	12
4.	**Area of receiving antenna** Effective area of receiving antenna, Friis transmission formula	12
5.	**Aperture antennas** Radiation by Large- Aperture antennas, Rectangular aperture with uniform aperture distribution	12
6.	**Antenna arrays** Antenna arrays presentation, N-element array with uniform phase distribution Electronic scanning of arrays, Electronic Scanning of Arrays	12

Textbook:	• F. Ulaby, Fundamentals of Applied Electromagnetics, 6th Media Edition, Prentice-Hall, 2010

Department	Telecommunication Engineering	Major	Telecommunication						
Course Name	Advanced Communication Systems	Course Code	TCOM 442						
Prerequisites	TCOM 468	Credit Hours CRH	3	CTH	4				
			L	3	P	0	T	1	

CRH: Credit Hours L: Lecture P: Practical T: Tutorial CTH: Contact Hours

Course description :

This course gives the student a basic knowledge about the Detailed description of at least three out of the following systems. Radio broadcasting Systems. TV and Video Systems. Radar Systems. Microwave Links, Telephony, Telegraphy and Telex systems. Satellite Communication Systems. Optical Communication Systems. Aircraft and Ship navigational systems.

Topics :

- Link Budget Analysis
- Digital Modulation
- Optical Communications
- Satellite Communications
- Mobile Communications
-

Experiments: If applicable, it will support the course topics.

References :

1. "Wireless Communications, principles and practice", 2nd ed by Theodore S. Rappaport, Prentice-Hall, 2002.
2. "Satellite Communications", by Dennis Roddy, McGraw-Hill, Chapter 16, 2001.

Details of Theoretical Contents		
No	**Contents**	**Hours**
1.	**Introduction, Noise in Communication Systems** Degradation of Link Quality, Internal and extern Noise, Signal Noise Ration, Noise Figure, Input Referred Noise (I), Minimum Signal (cont)	4
2.	**Link Budget Analysis** Context, Types of link, Free space loss, Power in a wireless system, Link budget, Example link budget calculation, Fresnel zone , Equation of Noise	4
3.	**Digital Modulation** Factors that influence the choice of Digital Modulation, BW and power Spectral density of digital signals, Linear Modulation Techniques, Constant Envelope Modulation, combine Linear and Constant Envelope Modulation Techniques, Modulation Performance in Fadding and multipath Channels	10
4.	**Optical Communications** Evolution of Lightwave Systems, Components Lightwave Systems, Optical signal generation, Signal Propagation in Fibers, Signal recovery and Noise, Optical Amplifier Noise, Presentation of Optical Network	10
5.	**Satellite Communications** Overview and historical perspective of the GSO, Communication Satellite Sharing of the GSO, Factors Affecting Orbit-Spectrum Utilization (homogenous case)	10
6.	**Mobile Communications** Introductory Concepts, Modern Wireless Communication Systems (first , second and 3rd generation), The Cellular Engineering Fundamentals (Channel Assignment Strategies, Handoff Process, Interference & System Capacity,	10

	Enhancing Capacity And Cell Coverage, Trunked Radio System) , Free Space Radio Wave Propagation (Outdoor Propagation Models, Indoor Propagation Models) , Multipath Wave Propagation and fadding	
Textbook:	1. "Wireless Communications, principles and practice", 2nd ed by Theodore S. Rappaport, Prentice- Hall, 2002. 2. "Satellite Communications", by Dennis Roddy, McGraw-Hill, Chapter 16, 2001.	

Department	Telecommunication Engineering	Major	Telecommunication						
Course Name	Project	Course Code	TCOM 490						
Prerequisites	-	Credit Hours CRH	4		CTH	6			
			L	2	P	4	T	0	

CRH: **Credit Hours** L: **Lecture** P: **Practical** T: **Tutorial** CTH: **Contact Hours**

Course Objectives:

The purpose of this course is to make the final year student aquatinted with the ways and means, which are adopted to carry out an investigation to solve one of the technical problems. Also, to make the student able to present and prepare a detailed report.

Topics :

Each student must undertake a project in one of the main topics listed there under. The relevant projects are offered as options. Details of the projects available will be handed out to the students at the last semester. Some of these projects will involve the use of laboratory or computer or both. It is recommended that the student should choose the project option that most relevant to the courses he undertakes. It is also expected that he will carry out a literature survey on the topic of this project. The main topics are given below as:

1. Electromagnetics
2. Cellular Mobile Communication
3. Wireless Communication
4. Digital Communication
5. Signal Processing
6. Error Detection in Wireless Communication
7. Any other Related topics approved by the Departement .

Department	Telecommunication Engineering	Major	Telecommunication						
Course Name	Electromagnetics	Course Code	TCOM 404						
Prerequisites	MATH 381	Credit Hours CRH	4		CTH	4			
			L	4	P	0	T	0	

CRH: Credit Hours L: Lecture P: Practical T: Tutorial CTH: Contact Hours

Course Description:
This course aims to make the trainee aware of the basic principles of static and time varying electric and magnetic fields. The course supplies the trainee with sufficient methods and rules for calculating the intensity of electric and magnetic fields as well as potential for conventional models.

Topics:

- Theory of the Electromagnetic Field
- Quantities of the Electromagnetic Field
- The Laws of the Electromagnetic Field
- The Energy of the Electromagnetic Field

Experiments: If applicable, it will support the course topics.

References: Andrei Nicolaide, "General Theory of the Electromagnetic Field**",** Transilvania University Press, Braşov, 2012**.**

Detailed of Theoretical Contents		
No.	**Contents**	**Hours**
1.	**Theory of the Electromagnetic Field** Field and Substance, Lines of Field, Physical Quantities, Manners of Studying the Theory of the Electromagnetic Field, General Considerations on the Structure of Conductors and Dielectrics, Electric Field Strength and The Electric Current.	**12**
2.	**Quantities of the Electromagnetic Field** The Expressions of the Force and Electric Field Strength and Electromagnetic Potentials.	**16**
3.	**The Laws of the Electromagnetic Field** The Law of Electric Flux, The Relation between the Electric Displacement, Electric Field Strength and Electric Polarization, The Law of Magnetic Flux, The Law of Electromagnetic Induction for Media at Rest, The Law of Magnetic Circuit and Derivation of the Fundamental Equations of the Electromagnetic Field Theory in the General Case. Maxwell Equations.	**20**
4.	**The Energy of the Electromagnetic Field** The Expression of the Energy of the Electromagnetic Field Poynting Vector, Theorem of Irreversible Transformation of Electromagnetic and The Theorem of Electromagnetic Momentum.	**16**

Textbook	• Andrei Nicolaide, " General Theory of the Electromagnetic Field**",** Transilvania University Press, Braşov, 2012**.** • Bo Thidé, "Electromagnetic Field Theory**",** Uppsala, sweden,2004.

Textbooks	• Andrei Nicolaide, " General Theory of the Electromagnetic Field**",** Transilvania University Press, Braşov, 2012**.** • Bo Thidé, "Electromagnetic Field Theory**",** Uppsala, sweden,2004.

Department	Telecommunication Engineering	Major	Telecommunication						
Course Name	Object Oriented Programming	Course Code	TCOM 424						
Prerequisites	TCOM 323	Credit Hours CRH	3				CTH	5	
			L	2	P	2	T	1	

CRH: Credit Hours L: Lecture P: Practical T: Tutorial CTH: Contact Hours

Course Description:
The purpose of this course is to give the trainee a basic knowledge of Object-oriented programming: classes, objects and methods. Object-oriented design. Simple data structures. Best programming practices (structured coding, documentation, testing and debugging).

Topics:

- The basic idea of Classes and Objects, Messages and Methods, Data Values, Inheritance, Software Engineering Life Cycle, Java Program Components.
- Numerical Data: Variables, Arithmetic Expressions, Constants, I/O.
- Self defined Classes: Constructors, Class/Object Methods, Data Members, Class/Object Constants, Methods/Constructors Overloading, Parameters Passing, Organizing Classes into Packages, Javadocs Comments.
- Flow Control: If Statement, Nested If Statement, Boolean Expressions, Switch Statement, For/do/While Loops.
- Arrays: Defining an Array, Arrays of Objects, Two-Dimensional Arrays, Lists and Maps.
- Classes: overloading constructor, this, Composition, static members, Final instance variables, Data abstraction**.** Error handling

Experiments: If applicable, it will support the course topics.

Detailed of Theoretical Contents		
No.	**Contents**	**Hours**
1	**Introduction To Computers and Programming Languages** • A history of Computers • Computer Architectures • Programming Languages • Java	**6**
2	**Introduction to Object-Oriented Programming and Software Development** • Classes and Objects • Messages and Methods • Class and Instance Data Values • Inheritance • Software Engineering and Software Life Sycle	**6**
3	**Numerical Data** • Variables • Arithmetic Expressions • Constants • Displaying Numerical Values • Getting Numerical Input • The Math Class • Random Number Generation	**6**

	• The Gregorian Calendar Class and Sample Development	
4	**Defining Your Own Classes** 4.1 First Example: Defining and Using a Class 4.2 Second Example: Defining and Using Multiple Classes 4.3 Matching Arguments and Parameters 4.4 Passing Objects to a Method 4.5 Constructors 4.6 Information Hiding and Visibility Modifiers 4.7 Class Constants 4.8 Local Variables 4.9 Calling Methods of the Same Class 4.10 Changing Any Class to a Main Class.	**6**
5	**Selection Statements** 5.1 The if Statement 5.2 Nested if Statements 5.3 Boolean Expressions and Variables 5.4 Comparing Objects 5.5 The switch Statement 5.6 Drawing Graphics 5.7 Enumerated Constants 5.8 Sample Development.	**6**
6	**Repetition Statements** **6**.1 The while Statement 6.2 Pitfalls in Writing Repetition Statement 6.3 The do–while Statement 6.4 Loop-and-a-Half Repetition Control 6.5 The for Statement 6.6 Nested for Statements 6.7 Formatting Output 6.8 Loan Tables 6.9 Estimating the Execution Time	**6**
7	**Exceptions and Assertions** Catching Exceptions Throwing Exceptions and Multiple catch Blocks Propagating Exceptions Types of Exceptions Programmer-Defined Exceptions Assertions	**3**
8	**Characters and Strings** 8.1 Characters 8.2 Strings 8.3 Pattern Matching and Regular Expression 8.4 The Pattern and Matcher Classes 8.5 Comparing Strings 8.6 String Buffer and String Builder 8.7 String Processing and Bioinformatics	**6**

	File Input and Output • File and jfilechooser objects • Low-Level File I/O • High-Level file I/O • Object I/O	**3**
Textbook	• C. Thomas Wu, An introduction to object-oriented programming with JAVA, 5th ed., McGraw-Hill, 2009.	

Textbooks	• C. Thomas Wu, An introduction to object-oriented programming with JAVA, 5th ed., McGraw-Hill, 2009.

Department	Telecommunication Engineering	Major	Telecommunication						
Course Name	Digital Signal Processing	Course Code	TCOM 473						
Prerequisites	TCOM 371	Credit Hours CRH	3				CTH		4
			L	3	P	0	T	1	

CRH: Credit Hours L: Lecture P: Practical T: Tutorial CTH: Contact Hours

Course Description :

This course provides the trainee the most extensive coverage of Discrete time signals and systems, Fourier analysis of discrete-time signals and Systems –Fast Fourier Transform- Digital Filter Design- Computer applications - Advanced Topics..

Topics :

- Discrete-Time Signal and Systems
- The Discrete-Time Fourier Analysis
- The z-Transform
- The Discrete Fourier Transform
- Implementation of Discrete-Time Filters
- FIR Filter Design
- IIR Filter Design

Experiments: If applicable, it will support the course topics.

Detailed of Theoretical Contents		
No.	**Contents**	**Hours**
1.	**DISCRETE-TIME SIGNALS AND SYSTEMS** • Discrete-time Signals • Discrete Systems • Convolution • Difference Equations	8
2.	**THE DISCRETE-TIME FOURIER ANALYSIS** • The Discrete-time Fourier Transform (DTFT) • The Properties of the DTFT • The Frequency Domain Representation of LTI Systems • Sampling and Reconstruction of Analog Signals.	8
3.	**THE z-TRANSFORM** • The Bilateral z-Transform • Important Properties of the z-Transform • Inversion of the z-Transform • System Representation in the z-Domain • Solutions of the Difference Equations	12
4.	**THE DISCRETE FOURIER TRANSFORM** • The Discrete Fourier Series • Sampling and Reconstruction in the z-Domain • The Discrete Fourier Transform • Properties of the Discrete Fourier Transform • Linear Convolution Using the DFT • The Fast Fourier Transform.	8
5.	**IMPLEMENTATION OF DISCRETE-TIME FILTERS**	12

	• Basic Elements • IIR Filter Structures • FIR Filter Structures • Lattice Filter Structures • Overview of Finite-Precision Numerical Effects • Representation of Numbers • The Process of Quantization and Error Characterizations • Quantization of Filter Coefficients	
6.	**FIR FILTER DESIGN** • Preliminaries • Properties of Linear-phase FIR Filters • Window Design Techniques • Frequency Sampling Design Techniques • Optimal Equiripple Design Technique	8
7.	**IIR FILTER DESIGN** • Some Preliminaries • Some Special Filter Types • Characteristics of Prototype Analog Filters • Analog-to-Digital Filter Transformations • Lowpass Filter Design Using MATLAB • Frequency-band Transformations	8
Textbook	V. K. Ingle and J. G. Proakis, Digital Signal Processing using MATLAB. 3rd ed., Cengage Learning, 2012.	

Department	Telecommunication Engineering	Major	Telecommunication						
Course Name	Digital Design	Course Code	TCOM 474						
Prerequisites	TCOM 371	Credit Hours CRH	3				CTH		4
			L	3	P	0	T	1	

CRH: Credit Hours L: Lecture P: Practical T: Tutorial CTH: Contact Hours

Course Description:

This course provides the trainee the most extensive coverage of Analysis and synthesis of gate networks. Elements of minimization techniques. Synthesis using NAND and NOR gates. Analysis of sequential networks. Synthesis of pulse-mode and fundamental mode sequential networks. Flow tables and State diagrams. Hazards. Use of MSI and LSI in the implementation of combinational and sequential circuits.

Topics :

- Review of flip-flops
- Design of sequential networks using state tables, state graphs, and K-maps for various examples
- Design of iterative networks using state tables, state graphs, and K-maps for various examples
- State reduction and assignment methods
- Design of code converters and pattern detectors
- Design of Arithmetic circuits
- Study of VHDL and its use in di

Experiments: If applicable, it will support the course topics.

Detailed of Theoretical Contents		
No.	**Contents**	**Hours**
1.	**Latches and Flip-Flops** • Introduction • Set-Reset Latch • Gated D Latch • Edge-Triggered D Flip-Flop • S-R Flip-Flop • J-K Flip-Flop • T Flip-Flop • Flip-Flops with Additional Inputs	12
2.	**Karnaugh Maps** • Minimum Forms of Switching Functions • Two- and Three-Variable Karnaugh Maps • Four-Variable Karnaugh Maps • Determination of Minimum Expressions • Using Essential Prime Implicants • Five-Variable Karnaugh Maps • Other Uses of Karnaugh Maps.	12
3.	**Analysis of Clocked Sequential Circuits** • A Sequential Parity Checker • Analysis by Signal Tracing and Timing Charts • State Tables and Graphs • Construction and Interpretation of Timing Charts	12

	• General Models for Sequential Circuits	
4.	**Introduction to VHDL** • VHDL Description of Combinational Circuits • VHDL Models for Multiplexers • VHDL Modules • Four-Bit Full Adder • Signals and Constants • Arrays • VHDL Operators • Packages and Libraries • IEEE Standard Logic • Compilation and Simulation of VHDL Code.	16
5.	**Circuits for Arithmetic Operations** • Serial Adder with Accumulator • 1Design of a Parallel Multiplier • Design of a Binary Divider	12
Textbook	Charles H. Roth Jr., Fundamentals of Logic Design, 6th Ed. Thomson Brooks, 2010	

Appendix Laboratory Equipment, Workshops and Laboratories

No.	Laboratory name / workshop	Capacity of training	Number of trainers	Training courses benefiting from the laboratory / workshop / lab
1.	Programming Lab	20	1	1. Object Oriented Programming
2.	MATLAB	20	1	1. Structured Computer Programming
3.	Electronics Lab	20	1	1. Electronics II
2	Automatic Control Lab.	20	1	Principle of Automatic Control

List of Detailed Equipment for Each Laboratory, Workshop or Lab

Programming Lab		
No.	**Product's Name**	**Quantity**
1.	Personal Computer	20
2.	JAVA	1
3.	ETAP package software	1
	معامل هذه المقررات تحتاج الى أجهزة كمبيوتر ونسخ من البرامج المستخدمة	

List of Detailed Equipment for Each Laboratory, Workshop or Lab

Electronic Laboratory		
No.	**Product's Name**	**Quantity**
1.	Function generator	20
2.	Measurement devices; voltmeter, ammeter and wattmeter	40
3.	Electronic components, diode and transistor	60
4.	Resistances, coils and capacitors	200
5.	Switches	60

6.	Oscilloscope	20
7.	Plug-in Board	20
8.	COM3LAB unit	20
9.	Personal Computer	20

List of Detailed Equipment for Each Laboratory, Workshop or Lab

MATLAB Laboratory		
No.	**Product's Name**	**Quantity**
1.	Personal Computer	20
2.	JAVA	1
3.	ETAP package software	1
4.	معامل هذه المقررات تحتاج الى أجهزة كمبيوتر ونسخ من البرامج المستخدمة	

List of Detailed Equipment for Each Laboratory, Workshop or Lab

Automatic Control Laboratory		
No.	**Product's Name**	**Quantity**
1.	Main control device	12
2.	Oscilloscope	12
3.	Control applications	4
4.	Control panel	4
5.	Fault diagnosis panel	4
6.	Amplifier unit	4
7.	COM3LAB unit	12
8.	Personal Computer	12

References

Textbooks	**1.**	W.J. Palm III, Introduction to MATLAB 7 for Engineers, McGraw-Hill International Edition, 2005.
	2.	J. W Nilsson, and S. Riedel, Electric Circuits, 9th ed., Addison Wesley, 2010
	3.	**4.** A.S. Sedra, and K.C. Smith, Microelectronic Circuits, 6th Ed., Oxford University Press, 2009
	5.	A. B. Carlson, P. B. Crilly, and J. C. Rutledge, Communication Systems: An Introduction to Signals and Noise in Electrical Communication, 5th ed., McGraw-Hill, 2009.
	6.	M.H. Rashid, Microelectronic Circuits: Analysis and Design, 2nd Ed., 2011
	7.	Signals and Systems, (2nd Edition) , Alan V. Oppenheim.2016
	8.	**9.** A. Molisch, *Wireless Communications*, John Wiley & Sons, 2006
	10.	**11.** J. David Parsons, *Mobile Radio Propagation Channel*, John Wiley & Sons, 2000
	12.	IEEE Transactions/Letters on “Vehicular Technology, Communications, Wireless Communications, Antenna Propagation, Signal Processing”.
	13.	**14.** M. Ogata " Modern Control Engineering " Last edition Prentice Hall
	15.	**16.** B C Nakra Theory and Applications of Automatic Controls
	17.	**18.** Robert E. King Computational Intelligence in Control Engineering
	19.	Pao C. Chau Process Control: A First Course with MATLAB
	20.	B. Sklar, Digital Communications: Fundamentals and Applications. 2nd Ed., Prentice-Hall, 2001. (17th printing, 2009)
	21.	Wireless Communications, A. Goldsmith, Cambridge, 2005
	22.	F. Ulaby, Fundamentals of Applied Electromagnetics, 6th Media Edition, Prentice-Hall, 2010.
	23.	Wireless Communications, principles and practice", 2nd ed by Theodore S. Rappaport, Prentice- Hall, 2002
	24.	Satellite Communications", by Dennis Roddy, McGraw-Hill, Chapter 16, 2001
	25.	Andrei Nicolaide, "General Theory of the Electromagnetic Field", Transilvania University Press, Braşov, 2012.

	26.	C. Thomas Wu, An introduction to object-oriented programming with JAVA, 5th ed., McGraw-Hill, 2009
	27.	V. K. Ingle and J. G. Proakis, Digital Signal Processing using MATLAB. 3rd ed., Cengage Learning, 2012.
	28.	Charles H. Roth Jr., Fundamentals of Logic Design, 6th Ed. Thomson Brooks, 2010