بسم الله الرحمن الرحيم

King Khalid University

College of Engineering
Electrical Engineering Department

Bachelor of Science in Electrical Engineering

New Program Study Plan

1439-1440

Course Code	Course Title	Weekly Distribution of Credit Hours				Prerequisites	Co-requisites
		Lectures	Lab	Credit Hours	Contact Hour		
First Year - First Level							
011-ENG-6	Intensive English Program-1	-	6	6	12	--	--
107-CHEM- 4	General Chemistry	3	1	4	5	--	--
119-MATH-3	Differentiation and Integration-1	3	-	3	3	--	--
111-ICl-2	The Entrance to the Islamic Culture	2	-	2	2	--	--
201-ARAB-2	Language Skills	2	-	2	2	--	--
Total Number of Hours		**10**	**7**	**17**	**24**		
First Year – Second Level							
012-ENG-6	Intensive English Program-2	-	6	6	12	011-ENG-6	--
104-CMS-2	Computer Science	1	1	2	3	--	--
219-MATH-3	Differentiation and Integration-2	3	-	3	3	119-MATH-3	--
129-PHYS-4	Physics-1	3	1	4	5	--	--
112-IC1-2	Islamic Culture-2	2	-	2	2	--	--
Total Number of Hours		**9**	**8**	**17**	**25**		
Second Year – Third Level							
111-GE-3	Engineering Drawing	-	3	3	6	--	--
202-ARAB- 2	Arabic Writing	2	-	2	2	--	--
211-EE-3	Electric Circuits 1	2	1	3	4	219MATH-3 129PHYS-4	--
211-GE-2	Learning skills	2	-	2	2	--	--
219-PHYS-4	Physics-2	3	1	4	5	129-PHYS-4	--
229-MATH- 3	Differentiation and Integration-3	3	-	3	3	219-MATH-3	--
Total Number of Hours		**12**	**5**	**17**	**22**		
Second Year – Fourth Level							
221-ME-3	Production Technology and Workshop	1	2	3	5	111-GE-3	
221-EE-3	Electric Circuits 2	2	1	3	4	211-EE-3	
319-PHYS-3	Physics-3	2	1	3	4	219-PHYS-4	
221-GE-2	Creativity and Innovation	2	-	2	2	--	
222-EE-1	Electric Circuits Lab	-	1	1	2	--	221-EE-3
319-MATH- 3	Differential Equations	3	-	3	3	219-MATH-3	
Total Number of Hours		**10**	**5**	**15**	**20**		

Third Year – Fifth Level							
212-ME-2	Engineering Mechanics (statics)	2	-	2	2		
311-EE-2	Electrical Measurements	2	-	2	2	211-EE-3	
312-EE-1	Electrical Measurements Lab	-	1	1	2		311-EE-2
329-STAT-2	Principles of Statistics and Probability	2	-	2	2		
113-IC1-2	Islamic Culture-3	2	-	2	2	--	
329-MATH- 3	Linear Algebra	3	-	3	3	--	
313-EE-3	Logic Design	2	1	3	4	211-EE-3	
314-EE-1	Logic Design Lab	-	1	1	2	313-EE-3	
Total Number of Hours		**13**	**3**	**16**	**19**		
Third Year – Sixth Level							
301-NGL-2	Technical Reports Writing	2	-	2	2	012-ENG-6	
321-EE-3	Computer Programming	2	1	3	4	104-CMS-2	
322-EE-3	Signals and Systems	2	1	3	4	229-MATH-3	
323-EE-3	Electromagnetics	2	1	3	4	319-MATH-3 129-PHYS-4	
324-EE-3	Introduction to Microprocessors and Microcontrollers	2	1	3	4	313-EE-3	
325-EE-1	Microprocessors and Microcontrollers Lab	-	1	1	2		324-EE-3
114-IC1-2	Islamic Culture-4	2	-	2	2	--	
Total Number of Hours		**12**	**5**	**17**	**22**		
Summer Internship							
400-EE-0	Summer Internship	0	0	0	0	Completion of 95 credit hours	
Fourth Year–Seventh Level							
311-ME-2	Engineering Mechanics (dynamic)	2	-	2	2		
411-EE-3	Automatic Control	2	1	3	4	322-EE-3	
412-EE-1	Automatic Control Lab	-	1	1	2		411-EE-3
414-IE -2	Engineering and Project Management	2	-	2	2		
413-EE-3	Basics of Electronic Devices	2	1	3	4	221-EE-3	
414-EE-1	Electronic Devices Lab	-	1	1	2		413-EE-3
411-GE-2	Professional Ethics and practice	2	-	2	2	--	
XXX	Free course - 1	3	-	3	3	--	
Total Number of Hours		**13**	**4**	**17**	**21**		

Fourth Year– Eighth Level							
421-EE-3	Electromechanical Energy Conversion - 1	2	1	3	4	221-EE-3	
564-IE-2	Safety and Environment Engineering	2	-	2	2		
423-EE-3	Analog Communications	2	1	3	4	322-EE-3	
	Elective -1	2	-	2	2		
422-EE-3	Numerical Methods	2	1	3	4	319-MATH-3	
XXX	Free course- 2	2	-	2	2		
Total Number of Hours		**12**	**3**	**15**	**18**		
Fifth Year–Ninth Level							
511-GE-2	Entrepreneurship and Venture Engineering	2	-	2	2		
512-EE-3	Digital Signal Processing	2	1	3	4	322-EE-3	
513-EE-1	Digital Signal Processing Lab	-	1	1	2		512-EE-3
514-EE-3	Electric Power System	2	1	3	4	221-EE-3	
515-EE-1	Electric Power System Lab	-	1	1	2		514-EE-3
	Elective-2	2	1	3	4	Refer to elective courses lists	
571-EE-2	Senior Design Project-1	2	-	2	2	Complete127 Cr. Hr	
Total Number of Hours		**10**	**5**	**15**	**20**		
Fifth Year–Tenth Level							
521-EE-3	Analog and Digital Electronic Circuits	2	1	3	4	413-EE-3	
522-EE-1	Analog and Digital Electronic Circuits Lab.	-	1	1	2		521-EE-3
523-EE-3	Digital Control Systems	2	1	3	4	411-EE-3	
	Elective -3	2	1	3	4	Refer to elective courses lists	
	Elective -4	2	1	3	4	Refer to elective courses lists	
572-EE-2	Senior Design Project-2	2	-	2	2	571-EE-2	
Total Number of Hours		**10**	**5**	**15**	**20**		

Elective courses

Elective courses (2), (3), and (4) are selected according to the following:

1. **Power system and machine engineering path**: choose the courses of Power system and machine engineering path only from the list of elective courses
2. **Students interested in Communication Engineering path**: Choose the courses of Communication Engineering path only from the list of elective courses
3. **Students interested in Electronics Engineering path**: Choose the courses of Electronics Engineering path only from the list of elective courses
4. **Students interested in general path**: choose elective courses without follow any path

List of Elective course -1

Course Code	Course Title	Weekly Distribution of Credit Hours				Prerequisites
		Lectures	Lab	Credit Hours	Contact Hour	
321-GE-2	Knowledge Management	2	-	2	2	--
322-GE-2	Design Thinking	2	-	2	2	--
323-GE-2	System Dynamics	2	-	2	2	--

List of Elective courses (2), (3) and (4)

Path	Course Code	Course Title	Weekly Distribution of Credit Hours				Prerequisites
			Lectures	Lab	Credit Hours	Contact Hour	
Electrical Power and Machine Engineering	531-EE-3	Electromechanical Energy Conversion -2	2	1	3	4	421-EE-3
	533-EE-3	High Voltage Engineering	2	1	3	4	221-EE-3
	534-EE-3	Power System Analysis	2	1	3	4	514-EE-3
	535-EE-3	Power Electronics	2	1	3	4	413-EE-3
Communicat ion Engineering	541-EE-3	Digital Communication	2	1	3	4	423-EE-3
	543-EE-3	Antennas and Wave Propagation	2	1	3	4	323-EE-3
	545-EE-3	Wireless Communication	2	1	3	4	423-EE-3
	546-EE-3	Communication Systems	2	1	3	4	423-EE-3
Electronics Engineering	551-EE-3	Electronic Instrumentation	2	1	3	4	413-EE-3
	552-EE-3	Embedded Systems Design	2	1	3	4	324-EE-3
	554-EE-3	VLSI Design	2	1	3	4	413EE-3
	556-EE-3	Solar Cells and Photovoltaic Systems	2	1	3	4	514-EE-3

College of Engineering

Department of Electrical Engineering

Course Description Files

Course Title	**Electric Circuit 1**
Course Code	**211-EE-3**
No. of Credit Hrs (Lecture + Tutorial/Lab)	**3 (2+1+0)**
No. of Contact Hrs (Lecture + Tutorial/Lab)	**4 (2+2+0)**
Level-Year	**3 - 2**
Prerequisite (if any)	**129-PHYS-4, 219-MATH-3**

1) Course Objectives:

This course provides basic concepts and theories of the electrical circuit analysis. Also, it provides understanding methodologies of solving electrical circuits and having an experience in the analysis of electric circuits. Also, both DC and AC circuit analysis methods are presented to help the students for solving any types of electrical circuits.

2) Expected Learning Outcomes:

By the end of this course the student will be able to:

1. Identify Basic concepts, components of Electric Circuits and Ohm’s law & Kirchhoff’s laws. (a1)
2. Identify Resistance and source combinations. Star-Delta transformation. (a1)
3. Use techniques and skills for solving DC electric circuits. (b4,b6)
4. Apply knowledge of AC sinusoidal sources, time domain and frequency domain. (b1)
5. Design and conduct experiments for basics of electrical circuits. (b2)
6. Identify Inductance, Mutual Inductance and capacitance, Phasor, impedance and phasor diagram. (a1)
7. Identify and solve AC electric circuits and Steady state power analysis problems (b4)

3) Course Contents

1. Introduction to the Electrical circuits;
2. Ohm’s law and Kirchhoff’s laws;
3. Nodal analysis and Mesh analysis;
4. Source transformation, Superposition, and Thevenin and Norton theories
5. AC circuit and Phasor concepts;
6. Energy storage elements;
7. Impedance, AC circuit theorems, and Power in AC circuits;

4) Teaching Methods:

- Lectures
- Videos
- Discussion
- Self-learning
- Tutorial sheets

5) Mode of Evaluation:
Course Assessment Methods

- Short quizzes on Blackboard
- Writing assignment
- Tutorial Sheets
- Mid-Term Exams
- Final Exam

Evaluation

- Mid-Term Tests (Not less than two Exams)……………………………..... (30 %)
- Practical Work and Assignments …………………………………………….. (20 %)
- Final Exam. ……………………………………………………………………………… (50 %)

6) Textbook(s):

– "Basic Engineering Circuit Analysis", J. D. Irwin, Fourth edition, Macmillan, most recent edition.

7) References:

– Engineering Circuit Analysis (6th Edition), W. H. Hayt, J.E. Kemmerly, and S. Durbin.
– Electronic Devices and Circuit Theory (7th ed.) by R. Boylestad and L. Nashelsky .

Course Title	**Electric circuits 2**
Course Code	**221-EE-3**
No. of Credit Hrs (Lecture + Tutorial/Lab)	**3 (2+1+0)**
No. of Contact Hrs (Lecture + Tutorial/Lab)	**4 (2+2+0)**
Level-Year	**4 – 2**
Prerequisite (if any)	**211-EE-3**

1) Course Objectives:

The course provides students with knowledge, skills and the ability to:

1. Develop the understanding regarding power calculations in ac circuits.
2. Find the circuit frequency response.
3. Understand the condition of resonance.
4. Understand the basic Op-Amp applications.
5. Design a simple passive filter.
6. Understand the mutual inductance and transformers.
7. Analyze a three-phase circuit.
8. Deal with two port circuits.
9. Understand the mutual inductance and transformer

2) Expected Learning Outcomes:

By the end of this course the student will be able to:

1. Analyze the transient behavior of electrical circuits and mutually coupled circuits (Outcome b1).
2. Identify the relation between three phase variables and to analyze three phase circuits (Outcome a1).
3. Identify resonance phenomenon in electrical circuits, and to design a frequency selective circuit (Outcome a1).
4. Perform Transient analysis for first-order and second order circuits (Outcome b1).
5. Get knowledge of operational amplifier basics and some of its simple applications (Outcome a1).
6. Analyze nonlinear circuit using IV characteristics (Outcome b1).
7. Understand the Diode IV characteristics as basic and elementary electronic devices (Outcome b1).
8. Study and explore the diode function for clipping and rectification (Outcome b1).

3) Course Contents

1. Revision of fundamentals of electric circuits
2. Frequency response of RLC and selective circuit
3. Series and parallel resonance
4. Transient analysis of first-order circuits
5. Transient analysis of second-order circuits
6. Introduction to operational amplifier ideal characteristics with simple applications
7. Nonlinear circuits, IV characteristics and Diode characteristics,
8. clipping and rectification circuits

4) Teaching Methods:

- Lectures
- Videos
- Discussion
- Self-learning
- Tutorial sheets

5) Mode of Evaluation:
Course Assessment Methods

- Short quizzes on Blackboard
- Writing assignment
- Tutorial Sheets
- Mid-Term Exams
- Final Exam

Evaluation

- Mid-Term Tests (Not less than two Exams)…………………………….... (30 %)
- Practical Work and Assignments ……………………………………….... (20 %)
- Final Exam. ……………………………………………………………………… (50 %)

6) Textbook(s):

- "Electric Circuits", James W. Nilsson and Susan A. Riedel, Addison Wesley, 6th edition.

7) References:

- Engineering Circuit Analysis (6th Edition), W. H. Hayt, J.E. Kemmerly, and S. Durbin.
- Electronic Devices and Circuit Theory (7th ed.) by R. Boylestad and L. Nashelsky .

Course Title	**Electric Circuits Lab**
Course Code	**222-EE-1**
No. of Credit Hrs (Lecture + Tutorial/Lab)	**1 (0+0+1)**
No. of Contact Hrs (Lecture + Tutorial/Lab)	**2 (0+0+2)**
Level-Year	**4 - 2**
Prerequisite (if any)	**221-EE-3**

1) Course Objectives:

The course provides students with knowledge, skills and the ability to

1. Use Kirchhoff's laws, circuit theorems and node voltage methodology to solve simple DC as well as AC circuits.
2. Apply simple steady state sinusoidal analysis to circuits.
3. Demonstrate a basic understanding of phasors and phasor diagrams for AC circuit analysis.
4. Demonstrate basic proficiency in building basic electrical circuits and operating fundamental electrical engineering equipment.

2) Expected Learning Outcomes:

At the end of the course, students will possess the knowledge and skills to

1. Assemble of simple circuits (Outcome b2).
2. Analyze the circuits using Ohms law (Outcome b2).
3. Connect and analyze Series and Parallel Connection of Resistors (Outcome b2).
4. Connection of Series and parallel connection of Batteries (Outcome b2).
5. Analyze AC Circuits using the Oscilloscope (Outcome b3).
6. Demonstrate basic proficiency in building basic electrical circuits and operating fundamental electrical engineering equipment (Outcome b3).

3) Course Contents:

1. Introductory to lab equipment's and basic components
2. Assemble of simple circuits
3. Ohms law, Series and Parallel Connection of Resistors
4. VDR on No-Load operation, VDR under Load
5. Series and parallel connection of Batteries
6. Determining the Internal Resistance of batteries connected in series and Parallel
7. Introduction to AC Circuits using the Oscilloscope
8. Introduction to AC Circuits using the Function Generator
9. Power Factor measurements and improvement
10. Introduction to Three Phase circuits.

4) Teaching Methods:

- Practical demos
- Videos
- Discussion
- Self-learning
- Tutorial sheets

5) Mode of Evaluation:

Course Assessment Methods

- In Lab discussion
- Writing reports with results presentation
- Mid-Term practical Exams
- Final practical and oral Exam

Evaluation

- Mid-Term Tests (Not less than two Exams)……………………………… (30 %)
- Practical Work and Assignments ……………………………………………. (20 %)
- Final Exam. ………………………………………………………………………… (50 %)

6) Textbook(s):

- Lab manual

7) References:

- "Electric Circuits", James W. Nilsson and Susan A. Riedel, Addison Wesley, 6th edition.

Course Title	**Electrical Measurements**
Course Code	**311-EE-2**
No. of Credit Hrs (Lecture)	**2 (2+0+0)**
No. of Contact Hrs (Lecture)	**2 (2+0+0)**
Level-Year	**4-7**
Prerequisite (if any)	**211-EE-3**

1) Course Objectives:

To inculcate in students about the measurement methods and needed equipment of various electrical quantities and the operation of electrical measuring instruments and their constructional details.

2) Expected Learning Outcomes:

1. Describe the measurement of various electrical quantities such as energy, power, resistance (Outcome a1, c1).
2. Apply the knowledge about the instruments to use them more effectively (Outcome a1, b1, b2).
3. Suggest the kind of instruments that has to be used in accordance with different scenarios and the methods to improve their performance (Outcome a1, b1, b2).
4. Describe the measurement of various electrical quantities such as energy, power, resistance (Outcome b2).

3) Course Contents

1. Measurement Units, standard units for basic quantities, errors, error analysis, data statistics and presentation
2. Measuring Instruments: -Classification – deflecting, control and damping torques – Ammeters and Voltmeters – PMMC, moving iron type instruments – expression for the deflecting torque and control torque, extension of range using shunts and series resistance.
3. Measurement of Power: -Single phase dynamometer wattmeter
4. Measurement of Energy: -Single phase induction type energy meter – driving and braking torques – errors and compensations.
5. Resistance Measurements: Method of measuring low, medium and high resistance – sensitivity of Wheatstone's bridge – Carey Foster's bridge, Kelvin's double bridge for measuring low resistance, measurement of high resistance – loss of charge method.
6. A.C. Bridges: -Measurement of inductance, Quality Factor - Maxwell's bridge, Hay's bridge.
7. Introduction to digital Instruments

4) **Teaching Methods:**
- Lectures
- Videos
- Discussion
- Self-learning
- Tutorial sheets

5) **Mode of Evaluation:**
Course Assessment Methods

- Short quizzes on Blackboard
- Writing assignment
- Tutorial Sheets
- Mid-Term Exams
- Final Exam

Evaluation

- Mid-Term Tests (Not less than two Exams)…………………………….. (30 %)
- Practical Work and Assignments …………………………………………. (20 %)
- Final Exam. ……………………………………………………………………… (50 %)

6) **Textbook(s):**
- Electrical Measurements and measuring Instruments – by E.W. Golding and F.C. Widdis, fifth Edition, Wheeler Publishing.
- Electrical & Electronic Measurement & Instruments by A.K.Sawhney Dhanpat Rai & Co.

7) **References:**
- Electrical Measurements – by Buckingham and Price, Prentice – Hall, latest edition.
- Electrical Measurements by Harris, John Wiley & Sons Inc; latest edition.
- Electrical Measurements: Fundamentals, Concepts, Applications – by Reissland, M.U,

Course Title	**Electrical Measurements Lab**
Course Code	**312-EE-1**
No. of Credit Hrs (Lecture + Tutorial/Lab)	**1 (0+0+1)**
No. of Contact Hrs (Lecture + Tutorial/Lab)	**2 (0+0+2)**
Level-Year	**4-7**
Prerequisite (if any), Co-requisite	**Co- (311-EE-2)**

1) Course Objectives:

To inculcate in students about the testing, calibration and extension of ranges of various measuring devices used for measuring electrical quantities.

2) Expected Learning Outcomes:

The students will be able to

1. Test, calibrate and make measurements using the measuring equipment for measuring various electrical quantities like voltage, current, power and energy (Outcome b2).
2. The students will be able to understand and apply their knowledge in measuring resistances and inductance using different methods (Outcome b2, b3).
3. Apply the knowledge about measuring instruments in extending their ranges to use them more effectively (Outcome b1, b3).

3) Course Contents:

1. Calibration and Testing of PMMC meters: ammeters and voltmeters, extension of range using shunts and series resistance.
2. Measurement of resistance: Wheatstone's bridge – Carey Foster's bridge, Kelvin's double Bridge – Determination of Tolerance.
3. Measurement of 3 phase reactive power with single-phase wattmeter.
4. Calibration and testing of single-phase energy Meter.
5. Measurement of inductance: Quality Factor - Maxwell's bridge, Hay's bridge.

4) Teaching Methods:

- Practical demos
- Videos
- Discussion
- Self-learning
- Tutorial sheets

5) Mode of Evaluation:
Course Assessment Methods

- In Lab discussion
- Writing reports with results presentation
- Mid-Term practical Exams
- Final practical and oral Exam

Evaluation

- Mid-Term Tests (Not less than two Exams)…………………………….. (30 %)
- Practical Work and Assignments …………………………………………. (20 %)
- Final Exam. ……………………………………………………………………… (50 %)

6) Textbook(s):

- Laboratory manual provided by the department.
- Electrical Measurements and measuring Instruments – by E.W. Golding and F.C. Widdis, fifth Edition, Wheeler Publishing.
- Electrical & Electronic Measurement & Instruments by A.K.Sawhney Dhanpat Rai & Co.

7) References:

- Electrical Measurements – by Buckingham and Price, Prentice – Hall, latest edition.
- Electrical Measurements by Harris, latest edition.
- Electrical Measurements: Fundamentals, Concepts, Applications – by Reissland, M.U, New Age International (P) Limited, Publish, latest edition.

Course Title	**Logic Design**
Course Code	**313-EE-3**
No. of Credit Hrs (Lecture + Tutorial/Lab)	**3 (2+1+0)**
No. of Contact Hrs (Lecture + Tutorial/Lab)	**4 (2+2+0)**
Level-Year	**5 - 3**
Prerequisite (if any)	**211-EE-3**

1) Course Objectives:

This course provides students with a comprehensive overview of

1. Logic Design concepts and ideas.
2. Number system
3. Design and optimization of different logic function using gate circuits.
4. Using logic design for replacing the switches in control system.
5. Sequential clocked synchronous circuits
6. work in the field of electronics operation and maintenance.
7. Topics and concepts taught as co-requisite in logic design lab,
8. Prepare students to work efficiently for their graduation project.

2) Expected Learning Outcomes:

1. Define different number systems, binary addition and subtraction, 2's complement representation and operations with this representation (Outcome a1).
2. Understand different algebra theorems and apply them for logic functions (Outcome a1).
3. Define the Karnaugh map for a few variables and perform an algorithmic reduction of logic functions (Outcome a1).
4. Define the following combinational circuits: buses, encoders/decoders, (de)multiplexers, exclusive-ORs, comparators, arithmetic-logic units; and to be able to build simple applications (Outcome a1).
5. Understand the bistable element and the different latches and flip-flops (Outcome b1).
6. Recognize sequential circuits, like counters and shift registers and memory units (Outcome b1).
7. Develop an understanding of designing a digital logic circuit-based system to achieve a prescribed task (Outcome b3).

3) Course Contents

1. Introduction to Number System, Binary, Octal, Decimal and Hexadecimal numbers and base conversions, Complements, binary Codes.
2. Boolean Functions, Basic Logic Gates (OR, AND & NOT, NOR, NAND XOR & XNOR Gates).
3. Adder & Subtractor.
4. Decoders & Encoders.
5. Multiplexers.
6. Code Converters,
7. Latches.
8. Flip-Flops,
9. Registers & Shift Registers,
10. Synchronous & Asynchronous Counters

4) Teaching Methods:

- Lectures
- Videos
- Discussion
- Self-learning
- Tutorial sheets

5) Mode of Evaluation:

Course Assessment Methods

- Short quizzes on Blackboard
- Writing assignment
- Tutorial Sheets
- Mid-Term Exams
- Final Exam

Evaluation

- Mid-Term Tests (Not less than two Exams)................................... (30 %)
- Practical Work and Assignments .... (20 %)
- Final Exam. .... (50 %)

6) Textbook(s):

- Digital Design, M. Morris Mano, Michael D. Ciletti , 4th Edition", Prentice Hall,.

7) References:

- John Passafiume and Michael Douglas, "Digital Logic Design: Tutorial and Laboratory Exercises",Wiley, 2008..

Course Title	**Logic Design Lab**
Course Code	**314-EE-1**
No. of Credit Hrs (Lecture + Tutorial/Lab)	**1 (0+0+1)**
No. of Contact Hrs (Lecture + Tutorial/Lab)	**2 (0+0+2)**
Level-Year	**5 - 3**
Prerequisite (if any)	**CO(313-EE-3)**

1) Course Objectives:

This course provides students with a comprehensive overview of

1. Well knowledge of Logic Design concepts and ideas.
2. Understanding of number system
3. Ability to construct and analyze different logic gate circuits
4. Introduction to sequential clocked synchronous circuits
5. Students should get ready and prepare to work in the field of electronics operation and
6. maintenance.
7. Specially focus on the topics and concepts taught as co-requisite in logic design lab,
8. Prepare students to work efficiently for their graduation project.

2) Expected Learning Outcomes:

1. Operate laboratory equipment (Outcome b2).
2. Recognize and understand basic logic gates (Outcome b1).
3. Design basic logic circuits (Outcome b2).
4. Construct, analyze, and troubleshoot simple combinational and sequential circuits (Outcome b3).
5. Measure and record the experimental data (Outcome b2).
6. Analyze the results, and prepare a formal laboratory report (Outcome b2, d1).
7. Work as a part of a team (Outcome c2).

3) Course Contents

1. Introduction to laboratory equipment and their use.
2. Digital electronic training system, Connectivity of ICs, logic Gates, equipment.
3. Lab Familiarization, Basic Logic Gates (OR, AND & NOT, NOR, NAND XOR & XNOR Gates).
4. Boolean Functions, Adder & Subtractor.
5. Decoders & Encoders, Multiplexers & Magnitude Comparator.
6. Code Converters, Latches & Flip-Flops, Registers & Shift Registers.
7. Synchronous & Asynchronous Counters

4) Teaching Methods:

- Practical demos
- Videos
- Discussion
- Self-learning
- Tutorial sheets

5) Mode of Evaluation:

Course Assessment Methods

- In Lab discussion
- Writing reports with results presentation
- Mid-Term practical Exams
- Final practical and oral Exam

Evaluation

- Mid-Term Tests (Not less than two Exams)................................... (30 %)
- Practical Work and Assignments .... (20 %)
- Final Exam. .... (50 %)

6) Textbook(s):

- Laboratory Manual

7) References:

- Digital Design, M. Morris Mano, Michael D. Ciletti , 4th Edition", Prentice Hall,

Course Title	**Computer Programming**
Course Code	**321-EE-3**
No. of Credit Hrs (Lecture + Tutorial/Lab)	**3 (2+1+0)**
No. of Contact Hrs (Lecture + Tutorial/Lab)	**4 (2+2+0)**
Level-Year	**6-3**
Prerequisite (if any)	**104-CS-2**

1) Course Objectives:

This Course qualifies engineering and computing students to know the principles and the basics of programming, which will be the focus of future studies. Students will learn programming terminology and will obtain a solid grasp of the basic mechanics of programming.

2) Expected Learning Outcomes:

1. Recognize programming concepts (Outcome a1).
2. Understand how to build simple programs (Outcome a1).
3. Understand basics of C++ programming language (Outcome a1).
4. Compare deferent problem solutions (Outcome b1).
5. Evaluate problem solutions alternatives (Outcome b1).
6. Analyze the daily life problem according to problem solving steps (Outcome c1).
7. Evaluate the alternative solutions and make decisions (Outcome c1).

3) Course Contents

1. Computer Fundamentals: Computer Environments, Computer languages and System Development
2. Computer Fundamentals: System software (SW) [compilers, interpreters, utility programs, programming languages]
3. Algorithmic Development: Techniques of problem solving
4. Algorithmic Development: Flowcharting, decision table.
5. Algorithmic Development: Structured Programming concepts.
6. Basics of C++: Structure of C++ program, keywords and identifiers
7. Basics of C++: Constants, variables, data types and type conversion.
8. Basics of C++: Types of operators and expressions
9. Basics of C++: Input and output functions in C++.
10. Basics of C++: Decision Statement: IF-ELSE statement, break, continue, go-to, switch case and nested IF statement.
11. Basics of C++: Loop Control Statements: For loop, While loop, Do-while loop and nested loops.

4) Teaching Methods:

- Lectures
- Videos
- Discussion
- Self-learning
- Tutorial sheets

5) Mode of Evaluation:
Course Assessment Methods

- Short quizzes on Blackboard
- Writing assignment
- Tutorial Sheets
- Mid-Term Exams
- Tutorial Sheets
- Final Exam

Evaluation

- Mid-Term Tests (Not less than two Exams)………………………………. (30 %)
- Practical Work and Assignments …………………………………………. (20 %)
- Final Exam. ……………………………………………………………………………. (50 %)

6) Textbook(s):

- Programming and Problem Solving With C++. By Nell Dale and Chip Weems. Jones & Bartlett Learning; 5 edition (February 27, 2009).

7) References:

- Introductory Problem Solving and Programming:Robotics versus Traditional Approaches Amanda Oddie, Paul Hazlewood, Stewart Blakeway, Alma Whitfield Department of Computer Science, Liverpool Hope University, Hope Park, Liverpool, L16 9JD oddiea@hope.ac.uk, hazlewp@hope.ac.uk, blakews@hope.ac.uk,whitfia@hope.ac.uk http://journals.heacademy.ac.uk/doi/abs/10.11120/ital.2010.09020011

Course Title	**Signals and Systems**
Course Code	**322-EE3**
No. of Credit Hrs (Lecture + Tutorial/Lab)	**3 (2+1+0)**
No. of Contact Hrs (Lecture + Tutorial/Lab)	**4 (2+2+0)**
Level-Year	**6-3**
Prerequisite (if any)	**229-MATH-3**

1) Course Objectives:

To inculcate in students the understanding of signals and systems. Help the student to analyze signals in both time and frequency domain. Make the student able to relate system behavior to circuit time and frequency response.

2) Expected Learning Outcomes:

1. Understand basic signal processing principles and apply them to practical examples (Outcome a1, a2, b1).
2. Use their skills and modern technology to conduct the experiments of signal processing (Outcome b2, b3).
3. Solve primary theorems of signal processing problems (Outcome b4).
4. Recognize of the need of life-long learning (Outcome c1).
5. Work independently and as part of a team and manage resources (Outcome c2).
6. Write the formal report and to increase the confidence of the students (Outcome d1).

3) Course Contents:

1. Motivation and Applications, Signal Classifications, Signal Operations.
2. Singularity Functions; Linear time-Invariant Systems and Convolution.
3. Correlation; Fourier Series and Transform for continuous and discrete time signals; Applications
4. Laplace transform and applications; Introduction to z-transform.

4) Teaching Methods:

- Lectures
- Videos
- Discussion
- Self-learning
- Tutorial sheets

5) Mode of Evaluation:

Course Assessment Methods

- Short quizzes on Blackboard
- Writing assignment
- Tutorial Sheets
- Mid-Term Exams
- Tutorial Sheets
- Final Exam

Evaluation

- Mid-Term Tests (Not less than two Exams)……………………………….. (30 %)
- Practical Work and Assignments …………………………………………….. (20 %)
- Final Exam. ……………………………………………………………………………… (50 %)

6) Textbook(s):

- Signals & Systems. By A. V. Oppenheim, A. S. Willsky and S. H. Nawab, Prentice Hall, 1997.

7) References:

- Haykin and Veen, Signals & Systems, John Wiley, 1998.

Course Title	**Electromagnetics**
Course Code	**323-EE-3**
No. of Credit Hrs (Lecture + Tutorial/Lab)	**3 (2+1+0)**
No. of Contact Hrs (Lecture + Tutorial/Lab)	**4 (2+2+0)**
Level-Year	**6-3**
Prerequisite (if any)	**229-MATH-3+129-PHYS-4**

1) Course Objectives:

To introduce basics of electromagnetics and establish the fundamentals of devices in electromagnetic applications, as required by engineers in energy systems, telecommunications, computing and other technologies.

2) Expected Learning Outcomes:

1. Identify the behavior of electromagnetic field and their applications in the real world (Outcome a1).
2. Apply knowledge of mathematics in solving electromagnetic problems (Outcome b1).
3. Use their skills of various mathematical design techniques in understanding the main subjects of electromagnetic fields (Outcome b2).
4. Ability to work independently and as part of a team and manage resources (Outcome c2).
5. Ability to write the formal report and to increase the confidence of the students (Outcome d1).

3) Course Contents

1. Vector Algebra, Co-ordinate Systems and Transformations;
2. Vector Calculus;
3. Electrostatic Fields
4. Electric Fields in Material Space
5. Magnetostatic Fields
6. Magnetic Forces, Materials and Devices

4) Teaching Methods:

- Lectures
- Discussion
- Self-learning
- Tutorial sheets

5) Mode of Evaluation:

Course Assessment Methods

- Short quizzes on Blackboard
- Writing assignment
- Tutorial Sheets
- Mid-Term Exams
- Final Exam

Evaluation

- Mid-Term Tests (Not less than two Exams)…………………………….. (30 %)
- Practical Work and Assignments ……………………………………….. (20 %)
- Final Exam. ……………………………………………………………………… (50 %)

6) Textbook(s):

- Elements of Electromagnetics, By Matthew N. O. Sadiku, Oxford University Press. (Latest Edition).

7) References:

- Staelin, David, Ann Morgenthaler, and Jin Au Kong. *Electromagnetic Waves.* Upper Saddle River, NJ: Prentice Hall, 1994. ISBN: 9780132258715.

Course Title	**Introduction to Microprocessors and Microcontrollers**
Course Code	**324-EE-3**
No. of Credit Hrs (Lecture + Tutorial/Lab)	**3 (2+1+0)**
No. of Contact Hrs (Lecture + Tutorial/Lab)	**4 (2+2+0)**
Level-Year	**6-3**
Prerequisite (if any)	**313-EE-3**

1) Course Objectives:

At the end of this course, the student should be able to

1. Understand components of the computers, microprocessors and microcontrollers
2. Understand role of CPU, registers, and modes of operation.
3. Understand concept of memory mapping and addressing modes.
4. Understand interrupt vectors, interrupt process, interrupt priorities, external and advanced interrupts.
5. Ability to work independently and as part of a team and manage resources.
6. Ability to write the formal report and to increase the confidence of the students.

2) Expected Learning Outcomes:

1. Understand components of the computers, microprocessors and microcontrollers (Outcome a1).
2. Understand role of CPU, registers, and modes of operation (Outcome a1).
3. Understand concept of memory mapping and addressing modes (Outcome a1).
4. Understand interrupt vectors, interrupt process, interrupt priorities, external and advanced interrupts (Outcome a1).
5. Recognize of components of microprocessors systems and recall architecture of microprocessor models (Outcome a1).
6. Describe bit manipulation methods (Outcome a2).
7. Define the main components of microprocessor (Outcome a2).
8. Analyze the connection strategy between memory and microprocessor (Outcome b1).
9. Use their knowledge in doing experiments (Outcome c1).

3) Course Contents

1. Introduction to microprocessors and microcontroller systems
2. Microprocessor model
3. Techniques used in microprocessor

4. Microprocessor programming techniques
5. Looping, counting, and indexing
6. Flowchart
7. Timing delay using counters
8. Stacks and subroutines
9. I/O memory interface with microprocessor
10. Input output system
11. I/O data transfer techniques
12. DMA transfer
13. I/O interfacing techniques with microprocessor
14. Microcontrollers and microprocessors
15. Microcontrollers in control systems

4) Teaching Methods:

- Lectures
- Videos
- Discussion
- Self-learning
- Tutorial sheets

5) Mode of Evaluation:
Course Assessment Methods

- Short quizzes on Blackboard
- Writing assignment
- Tutorial Sheets
- Mid-Term Exams
- Tutorial Sheets
- Final Exam

Evaluation

- Mid-Term Tests (Not less than two Exams)…………………………….… (30 %)
- Practical Work and Assignments ………………………………………….… (20 %)
- Final Exam. …………………………………………………………………………… (50 %)

6) Textbook(s):

- "Microprocessor and microcontroller System", A.P Godse and Mrs. D. A. Godse

7) References:

- "Microprocessor Architecture, Programming, and the Applications with the 8085"

Course Title	**Microprocessors and Microcontrollers Lab**
Course Code	**325-EE-1**
No. of Credit Hrs (Lecture + Tutorial/Lab)	**1 (0+0+1)**
No. of Contact Hrs (Lecture + Tutorial/Lab)	**2 (0+0+2)**
Level-Year	**6-3**
Prerequisite (if any)	**Co(324-EE-3)**

1) Course Objectives:

At the end of this course, the student should be able to do the following Experiments:

1. Programs for 16 bit arithmetic operations for 8086 (using Various Addressing Modes).
2. Program for sorting an array for 8086.
3. Program for searching for a number or character in a string for 8086.
4. Program for string manipulations for 8086.
5. Program for digital clock design using 8086.
6. Interfacing ADC and DAC to 8086.
7. Parallel communication between two microprocessors using 8255.
8. Serial communication between two microprocessor kits using 8251.
9. Interfacing to 8086 and programming to control stepper motor.
10. Programming using arithmetic, logical and bit manipulation instructions of 8051.
11. Program and verify Timer/Counter in 8051.
12. Program and verify Interrupt handling in 8051.
13. UART Operation in 8051.
14. Communication between 8051 kit and PC.
15. Interfacing LCD to 8051.
16. Interfacing Matrix/Keyboard to 8051.
17. Data Transfer from Peripheral to Memory through DMA controller 8237/8257.

2) Expected Learning Outcomes:

1. Recognize of components of microprocessors systems (Outcome a1).
2. Recall architecture of microprocessor models (Outcome a1).
3. Describe bit manipulation methods (Outcome a2).
4. Define the main components of microprocessor (Outcome a2).
5. Design, build, and document a functional microprocessor system, including hardware and software (Outcome b1).
6. Write robust interrupt routines in a microprocessor system and use technical data sheets (Outcome c1).
7. Use computer laboratory equipment for the construction of digital systems (Outcome c1).

3) Course Contents:

1 Introduction to microprocessors and microcontroller systems
2 Microprocessor model
3 Techniques used in microprocessor
4 Microprocessor programming techniques
5 Looping, counting, and indexing
6 Flowchart
7 Timing delay using counters
8 Stacks and subroutines
9 I/O memory interface with microprocessor
10 Input output system
11 I/O data transfer techniques
12 DMA transfer
13 I/O interfacing techniques with microprocessor
14 Microcontrollers and microprocessors
15 Microcontrollers in control systems

4) Teaching Methods:

- Practical demos
- Videos
- Discussion
- Self-learning
- Tutorial sheets

5) Mode of Evaluation:
Course Assessment Methods

- In Lab discussion
- Writing reports with results presentation
- Mid-Term practical Exams
- Final practical and oral Exam

Evaluation

- Mid-Term Tests (Not less than two Exams)……………………………….. (30 %)
- Practical Work and Assignments ……………………………………….….. (20 %)
- Final Exam. ……………………………………………………………………….…. (50 %)

6) Textbook(s):

- Lab Manual
- "Microprocessor and microcontroller System", A.P Godse and Mrs. D. A. Godse

7) References:

- "Microprocessor Architecture, Programming, and the Applications with the 8085"

Course Title	**Automatic Control**
Course Code	**411-EE-3**
No. of Credit Hrs (Lecture + Tutorial/Lab)	**3 (2+1+0)**
No. of Contact Hrs (Lecture + Tutorial/Lab)	**4 (2+ 2+0)**
Level-Year	**7th Level/ 4th Year**
Prerequisite (if any)	**322-EE-3**

1) Course Objectives:

The main objective of the course is to acquire the basic concepts of control systems' analysis; particularly, to learn the basics of control systems representations/modeling and stability analysis (in time and frequency domains).

2) Expected Learning Outcomes:

1 Ability to formally model basic electrical and mechanical systems (Outcome a1).
2 Understand the properties of feedback control and basic control actions (Outcome a2).
3 How to apply the design control techniques to single-variable continuous systems in the time and frequency domains (Outcome b1).
4 Ability to select the different basic control schemes (Outcome b1).
5 Ability to model a number of electrical, mechanical, and electromechanical systems, and by studying the basic components of control system, the course helps in the department’s production of students with a strong foundation in electrical engineering (Outcome a2).

3) Course Contents

1 System representation,
2 State variable analysis,
3 Stability analysis,
4 Time domain analysis,
5 Root locus, Bode plots, Nyquist plots,
6 System modeling,
7 Introduction to basic control design.

4) Teaching Methods:

- Lectures
- Videos
- Discussion
- Self-learning
- Tutorial sheets

5) Mode of Evaluation:

Course Assessment Methods

- Short quizzes on Blackboard
- Writing assignment
- Tutorial Sheets
- Mid-Term Exams
- Final Exam

Evaluation

- Mid-Term Tests (Not less than two Exams)…………………………….. (30 %)
- Tutorial Work, Quizes and Assignments ………………………………………….. (20 %)
- Final Exam. …………………………………………………………………………… (50 %)

6) Textbook(s):

- Modern Control Engineering (4th edition) by K. Ogata, 2002

7) References:

- Control System Engineering, Norman S. Nice, Fifth Edition, John Wiley &Sons
- Feedback Control of Dynamic Systems by Gene F. Franklin, J. David Powell and Abbas Emami Naeini, 4th Edition, Prentice Hall, 2002.

Course Title	**Automatic Control Lab**
Course Code	**412-EE-1**
No. of Credit Hrs (Theoretical + Tutorial/Lab)	**1 (0+1)**
No. of Contact Hrs (Theoretical + Tutorial/Lab)	**2 (0+ 2)**
Level-Year	**7th Level/ 4th Year**
Prerequisite (if any)	**411-EE-3 Co-requisite)**

1) Course Objectives:

The main objective of the course is to supplement the Automatic Control Theory Course (411EE-3) through practical experiment in the laboratory.

2) Expected Learning Outcomes:

1. Ability to practically model basic electrical and mechanical systems.
2. The properties of feedback control and basic control actions.
3. Apply the design control techniques to single-variable continuous systems in the time and frequency domains.
4. Ability to select the different basic control schemes.
5. By strongly encouraging students to participate in class and occasionally solve problems in teams and by valuing attendance (and on time), this course equips the students with some group dynamics abilities and professional practices which supports the department's Specification of producing graduates with good communication skills.

3) Course Contents

Experiments are organized in several groups of real time applications, such as:

- Step Response analysis of 1st and 2nd order System.
- Frequency Response of 1st and 2nd order System.
- Root Locus Plot of a given system.
- Bode plots of a given system
- Nyquist plots of a given system
- Lead-Lag compensation design
- PID controller design
- Speed control of DC motor
- Position Control.

4) Teaching Methods:

- Lectures

- Videos
- Discussion
- Self-learning
- Lab manuals

5) Mode of Evaluation:
Course Assessment Methods

- Short quizzes
- Experiment Manual
- Experiment Sheets
- Mid-Term Exams
- Final Exam

Evaluation

- Mid-Term Tests (Not less than two Exams)…............................... (30 %)
- Tutorial Work, Quizes and Assignments …... (20 %)
- Final Exam. ………………………………………………….……………………… (50 %)

6) Textbook(s):

- Lab Manual.
- Modern Control Engineering (4th edition) by K. Ogata, 2002

7) References:

Nil

Course Title	**Basics of Electronic Devices**
Course Code	**413-EE-3**
No. of Credit Hrs (Lecture + Tutorial/Lab)	**3 (2+1+0)**
No. of Contact Hrs (Lecture + Tutorial/Lab)	**4 (3+ 1+0)**
Level-Year	**7-4**
Prerequisite (if any)	**211-EE-3**

1) Course Objectives:

To introduce students to the basic physics and operation of semiconductor devices as well as some simple applications. Students will gain good background for more advanced courses.

2) Expected Learning Outcomes:

1. Knowledge of basic semiconductor physics (Outcome a1).
2. Knowledge and understanding of applications of semiconductor devices (Outcome b2).
3. Understanding of the construction of semiconductor devices using semiconductor materials (Outcome b2).
4. Knowledge and understanding of different operating modes of semiconductor devices (Outcome a2).
5. Ability to design and construct circuits using semiconductor devices (Outcome b1).
6. Application of electric circuit theory to semiconductor circuits (Outcome b1).
7. Analysis and design of electronic circuits (Outcome b2).
8. Development of the background and fundamental knowledge to pursue more advanced courses (Outcome c1).

3) Course Contents:

1. Intrinsic and doped semiconductors, drift and diffusion currents.
2. PN junction diode: basic structure, I-V characteristics, large and small-signal models.
3. Diode circuit applications.
4. Bipolar junction transistor (BJT): basic structure, modes of operation, dc biasing, dc and small-signal models, single stage BJT amplifiers.
5. Field-effect transistors (FET): structure and operation of enhancement and depletion MOSFETs, I-V characteristics, dc biasing.
6. Introduction to JFET.

4) Teaching Methods:

Lectures

- Discussion

- Self-learning
- Tutorial sheets

5) Mode of Evaluation:

Course Assessment Methods

- Short quizzes on Blackboard
- Writing assignment
- Tutorial Sheets
- Mid-Term Exams
- Final Exam

Evaluation

- Mid-Term Tests (Not less than two Exams)……………………………… (30 %)
- Practical Work and Assignments ……………………………………………. (20 %)
- Final Exam. ………………………………………………………………………… (50 %)

6) Textbook(s):

- A. S. Sedra and K. C. Smith, "Microelectronic Circuits: Theory and Applications", Oxford University Press, 2014.

7) References:

- J. Millman and A. Grabel,"Digital and analog circuits and systems," Wiley Eastern, 1987.

Course Title	**Electronic Devices Lab**
Course Code	**414-EE-1**
No. of Credit Hrs (Lecture + Tutorial/Lab)	**1 (0+0+1)**
No. of Contact Hrs (Lecture + Tutorial/Lab)	**2 (0+0+2)**
Level-Year	**7-4**
Prerequisite (if any)	**Co(413-EE-3)**

1) Course Objectives:

The course is designed to develop practical knowledge of basic electronic devices, their operation and application in designing modern electronic circuits.

2) Expected Learning Outcomes:

1. Knowledge of basic semiconductor physics (Outcome a1).
2. Knowledge and understanding of applications of semiconductor devices (Outcome b2).
3. Understanding of the construction of semiconductor devices using semiconductor materials (Outcome b2).
4. Ability to design and construct circuits using semiconductor devices (Outcome b1).
5. Application of electric circuit theory to semiconductor circuits (Outcome b1).
6. Analysis and design of electronic circuits (Outcome b2).
7. Development of the background and fundamental knowledge to pursue more advanced courses (Outcome c1).
8. Development of technical writing and team-working skills (Outcome c2).

3) Course Contents

Conduct experiments that cover the following topics

1 PN junction diode: basic structure, I-V characteristics, large and small-signal models.
2 Diode rectifier circuits, clipping and clamping, Zener diode simple regulator
3 Bipolar junction transistor (BJT): basic structure, modes of operation, dc biasing, dc and small-signal models, single stage BJT amplifiers.
4 Field-effect transistors (FET): structure and operation of enhancement and depletion MOSFETs, I-V characteristics, dc biasing.

4) Teaching Methods:

- Practical Demos
- In Lab experimental setup
- Discussion
- Self-learning

- Tutorial sheets

5) Mode of Evaluation:

Course Assessment Methods

- In Lab discussion
- Writing reports with results presentation
- Mid-Term practical Exams
- Final practical and oral Exam

Evaluation

- Mid-Term Tests (Not less than two Exams)………………………………. (30 %)
- Practical Work and Assignments ……………………………………………. (20 %)
- Final Exam. ……………………………………………………………………………. (50 %)

6) Textbook(s):

- Laboratory Manual.

7) References:

- A. S. Sedra and K. C. Smith, "Microelectronic Circuits: Theory and Applications",Oxford University Press, 2014.

Course Title	**Electromechanical Energy Conversion 1**
Course Code	**421-EE-3**
No. of Credit Hrs (Lecture + Tutorial/Lab)	**3 (2+1+0)**
No. of Contact Hrs (Lecture + Tutorial/Lab)	**4 (2+2+0)**
Level-Year	**9-5**
Prerequisite (if any)	**221-EE-3**

1) Course Objectives:

This course aims at providing the basic knowledge required by practicing engineers for dealing with the principals and different types direct-current machines and transformers in order to:

1. Enhance the information about construction and main types of direct-current machines and transformers
2. Acquire the applications of direct-current machines and transformers
3. Assist to know the main characteristics of direct-current machines and transformers
4. Encourage Knowing the design aspects of direct-current machines and transformers
5. Enhance thought about main methods of deriving the equivalent circuit of direct-current machines and transformers
6. Enable Studying the main characteristics of transformers and their type and routine tests
7. Assist the knowledge about the concept of instrument transformers.

2) Expected Learning Outcomes:

1. Distinguish the different types of direct-current machines and transformers (Outcome a2).
2. Justify the advantages and the disadvantages of different methods used to control the speed of direct-current motors (Outcome a2).
3. Develop the mathematical formulas for dealing with the different types of direct-current machines and transformers (Outcome b1).
4. Solve the equation of direct-current machines and transformers to get their performance (Outcome b2).
5. Put into practice the characteristics of direct-current machines and transformers (Outcome b2).
6. Validate the different methods of controlling the speed of direct-current motors (Outcome b3).
7. Apply the mmf equation to design different types of machines (Outcome b3).
8. Validate traditional method of design using computer-aided design method (Outcome c2).

3) Course Contents:

1. Transformer types
2. Construction and theory of operation of transformers

3. Equivalent-circuit and the characteristics of ideal and practical transformer
4. Calculating the voltage regulation and the efficiency of transformers
5. Determination of transformer's parameters from open circuit test and short circuit test data
6. Cooling methods of power transformer
7. Autotransformer (step-up and step-down)
8. Three-phase transformers
9. An overview about the electromagnetic energy conversion
10. Construction and theory of operation of direct-current machines
11. Magnetic circuit and armature reaction of direct-current machines
12. Performance analysis of the different types of direct-current generators.
13. Performance analysis of the different types of direct-current motors

4) Teaching Methods:

- Lectures
- Discussion
- Self-learning
- Tutorial sheets

5) Mode of Evaluation:
Course Assessment Methods

- Short quizzes on Blackboard
- Writing assignment
- Tutorial Sheets
- Mid-Term Exams
- Final Exam

Evaluation

- Mid-Term Tests (Not less than two Exams)…………………………….... (30 %)
- Practical Work and Assignments ……………………………………….…. (20 %)
- Final Exam. ……………………………………………………….………………… (50 %)

6) Textbook(s):

- P. C. Sen, Principles of Electric Machines and Power Electronics
- Stephen J. Chapman, Electric Machinery Fundamentals

7) References:

- Course Notes: Presentation slides is submitted to student every lecture
- Recommended Books: Theodore Wildi, Electrical Machines, Drives and Power Systems
- Periodicals, Web Sites, … etc: To be cited during the course

Course Title	**Numerical Methods**
Course Code	**422-EE-3**
No. of Credit Hrs (Lecture + Tutorial/Lab)	**3 (2+1+0)**
No. of Contact Hrs (Lecture + Tutorial/Lab)	**4 (2+2+0)**
Level-Year	**8-4**
Prerequisite (if any)	**319-MATH-3**

1) Course Objectives:

The primary goal is to provide electrical engineering majors with a basic knowledge of numerical methods including: root-finding, elementary numerical linear algebra, solving systems of linear equations, curve fitting, and numerical solution to ordinary differential equations.

2) Expected Learning Outcomes:

1. Knowledge of mathematical techniques for engineering (a1, b1).
2. Ability to implement mathematical techniques using different algorithms (b1).
3. Knowledge and ability to solve mathematical problems using computing tools (b6).
4. Understanding the issues of complexity and accuracy when implementing mathematical techniques in real world scenarios (b3, b5).
5. Knowledge of the applications of various mathematical techniques to solve real world engineering problems (b4).
6. Sound working knowledge of a computing tool of importance (MATLAB) (b6).
7. Sound working knowledge of a computing tool of importance (MATLAB) (b6)
8. Ability to formulate and solve engineering problems (b4)

3) Course Contents:

1. Basics of Matrices. Solutions of Linear Equations: Direct Methods: Cramer's Rule, Matrix Inversion Method, Gaussian Elimination Method, Gauss - Jordon Method.
2. Iterative Methods: Jacobi Method, Gauss - Seidal Method, Relaxation Method.
3. Solutions of Non-Linear Equations: Bisection Method, Method of Chords, Secant Method, Newton-Raphson Method, Fixed Point Iteration Method.
4. Solution of Ordinary Differential Equations: Taylor Series, Euler Method, Modified Euler Method, Ranga – Kutta Methods.
5. Systems of O.D. Equations and Higher Order Diff. equations. MATLAB Applications on above mentioned topics

4) Teaching Methods:

- Lectures

- Discussion
- Self-learning
- Tutorial sheets

5) Mode of Evaluation:

Course Assessment Methods

- Short quizzes on Blackboard
- Tutorial Sheets
- Mid-Term Exams
- Final Exam

Evaluation

- Mid-Term Tests (Not less than two Exams)……………………………..... (30 %)
- Practical Work and Assignments …………………………….…………….. (20 %)
- Final Exam. ……………………………………………….…………….…….…… (50 %)

6) Textbook(s):

- Rizwan Bhutt, "Introduction to numerical analysis Using MATLAB" John and Bartlett Publisher. McGraw-Hill.

7) References:

- Gerald CF and Wheatly PO, "Applied Numerical Analysis "Addison-Wesley Publishing Company.

Course Title	**Analog Communications**
Course Code	**423-EE-3**
No. of Credit Hrs (Lecture + Tutorial/Lab)	**3 (2+1+0)**
No. of Contact Hrs (Lecture + Tutorial/Lab)	**4 (2+2+0)**
Level-Year	**8 - 4**
Prerequisite (if any)	**322-EE-3**

1) Course Objectives:

To develop an understanding of signal analysis in time and frequency domain, analog modulation (AM) techniques and their performance in the presence of channel noise moreover, to provide experimental foundation for the theoretical concepts of the AM. The students will also become familiar with pulse modulation techniques.

2) Expected Learning Outcomes:

1. Understanding of signal analysis in time and frequency domain (Outcome a1).
2. Knowledge and understanding of analog communication principles (Outcome a2).
3. Understanding of different analog modulation techniques used in analog communications (Outcome a2).
4. Ability to analyze the characteristics and performance of analog modulation techniques (Outcome b1).
5. Compare the practical results with theoretical results to interpret and understand different rules and laws studied in course (Outcome b1).
6. Ability to characterize and analyze real world imperfections (noise) within reasonable engineering assumptions (Outcome b1).
7. Knowledge of design and implementation of analog communication systems (Outcome b2).
8. Learn how to work in a teamwork group (Outcome c2).
9. Ability to write technical reports and work in teams (Outcome d1).

3) Course Contents:

1. Review of spectrum for periodic and aperiodic signals – continuous and line spectra.
2. Linear modulation: Need for modulation, Expression for AM wave, power and BW, expression for DSB-SC/SSB, power and BW, comparison
3. Modulation and Demodulation of AM – Rectifier detector, envelope detector, Product Modulation and demodulation of DSB-SC, SSB – Frequency discrimination method, Hilbert transform, Phase discrimination method

4. Angle Modulation: FM expression, Bessel function analysis, power and BW considerations, Carson's rule for BW approximation, PM expression, relationship between FM and PM, Armstrong method of FM generation, PLL and FM demodulation using PLL
5. Introduction to Information theory – Entropy, Source coding: Huffman code, Shannon Fano code

4) Teaching Methods:

- Lectures
- Lab work
- Videos
- Discussion
- Self-learning
- Tutorial sheets

5) Mode of Evaluation:

Course Assessment Methods

- Short quizzes on Blackboard
- Writing assignment
- Tutorial Sheets
- In Lab discussion
- Writing reports with results presentation
- Mid-Term Exams
- Final Exam

Evaluation

- Mid-Term Tests (Not less than two Exams)………………………………. (30 %)
- Practical Work and Assignments ……………………………………….. (20 %)
- Final Exam. ………………………………………………………………………… (50 %)

6) Textbook(s):

- Simon Haykin, Communication Systems, John Wiley & Sons, Inc., New York, 4th Edition, 2001.
- Lab Nots

7) References:

- Bruce Carlson, Paul B. Crilly, and Janet C. Rutledge, Communication Systems, McGraw Hill, Boston, 4th Edition, 2002.
- B. P. Lathi, Modern Digital and Analog Communication Systems, Oxford University Press, New York, 3rd Edition, 1998.

Course Title	**Digital Signal Processing**
Course Code	**512-EE-3**
No. of Credit Hrs (Lecture + Tutorial/Lab)	**3 (2+1+0)**
No. of Contact Hrs (Lecture + Tutorial/Lab)	**4 (2+2+0)**
Level-Year	**9-5**
Prerequisite (if any)	**322-EE-3**

1) Course Objectives:

The course is designed to introduce the students to the representation of signals and systems in time and frequency domains. Mathematical tools fundamental to all DSP techniques shall be taught. An understanding of the design, analysis and implementation of DSP systems shall be developed.

2) Expected Learning Outcomes:

1. Understand how the combination of A/D conversion, digital filtering, and D/A conversion may be used to filter analog signals such as speech and music (1-D), and images (2-D) (Outcome a1).
2. Understand the time- and frequency-domain concepts (Outcome a1).
3. Understand the roles of down sampling and up sampling in digital processing of analog signals (Outcome a1)..
4. Understand the relations between the DTFT, the DFT, and the FFT (Outcome a1).
5. Design FIR filters using the Windowing Method (Outcome b1).
6. Implement and test FFT-based frequency response computation for stable IIR filters (Outcome b1).
7. Discover the differences between the types of commercially available DSP chipsets (Outcome b1).
8. Understanding of safe and ethical engineering practices (Outcome b3).

3) Course Contents:

1. Review of discrete-time signals and systems;
2. The Discrete-Time Fourier transform, Fast Fourier Transform
3. Z Transform, Recursive and no recursive digital filters design and realization;
4. Decimation and interpolation;
5. Applications of digital signal processing in communications.

4) Teaching Methods:

- Lectures
- Discussion

- Self-learning
- Tutorial sheets

5) Mode of Evaluation:

Course Assessment Methods

- Short quizzes on Blackboard
- Tutorial Sheets
- Mid-Term Exams
- Final Exam

Evaluation

- Mid-Term Tests (Not less than two Exams)……………………………..… (30 %)
- Practical Work and Assignments ………………………………….……….. (20 %)
- Final Exam. …………………………………………………….…………………… (50 %)

6) Textbook(s):

– Discrete time signal processing By Alan V. Oppenheim, Ronald, W Schafer, John R. Buck, 2nd edition, Pearson Education.

7) References:

– Digital Signal Processing – a computer based approachh By, Sanjit K. Mitra and Yonghong Kuo, 2nd edition, McGraw Hill

Course Title	Digital Signal Processing Lab
Course Code	513-EE-1
No. of Credit Hrs (Lecture + Tutorial/Lab)	1 (0+0+1)
No. of Contact Hrs (Lecture + Tutorial/Lab)	2 (0+0+2)
Level-Year	9 - 5
Prerequisite (if any)	Co (512-EE-3)

1) Course Objectives:

The course is designed to complement Digital Signal Processing theory course and intended to provide practical knowledge of digital signal processing

2) Expected Learning Outcomes:

1. Describe and analyze digital signals and systems in time and frequency domain using MATLAB (Outcome a1).
2. Process digital signals in time and frequency domains using MATLAB (Outcome b1).
3. Sample analog signals and observe the effects of violating the sampling theorem and quantizing the sampled signal (Outcome b1).
4. Design digital filters of different kinds in MATLAB (Outcome b1) .
5. Use of different hardware and software tools for programming, implementation, tests and measurements (Outcome b3).
6. In a team, identify any useful DSP application/algorithm, then plan, design and implement it on a digital signal processor or in MATLAB (Outcome c2).

3) Course Contents:

1. Sampling –Sampling theorem
2. Quantization and calculation of quantization error
3. Up-sampling and Down-sampling
4. Fast Fourier Transform
5. FIR filter design
6. IIR filter design
7. Filtering and effects of filtering.

4) Teaching Methods:

- Practical Demos
- In Lab experimental setup
- Discussion
- Self-learning

- Tutorial sheets

5) Mode of Evaluation:

Course Assessment Methods

- In Lab discussion
- Writing reports with results presentation
- Mid-Term practical Exams
- Final practical and oral Exam

Evaluation

- Mid-Term Test……………………………………………………………………….. (30 %)
- Practical Work and Assignments ……………………………………………….. (20 %)
- Final Exam. ……………………………………………………………………………… (50 %)

6) Textbook(s):

– Lab Manual

7) References:

– Discrete time signal processing By Alan V. Oppenheim, Ronald, W Schafer, John R. Buck, 2nd edition, Pearson Education.
– Digital Signal Processing – a computer based approachh By, Sanjit K. Mitra and Yonghong Kuo, 2nd edition, McGraw Hill

Course Title	**Electric Power System**
Course Code	**514-EE-3**
No. of Credit Hrs (Theoretical + Tutorial/Lab)	**3 (2+1)**
No. of Contact Hrs (Theoretical + Tutorial/Lab)	**4 (2+ 2)**
Level-Year	**5/9**
Prerequisite (if any)	**221-EE-3**

1) Course Objectives:

This course is aim to help the students to understand the basic components of a power system.

This course also deals the design and performance analysis of power transmission lines. Strong emphasis will be given to the demonstration of the theoretical material with examples drawn from per unit systems and the basic concepts of Power flow and load flow analysis. Application cases will be discussed during the lectures and will be further illustrated during the tutorials with real examples the methodologies for main and alternative sources of electrical energy.

2) Expected Learning Outcomes:

1. Describe and analyze electric power generation, based on principles of conversion of energy from other sources, including thermal, solar and wind (Outcome a1).
2. Describe the components of Power System and explain their interactions (Outcome a1).
3. Describe the basic principles use of voltage levels in transmission and distribution, transmission line parameters (Outcome b1).
4. Design and model of the transmission line and evaluate its performance (Outcome b1).
5. Understand the nature of balanced and unbalanced faults occur on the transmission lines (Outcome b1).
6. Explain the per unit systems and reactance diagram (Outcome b2).

3) Course Contents:

1. The Power System,
2. Transmission Line Parameters
3. Line Model and Performance
4. Per unit system calculation, per unit calculations and equivalent diagram
5. Power/ Load Flow Analysis
6. Balanced and Unbalanced Faults

4) Teaching Methods:

- Lectures
- Videos
- Discussion
- Self-learning
- Tutorial sheets

5) Mode of Evaluation:

Course Assessment Methods

- Short quizzes on Blackboard
- Writing assignment
- Tutorial Sheets
- Mid-Term Exams
- Final Exam

Evaluation

- Mid-Term Tests (Not less than two Exams)…………………………….... (30 %)
- Practical Work and Assignments …………………………………………... (20 %)
- Final Exam. ……………………………………………………………………… (50 %)

6) Textbook(s):

– Hadi Saadat, "Power System analysis" McGraw-Hill,
– Stevenson WD,Jr "Elements of Power System analysis" McGraw-Hill, 4th Edition.Series) by Leonard L. Grigsby.

7) References

– Alarainy, et…," Fundamentals of electrical power engineering", King Saud Univ., academic press.
– Gross CA, "Power System analysis" John Wiley.

Course Title	**Electric Power System Lab**
Course Code	**515-EE-1**
No. of Credit Hrs (Lecture + Tutorial/Lab)	**1 (0+0+1)**
No. of Contact Hrs (Lecture + Tutorial/Lab)	**2 (0+0+2)**
Level-Year	**5/9 or 5/10**
Prerequisite (if any)	**Co (514-EE-3)**

1) Course Objectives:

1. Emphasized the concepts taught in the power system theoretical courses.
2. To gain the laboratory benefits of modeling an actual power system under different loading conditions.
3. Prepared to do experimental work in the graduation project when necessary.
4. Prepared to work in the field of operation, control and maintenance of power systems.
5. Giving the student the chance to recognize the induction and dc machine, and teach them how to read the name plate data of the machines and implement it.
6. Teaching the students, the essential experiments which are necessary to determine the parameters and the performance characteristics of the induction and dc machines
7. Emphasizing the concepts taught in the machine theoretical courses, and preparing them to do experimental work in their graduation project when necessary.

2) Expected Learning Outcomes:

1. Ability to carry out test for protection relays and the commissioning tests in the sites (Outcome b1).
2. Ability to carry out test for power systems on the system simulator (Outcome b1).
3. Ability to recognize different electrical machines which are taught in the electrical machine courses, and teach them how to read the name plate data of the machines and implement it (Outcome a2).
4. Be prepared to work in the field of operation, control and maintenance (Outcome a2).
5. Emphasized the concepts taught in the machine theoretical courses (Outcome a2).
6. Prepare them to do experimental work in their graduation project when necessary (Outcome b2).
7. Ability to carry out necessary tests after manufacturing the machines or the commissioning tests in the sites (Outcome b1).
8. The ability to select the suitable instruments and materials as per assigned objective of experiment (Outcome b1).
9. Ability to prepare laboratory setup (circuits) with proper connections (Outcome b2).

3) Course Contents:

Conduct experiments to cover the following topics

1. Symmetrical and unsymmetrical fault analysis;

2. Load-flow simulation;
3. Transient stability simulation;
4. Active and reactive power generator control;
5. Characteristics of isolated and interconnected systems.
6. Equivalent circuit of transformers;
7. Three-phase connections and harmonic problems;
8. Equivalent circuit of three-phase and single-phase induction motors;
9. Load testing of induction motors;
10. Starting of single-phase induction motors;
11. Terminal characteristics of dc machines.

4) Teaching Methods:

- Lab demos
- Videos
- In Lab dissection
- Self-learning

5) Mode of Evaluation:

Course Assessment Methods

- Lab demos
- In lab discussion
- Writing reports and results presentation
- Mid-Term Exams
- Final Exam

Evaluation

- Mid-Term Tests (Not less than two Exams)………………………………. (30 %)
- Practical Work and Assignments ……………………………………………. (20 %)
- Final Exam. …………………………………………………………………………… (50 %)

6) Textbook(s):

- Lab manual
- Saadat, “Power System Analysis”, McGraw Hill.
- S. J. Chapman, “Electric Machinery Fundamentals”, McGraw Hill

7) References:

Grainger and Stevenson, "Power System Analysis", McGraw Hill
SARMA, "Electric Machines Steady State Theory and Dynamic Performance".
Laboratory Manual will be distributed by the Lecturer

Course Title	**Analog and Digital Electronic Circuits**
Course Code	**521-EE-3**
No. of Credit Hrs (Lecture + Tutorial/Lab)	**3 (2+1+0)**
No. of Contact Hrs (Lecture + Tutorial/Lab)	**4 (2+2+0)**
Level-Year	**9 - 5**
Prerequisite (if any)	**413-EE-3**

1) Course Objectives:

This course covers the design, construction, and debugging of analog and digital electronic circuits. The main contents are: Op-amp applications: inverting and non-inverting amplifiers, integrator, difference amplifier. Differential amplifier. Current Mirror. Negative and positive feedback. Frequency response of cascaded amplifiers and gain-bandwidth considerations. Concepts of feedback, stability and frequency compensation. Includes weekly laboratory

2) Expected Learning Outcomes:

1. Learn how to develop and employ circuit models for elementary electronic components, e.g., resistors, sources, inductors, capacitors, diodes and transistors (Outcome a1, b1).
2. Identify the basic blocks in any electronic system (Outcome a1).
3. Become adept at using various methods of circuit analysis, including simplified methods such as series-parallel reductions, voltage and current dividers, and the node method (Outcome a1, b1).
4. Appreciate the consequences of linearity, in particular the principle of superposition and Thevenin Norton equivalent circuits (Outcome b1).
5. Develop the capability to analyze and design simple circuits containing non-linear elements such as transistors using the concepts of load lines, operating points and incremental analysis (Outcome b2, b3).
6. Be able to differentiate electronic from electrical systems (Outcome b1).
7. Learn how to work in a teamwork group (Outcome c2).
8. Ability to write technical reports and work in teams (Outcome d1).

3) Course Contents:

1. Introduction and background.
2. Frequency Response.
3. Operational Amplifiers & Active Filters.

4. Power Amplifiers.
5. Digital ICs.
6. Feedback & Oscillators.
7. Digital Circuits

4) Teaching Methods:

- Lectures
- Videos
- Discussion
- Self-learning
- Tutorial sheets
- **Lab Work**

5) Mode of Evaluation:

Course Assessment Methods

- Short quizzes on Blackboard
- Writing assignment
- Tutorial Sheets
- Mid-Term Exams
- Final Exam
- **In Lab Discussion**

Evaluation

- Mid-Term Tests (Not less than two Exams)…………………………….… (30 %)
- Practical Work and Assignments ……………………………………….…. (20 %)
- Final Exam. ……………………………………………………….…………… (50 %)

6) Textbook(s):

– Sedra and K. Smith, “Microelectronic Circuits”, 9th Ed..

7) References:

– Paul Horowitz, The Art of Electronics, Winfield Hill, 2nd ed, 1996.

Course Title	**Analog and Digital Electronic Circuits Lab**
Course Code	**522-EE-1**
No. of Credit Hrs (Lecture + Tutorial/Lab)	**1(0+0+1)**
No. of Contact Hrs (Lecture + Tutorial/Lab)	**2 (0+0+2)**
Level-Year	**9 - 5**
Prerequisite (if any)	**Co (521-EE-3)**

1) Course Objectives:

This course is designed to:

1. Emphasize the concepts taught in the analog and digital electronic course.
2. Gain the laboratory benefits of modeling an actual Ideal and Non-Ideal Op-amp circuits and its applications.
3. Analyze different analog and digital electronic circuits such as BJT, CMOS, TTL and ECL.
4. Emphasizing the concepts taught in the theoretical courses, and preparing them to do experimental work in their graduation project when necessary

2) Expected Learning Outcomes:

1. An understanding of the fundamental principles and applications of digital logic circuits (Outcome a1).
2. An ability to design periodic signal generators from digital logic circuits (Outcome b1, b3).
3. An understanding of filter design principles and circuit technologies (Outcome a1, b3).
4. An ability to apply theory and realize analog filter circuits (Outcome a1, b3).
5. Learn how to work in a teamwork group (Outcome c2).
6. Ability to write technical reports and work in teams (Outcome d1).

3) Course Contents

1. Orientation.
2. Ideal OP-Amp characteristics.
3. Ideal Op-amp Application.
4. Non ideal op-amp characteristics.
5. Non-ideal op-amp applications.
6. Oscillators, Schmitt trigger and unstable multi-vibrator.
7. CMOS inverter characteristics.
8. TTL inverter characteristics.
9. ECL characteristics

4) Teaching Methods:

- Practical Demos
- In Lab experimental setup
- Discussion
- Self-learning
- Tutorial sheets
- Lab Work

5) Mode of Evaluation:

Course Assessment Methods

- In Lab discussion
- Writing reports with results presentation
- Mid-Term practical Exams
- Final practical and oral Exam

Evaluation

- Mid-Term Tests (Not less than two Exams)………………………………. (40 %)
- Practical Work and Assignments ………………………………………….. (20 %)
- Final Exam. ……………………………………………………………………… (40 %)

6) Textbook(s):

- Lab manual is available in the lab

7) References:

- Jaeger, R.C," Microelectronic Circuit Design, 2nd Edition", McGraw Hill,2004
- Herniter, M.E., Schematic Capture with Cadence PSpice, Prentice-Hall, 2 nd Edition, 2003,

Course Title	**Digital Control Systems**
Course Code	**523-EE-3**
No. of Credit Hrs (Lecture + Tutorial/Lab)	**3 (2+1+0)**
No. of Contact Hrs (Lecture + Tutorial/Lab)	**4 (2+ 2+0)**
Level-Year	**9 - 5**
Prerequisite (if any)	**411-EE-3**

1) Course Objectives:

1. The core course in electrical engineering introduces the fundamental concepts, principles and application of digital control system analysis.
2. This course goes deeper into the various aspects of digital control engineering.
3. The topics cover classical control design methods as well as the modern control design techniques.
4. A number of chosen problems are solved to illustrate the concepts clearly. A suite of exercises is also provided in the appendix after each module.

2) Expected Learning Outcomes:

1. Understand control system design techniques, their limitations and benefits (Outcome a1).
2. Become familiar with issues faced in sampling, digital data and discrete time systems (Outcome b1).
3. Gain experience in designing digital controllers either by emulating continuous time compensators or by direct digital design using the Root Locus and Frequency Response methods (Outcome b2).
4. Be given a brief introduction to digital filter design (Outcome b4).

3) Course Contents

1. Introduction, digital control system and Analog control system
2. Discrete time systems and the z-transform and properties of the z-transform
3. Solution of difference equations
4. The inverse z-transform, simulation diagrams and flow graphs,
5. State variables, transfer functions, solutions of the state equations
6. Sampling and reconstruction
7. Open-loop discrete time systems
8. State variable models, discrete state equations.
9. Closed-loop systems: derivation procedure, state-variable models
10. Controllability and Observability
11. Stability analysis techniques

4) Teaching Methods:

- Lectures
- Videos
- Discussion
- Self-learning
- Tutorial sheets

5) Mode of Evaluation:

Course Assessment Methods

- Short quizzes on Blackboard
- Writing assignment
- Tutorial Sheets
- Mid-Term Exams
- Tutorial Sheets
- Final Exam

Evaluation

- Mid-Term Tests (Not less than two Exams)……………………………… (30 %)
- Practical Work and Assignments ……………………………………………. (20 %)
- Final Exam. ……………………………………………………………………………… (50 %)

6) Textbook(s):

– Charles, Phillips and Nagle "Digital Control System Analysis and Design", Prentice-Hall, 2000.

7) References:

– K. Ogata, "Discrete-Time Control Systems," Second Edition, Prentice Hall, 1995

Specialization

(Power)

Course Title	**Electromechanical Energy conversion 2**
Course Code	**531-EE-3**
No. of Credit Hrs (Lecture + Tutorial/Lab)	**3 (2+1+0)**
No. of Contact Hrs (Lecture + Tutorial/Lab)	**4 (2+ 2+0)**
Level-Year	**9-5**
Prerequisite (if any)	**531-EE-3**

1) Course Objectives:

This course aims at providing the basic knowledge required by practicing engineers for dealing with induction and synchronous machines in order to:

1. Improve knowledge for the construction and the principle of operation of the three phase induction and synchronous machines
2. Acquire information concerning the equivalent circuit and different experimental tests of a three phase induction and synchronous machines
3. Help dealing with the power relation and characteristic curves of the three phase induction and synchronous machines
4. Enable Studying the methods of speed control and starting of induction motor
5. Enhance thought about the Equivalent circuit, starting methods of a single phase induction motor
6. To provide experimental foundation for the theoretical concepts introduced in the theoretical courses of Electromechanical Energy conversion.

2) Expected Learning Outcomes:

1. Estimate the parameters of a of induction and synchronous machines using the experimental tests (Outcome b3).
2. Understand the different methods of operation of induction and synchronous machines (Outcome a1).
3. Differentiate between the different methods used to control the speed and starting this motor type (Outcome a2).
4. Develop the mathematical formulas used in calculating the voltage regulation and efficiency of synchronous machines (Outcome b1).
5. Justify the advantages and the disadvantages of different methods of calculating voltage regulation (Outcome a2).
6. Apply different experimental tests of induction and synchronous machines (Outcome b1).
7. Calculate the machine parameters based on the measurement tests (Outcome b2).
8. Solve the equations of synchronous machines to get their performance (Outcome a2).
9. Compare the practical results with theoretical results to interpret and understand different rules and laws studied in Theoretical course (Outcome b2).

3) Course Contents:

1. AC armature windings
2. Three phase induction motor types, Construction, principles of operation and modes of operation
3. Equivalent circuit and measurement tests of a three phase induction motor
4. Power balance equations, Torque/speed curves of a 3 phase I.M.
5. Speed control methods of a 3 phase I.M.
6. Starting methods of a three phase induction motor of a 3 phase I.M.
7. Construction of synchronous
8. Armature reaction, armature leakage reactance and equivalent circuit of cylindrical synchronous machine
9. Equivalent circuit of salient pole synchronous machine
10. Determination of parameters
11. Voltage regulation for unity, lagging and leading power factor loads
12. Parallel operation and synchronizing torque
13. Equivalent circuit of synchronous motors
14. V-curves and Synchronous Condenser
15. Synchronous motor starting

4) Teaching Methods:

- Lectures
- Discussion
- Self-learning
- Tutorial sheets
- Lab work

5) Mode of Evaluation:

Course Assessment Methods

- Short quizzes on Blackboard
- Writing assignment
- Tutorial Sheets
- In Lab discussion
- Writing reports with results presentation
- Mid-Term Exams
- Final Exam

Evaluation

- Mid-Term Tests (Not less than two Exams)…………………… (30 %)
- Practical Work and Assignments (20 %)
- Final Exam. ……… …………………………………… (50 %)

6) Textbook(s):

- P. C. Sen, Principles of Electric Machines and Power Electronics
- Stephen J. Chapman, Electric Machinery Fundamentals
- B.L. Theraja and A.K.Theraja, Electrical Technology
- P. C. Sen, Principles of Electric Machines and Power Electronics
- Lab Notes

7) References:

- Course Notes: Presentation slides is submitted to student every lecture
- Recommended Books: Theodore Wildi, Electrical Machines, Drives and Power Systems Stephen J. Chapman, Electric Machinery Fundamentals
- Periodicals, Web Sites, … etc: To be cited during the course.
- Chapman, "Fundamentals of Electric Machinery", McGraw Hill, 1998.

Course Title	**High Voltage Engineering**
Course Code	**533-EE-3**
No. of Credit Hrs (Lecture + Tutorial/Lab)	**3 (2+1+0)**
No. of Contact Hrs (Lecture + Tutorial/Lab)	**4 (2+ 2+0)**
Level-Year	**10 – 5**
Prerequisite (if any)	**221-EE-3**

1) Course Objectives:

This course is delivered to clearly and understand the basic concepts of high voltage generation, measurement and testing techniques. Furthermore, the properties, applications and conduction and breakdown phenomena in various classes of insulation materials are discussed in this course. To provide experimental foundation for the theoretical concepts introduced in the theoretical courses of High Voltage Engineering.

2) Expected Learning Outcomes:

1. Apply the knowledge of mathematics and engineering, especially in the areas of high voltage engineering, electromagnetics, and power engineering (Outcome b1).
2. Understand Ionization processes in gas discharges, Relevant gas ionization processes (Outcome a1).
3. Understand Paschen's Law, Streamer Mechanism, Factors affecting the breakdown voltage a Vacuum gap, Corona Discharges (Outcome a1).
4. Understand Power loss in the Cable and Properties required of cable insulation. and breakdown in liquids electron avalanche mechanism (Outcome a1).
5. Understand High Voltage Measurement, Direct Measurement of High Voltages, Electrostatic Voltmeters and Sphere gaps (Outcome a1).
6. Work individually or in a team (Outcome c2).
7. Understand their ethical responsibility (Outcome c3).
8. design and conduct high voltage experiments through their experience in the High Voltage Laboratory (Outcome b2).
9. Design a system, component or process, and apply simultaneously high voltage criteria (Outcome b2).
10. Understand professional responsibility through meticulous safety procedures (Outcome c3).
11. Work and write reports together as team members (Outcome d1).

3) Course Contents:

1. Introduction to high voltage (Concepts and types)
2. Generation of high voltage 1

3. Generation of high voltage 2
4. Measurements and testing of high voltage
5. Generalized HV testing circuit
6. High voltage breakdown theories for insulating materials
7. Underground cable (operation and construction)
8. Experiment on solid

4) Teaching Methods:

- Lectures
- Videos
- Discussion
- Self-learning
- Tutorial sheets
- Lab demos

5) Mode of Evaluation:

Course Assessment Methods

- Short quizzes on Blackboard
- Writing assignment
- Tutorial Sheets
- Lab demos
- Writing reports and results presentation
- Mid-Term and Final Exam

Evaluation

- Mid-Term Tests (Not less than two Exams)................................... (30 %)
- Practical Work and Assignments .... (20 %)
- Final Exam. .... (50 %)

6) Textbook(s):

- A.A.Al-Arainy, M.I.Qureshi and N.H.Malik, ” Fundamentals of High Voltage Engineering” King Saud University Press, 2005.
- High Voltage Lab. Manual – User Guide

7) References:

- “High Voltage Engineering Fundamentals,” Second Edition, by J. Kuffel, E. Kuffel and W. S. Zaengl (Aug 14, 2000) ISBN: 0750636343.
- J. Choi, “Introduction of the Magnetic Pulse Compressor (MPC) - Fundamental Review and Practical Application”, Journal of Electrical Engineering & Technology Vol. 5, No. 3, pp. 484~492, 2010.
- A. A. Al-Arainy, M. I. Qureshi and N. H. Malik, ” Fundamentals of High Voltage Engineering” King Saud University Press, 2005.

Course Title	Power System Analysis
Course Code	534-EE-3
No. of Credit Hrs (Lecture + Tutorial/Lab)	3 (2+1+0)
No. of Contact Hrs (Lecture + Tutorial/Lab)	4 (2+ 2+0)
Level-Year	10 - 5
Prerequisite (if any)	514-EE-3

1) Course Objectives:

Understanding the fundamentals of both normal and abnormal operations of power systems. Analyzing the normal operation through power flow calculations. Analyzing the abnormal operation through symmetrical fault, symmetrical components and stability calculations. To gain the laboratory benefits of modeling an actual power system under different loading conditions. Prepared to do experimental work in the graduation project when necessary. Prepared to work in the field of operation, control and maintenance of power systems.

2) Expected Learning Outcomes:

1. Perform fundamental three-phase power system calculations (Outcome a1).
2. Solve practical steady-state power system problems (Outcome a2).
3. Work individually or in a team (Outcome c3).
4. Understand their ethical responsibility (Outcome c1).
5. Conduct a power and a fault study to study and implement in Power World Simulator (Outcome c4).
6. Ability to carry out test for power systems on the system simulator (Outcome b1).
7. Prepare them to do experimental work in their graduation project when necessary (Outcome b2).
8. The ability to select the suitable instruments and materials as per assigned objective of experiment (Outcome b1).

3) Course Contents:

1. Per Unit system; Power System Matrices.
2. Bus Admittance Matrix; Bus Impedance Matrix.
3. Load Flow Analysis by Gauss-Seidel Method and Newton-Raphson Method.
4. Fast decoupled solution, Sparsity techniques.
5. Symmetrical Components, Sequence networks of loads, Sequence networks of series impedances, Sequence networks of machines. Sequence networks of transformers
6. System modeling under fault conditions, Fault calculation using Zbus, Circuit breaker selection.
7. Stability Analysis: steady state stability, transient stability and equal area criterion.

8. Symmetrical and unsymmetrical fault analysis
9. Load-flow simulation
10. Transient stability simulation;

4) Teaching Methods:

- Lectures
- Videos
- Discussion
- Lab demos
- In Lab Discussion
- Self-learning
- Tutorial sheets

5) Mode of Evaluation:

Course Assessment Methods

- Short quizzes on Blackboard
- Writing assignment
- Tutorial Sheets
- Lab demos
- In lab discussion
- Writing reports and results presentation
- Mid-Term Exams
- Final Exam

Evaluation

- Mid-Term Tests (Not less than two Exams)………………………………. (30 %)
- Practical Work and Assignments …………………………………………… (20 %)
- Final Exam. …………………………………………………………………………… (50 %)

6) Textbook(s):

- J.D. Glover & M Sarma, "Power system analysis and Design", 3rd edition, PWS Publishing, 2002.
- Saadat, “Power System Analysis”, McGraw Hill, 2nd edition.
- Lab manual
- Saadat, “Power System Analysis”, McGraw Hill

7) References:

- S.A.Nasar and F.C.Trutt, Electric Power Systems, CRC Press, 1999.
- Grainger and Stevenson, "Power System Analysis", McGraw Hill
- SARMA, "Electric Machines Steady State Theory and Dynamic Performance".
- Laboratory Manual will be distributed by the Lecturer

Course Title	**Power electronics**
Course Code	**535-EE-3**
No. of Credit Hrs (Lecture + Tutorial/Lab)	**3 (2+1+0)**
No. of Contact Hrs (Lecture + Tutorial/Lab)	**4 (2+2+0)**
Level-Year	**5/9**
Prerequisite (if any)	**413-EE-3**

1) Course Objectives:

This course aims at providing the basic knowledge required by practicing engineers for dealing with power electronics in order to:

1. Acquire information concerning the different types of power converters
2. Enhance thought about the main methods of AC regulators
3. Improve knowledge for the main difference between different types of dc chopper circuits
4. Help dealing with the different types of inverter circuits and their applications
5. To provide experimental foundation for the theoretical concepts introduced in the theoretical courses of power electronics such as power converters and rectifiers power switches.

2) Expected Learning Outcomes:

1. Differentiate between AC to DC converters, AC regulators and cycle converter (Outcome a2).
2. Evaluate the advantages and disadvantages of the different regulators of chopper circuits (Outcome a2).
3. Develop the mathematical formulas used in measuring the regulated voltages on chopper circuits (Outcome b1).
4. Extract the mathematical formulas for dealing with three phase inverters (Outcome a2).
5. Distinguish between stepped inverters, six step inverter, PWM inverters, current source and voltage source inverters (Outcome b2).
6. Use different types of regulators depending on the investigated application (Outcome b1).
7. Apply the different methods used for protection for control units (Outcome b2).
8. Create suitable firing circuits for power converters and inverters (Outcome b3).
9. Solve for the performance of the firing and control circuits under loading (Outcome b3).
10. Compare the practical results with theoretical results to interpret and understand different rules and laws studied in Theoretical courses (Outcome b1).
11. Design and create the circuit, measure the required readings and do the calculations to analyze the results (Outcome b2).
12. Calculate and interpret the reading and graphs to write a formal lab report (Outcome d1).

3) Course Contents

1. AC to DC converters - AC regulators – Cycle converters
2. Chopper circuits: Buck regulator, Boost regulator, Buk-Boost regulators, and cuk regulators
3. Converter operation - Pulse circuits
4. Three phase voltage source inverter - Stepped inverters – six step inverter - PWM inverters
5. Current source inverters
6. Voltage source inverters
7. Firing circuits
8. Control units – Protection
9. Heat sinks – Isolation

4) Teaching Methods:

- Lectures
- Discussion
- Self-learning
- Tutorial sheets
- Lab work

5) Mode of Evaluation:

Course Assessment Methods

- Short quizzes on Blackboard
- Writing assignment and Tutorial Sheets
- Lab demos
- In lab discussion
- Writing reports and results presentation
- Mid-Term and Final Exams

Evaluation

- Mid-Term Tests (Not less than two Exams)……………………………... (30 %)
- Practical Work and Assignments …………………………………………... (20 %)
- Final Exam. ……………………………………………………………… (50 %)

6) Textbook(s):

- M.H. Rashid, Power Electronics.
- Lab manual.

7) References:

- Course Notes: Presentation slides is submitted to student every lecture.
- Essential Books (Text Books): Williams, Power Electronics and Drive Applications.
- Periodicals, Web Sites, … etc: To be cited during the course.

Power Electronics, Circuits, Devices and Applications", Muhammad H. Rashid, Second edition.

Specialization

(Communication)

Course Title	**Digital Communications**
Course Code	**541-EE-3**
No. of Credit Hrs (Lecture + Tutorial/Lab)	**3 (2+1+0)**
No. of Contact Hrs (Lecture + Tutorial/Lab)	**4 (2+2+0)**
Level-Year	**9-5**
Prerequisite (if any)	**423-EE-3**

1) Course Objectives:

To develop an understanding of digital communication systems and the techniques used in digital communication. The trade-off between error probability and data rate shall be understood.

2) Expected Learning Outcomes:

1. Understanding of the fundamentals of digital communications (Outcome a1)
2. Understand the fundamental laws that govern the operation of digital communication systems (Outcome a1)
3. Ability to apply mathematical principles to analyze and design digital communication systems (Outcome b1)
4. Understand the fundamental laws that govern the operation of digital communication systems (Outcome b1)
5. A basic understanding of various digital processing techniques and their advantages (Outcome b2)
6. Knowledge and understanding of the effects of channel impairments on digital transmission and various techniques used to combat those impairments (Outcome b2)
7. Understanding the trade-offs between data rate and error probability in the design of digital communication systems (Outcome b4)
8. Knowledge and understanding of the effects of channel impairments on digital transmission and various techniques used to combat those impairments (Outcome b4)
9. Learn how to work in a teamwork group (Outcome c2).
10. Calculate and interpret the reading and graphs to write a formal lab report (Outcome d1).

3) Course Contents:

1. Introduction to Digital Communication
2. Sampling, PCM, DPCM, DM, Line Coding.
3. Review of probability theory; Baseband pulse transmission (matched filters, intersymbol interference); M-ary signaling and error probability in the presence of AWGN, Eye pattern

4. Nyquist criteria;
5. Equalization;
6. Digital Passband transmission: Coherent PSK, FSK, QPSK, MSK.
7. Noncoherent orthogonal modulation; Power spectra and bandwidth efficiency of binary and quaternary modulation schemes.

4) Teaching Methods:

- Lectures
- Videos
- Discussion
- Self-learning
- Tutorial sheets
- Lab work

5) Mode of Evaluation:

Course Assessment Methods

- Short quizzes on Blackboard
- Writing assignment
- Tutorial Sheets
- In Lab discussion
- Mid-Term Exams
- Tutorial Sheets
- Final Exam

Evaluation

- Mid-Term Tests (Not less than two Exams)…………………………….. (30 %)
- Practical Work and Assignments …………………………………….……. (20 %)
- Final Exam. …………………………………………………………..…………………. (50 %)

6) Textbook(s):

– Simon Haykin, Communication Systems, John Wiley & Sons, Inc., New York, 4th Edition, 2001.
– Lab nots

7) References:

– Bruce Carlson, Paul B. Crilly, and Janet C. Rutledge, Communication Systems, McGraw Hill, Boston, 4th Edition, 2002.
– B. P. Lathi, Modern Digital and Analog Communication Systems, Oxford University Press, New York, 3rd Edition, 1998.

Course Title	**Antennas and Wave Propagation**
Course Code	**543-EE-3**
No. of Credit Hrs (Lecture + Tutorial/Lab)	**3 (2+1+0)**
No. of Contact Hrs (Lecture + Tutorial/Lab)	**4 (2+2+0)**
Level-Year	**9-5**
Prerequisite (if any)	**323-EE-3**

1) Course Objectives:

To emphasize the concepts of electromagnetics and field theory and develop the capability to apply these concepts to transmission lines and antennas.

2) Expected Learning Outcomes:

1. Use their skills of various mathematical design techniques in understanding the main subjects of electromagnetic wave propagation and antennas (Outcome a1).
2. Apply knowledge of electromagnetic wave propagation and antennas to understand advanced concepts of electromagnetics in the real world (Outcome b1).
3. Apply knowledge of mathematics in solving problems in wave propagation and antenna design (Outcome b1).
4. Ability to work independently and as part of a team and manage resources (Outcome c2).
5. Ability to write the formal report and to increase the confidence of the students (Outcome d1).

3) Course Contents:

1. Time varying fields; Faraday's law. Transformer and motional emfs; Displacement current; Maxwell's equations and time harmonic fields; Wave equation; Power transfer and Poynting vector;
2. Plane wave propagation in free space, in lossy dielectrics and in good conductors; Polarization; Reflection of plane wave at normal and oblique incidence.
3. Transmission lines; Impedance matching.
4. Introduction to radiation and antennas; Antenna parameters; Wire antennas.

4) Teaching Methods:

- Lectures
- Videos
- Discussion
- Self-learning

- Tutorial sheets

5) Mode of Evaluation:

Course Assessment Methods

- Short quizzes on Blackboard
- Writing assignment
- Tutorial Sheets
- Mid-Term Exams
- Tutorial Sheets
- Final Exam

Evaluation

- Mid-Term Tests (Not less than two Exams)………………………………. (30 %)
- Practical Work and Assignments ………………………………………….. (20 %)
- Final Exam. …………………………………………………………………… (50 %)

6) Textbook(s):

- Engineering Elements of Electromagnetics, 3rd Edition. Mathew N.O. Sadiku, Oxford University Press.
- Antennas And Wave Propagation, 5th Edition Paperback (2017) John D. Kraus and Ronald J. Marhefka, McGraw Hill.

7) References:

- Electromagnetic Waves, Staelin, David, Ann Morgenthaler, and Jin Au Kong, Upper Saddle River, NJ: Prentice Hall, 1994, ISBN: 9780132258715.

Course Title	**Wireless Communication**
Course Code	**545-EE-3**
No. of Credit Hrs (Lecture + Tutorial/Lab)	**3 (2+1+0)**
No. of Contact Hrs (Lecture + Tutorial/Lab)	**4 (2+2+0)**
Level-Year	**10 -5**
Prerequisite (if any)	**423-EE-3**

1) Course Objectives:

This course provides a comprehensive overview and advanced knowledge of modern mobile and wireless communication systems. The course also provides understanding of the challenges and opportunities brought by the wireless medium in designing current and future wireless communication systems and networks.

2) Expected Learning Outcomes:

After completing this course, the students should be able to:

1. Apply the cellular concepts to evaluate the signal reception performance in a cellular network (Outcome b1).
2. Apply the traffic analysis to design cellular network with given quality of service constraints (Outcome b3).
3. Determine the type and appropriate model of wireless fading channel based on the system parameters and the property of the wireless medium (Outcome b3).
4. Analyse and design receiver and transmitter diversity techniques (Outcome b3).
5. Determine the appropriate transceiver design of multi-antenna systems and evaluate the data rate performance (Outcome b3).
6. Design wireless communication systems with key 3G (e.g., CDMA) and 4G (OFDM) technologies (Outcome b3).
7. Describe and differentiate four generations of wireless standard for cellular networks (Outcome b1).

3) Course Contents:

1. Overview of digital wireless communications and cellular concept;
2. interference and traffic analysis for cellular networks;
3. wireless fading channel modelling and characterization;
4. modulation and detection performance over fading channels;
5. equalization techniques; multi-carrier systems;
6. spread spectrum techniques;

7. receiver and transmitter diversity techniques;
8. information theory of wireless channels;
9. multiple antenna systems and space-time communications;
10. and cooperative communications; 2G standards (e.g. GSM, CDMA), 3G standards and beyond.

4) Teaching Methods:

- Lectures
- Videos
- Discussion
- Self-learning
- Tutorial sheets

5) Mode of Evaluation:

Course Assessment Methods

- Short quizzes on Blackboard
- Writing assignment
- Tutorial Sheets
- Mid-Term Exams
- Final Exam

Evaluation

- Mid-Term Tests (Not less than two Exams)…………………………….... (30 %)
- Practical Work and Assignments ………………………………….……….. (20 %)
- Final Exam. ………………………………………………….……………………… (50 %)

6) Textbook(s):

– Wireless communications by Andreas Molisch, Wiley-IEEE Press, 2nd Ed, 2011.

7) References:

– Wireless Communications - Principles and Practice by T. S. Rappaport. 2nd Ed. Prentice Hall, 2002
– Wireless Communications by Andrea Goldsmith. 1st Ed. Cambridge University Press, 2005.
– Fundamentals of Wireless Communication by David Tse, Pramod Viswanath . 1st Ed. Cambridge University Press, 2005.

Course Title	**Communication Systems**
Course Code	**546-EE-3**
No. of Credit Hrs (Lecture + Tutorial/Lab)	**3 (2+1+0)**
No. of Contact Hrs (Lecture + Tutorial/Lab)	**4 (2+2+0)**
Level-Year	**10-5**
Prerequisite (if any)	**423-EE-3**

1) Course Objectives:

To introduce students to the theory, design analysis and operation of communication systems. This course aims to represent the basic knowledge necessary for transmitting and receiving information using today's communication technologies.

2) Expected Learning Outcomes:

1. Understand the basic concept of information (Outcome a1).
2. Understand how information is put into electronic for storage and delivery (Outcome a1).
3. Have detailed understanding of digital communication basics (Outcome a1).
4. Have an understanding of frequencies and their locations from baseband to RF (Outcome a1).
5. Have detailed understanding of amplitude and frequency modulation and demodulation methods (Outcome a1, b1).
6. Understand basic principles of Gaussian noise processes and their use/utility in communication system design (Outcome a1, b1).
7. An ability to design, build, test and analyse circuits and systems relevant to communications systems (Outcome b2, b3).

3) Course Contents

1. copper wire transmission systems, Digital subscriber loops (xDSL)
2. Introduction to radio transmission systems; wireless local loops (WLL); satellite systems for fixed and mobile communications (GEO, MEO, LEO) ; VSATs systems.
3. Noise, Noise – Figure and SNR analysis in communication systems.
4. Link budget analysis, Principles of cellular mobile systems.
5. Mobile Communications; Spectrum Management and Frequency Planning, Spread Spectrum and CDMA

4) Teaching Methods:

- Lectures
- Videos
- Discussion
- Self-learning
- Tutorial sheets

5) Mode of Evaluation:

Course Assessment Methods

- Short quizzes on Blackboard
- Writing assignment
- Tutorial Sheets
- Mid-Term Exams
- Tutorial Sheets
- Final Exam

Evaluation

- Mid-Term Tests (Not less than two Exams)………………………………. (30 %)
- Practical Work and Assignments ……………………………………………. (20 %)
- Final Exam. …………………………………………………………………………… (50 %)

6) Textbook(s):

– Communication Networks, Fundamental Concepts and Key Architectures, Alberto Leon-Garcia & Indra Widjaja, Mc Graw Hill, 2002.

7) References:

– Telecommunication Transmission Handbook, Roger Freeman, Wiley Inter-sciences, 1991
– Wireless Communications: Principles and Practice By T.S. Rappaport, Prentice Hall

Specialization

(Electronics)

Course Title	**Electronic Instrumentation**
Course Code	**551-EE-3**
No. of Credit Hrs (Lecture + Tutorial/Lab)	**3 (2+1+0)**
No. of Contact Hrs (Lecture + Tutorial/Lab)	**4 (2+ 2+0)**
Level-Year	**9-5**
Prerequisite (if any)	**413-EE-3**

1) Course Objectives:

The purpose this course is to introduce students to the basic electronic components and circuits used in instrumentation systems. They will also gain a good understanding of their design and applications.

2) Expected Learning Outcomes:

By the end of this course the student will:

1. Know the importance of the components and circuits related to instrumentation systems (Outcome a1).
2. Understand the working of timer circuits, switches and multipliers (Outcome a1).
3. Know and understand the applications of instrumentation circuits and systems (Outcome a1, b1, b3).
4. Understanding of the working and design of PLLs (Outcome a1, b1).
5. Analysis and design of electronic instrumentation circuits (Outcome b2, b3).
6. Learn how to work in a teamwork group (Outcome c2).
7. Ability to write technical reports and work in teams (Outcome d1).

3) Course Contents:

1. 555 Timer and its applications.
2. Analog switches and Analog multipliers.
3. Operational trans-conductance amplifier (OTA).
4. Current conveyor.
5. Switched capacitor circuits.
6. Phase-locked-loop (PLL) with applications.
7. Data conversion: digital-to-analog and analog-to-digital converters.
8. Digital PLL.

4) Teaching Methods:

- Lectures

- Videos
- Discussion
- Self-learning
- Tutorial sheets
- Lab Work

5) Mode of Evaluation:

Course Assessment Methods

- Short quizzes on Blackboard
- Writing assignment
- Tutorial Sheets
- Mid-Term Exams
- Tutorial Sheets
- Final Exam
- In Lab Discussion

Evaluation

- Mid-Term Tests (Not less than two Exams)…………………………….. (30 %)
- Practical Work and Assignments ……………………………………….. (20 %)
- Final Exam. ……………………………………………………………………… (50 %)

6) Textbook(s):

– "Design with Operational Amplifiers and Analog Integrated Circuits", Franco, 3 rd Edition, McGraw Hill, 2001.

7) References:

– Electronic Instrumentation and Measurements David A bell 2nd edition

Course Title	**Embedded system design**
Course Code	**552-EE-3**
No. of Credit Hrs (Lecture + Tutorial/Lab)	**3 (2+1+0)**
No. of Contact Hrs (Lecture + Tutorial/Lab)	**4 (2+2+0)**
Level-Year	**9 - 5**
Prerequisite (if any)	**324-EE-3**

1) Course Objectives:

In this course, the fundamentals of embedded system hardware and firmware design will be explored. This course presents state-of-the-art methods, concepts, tools and techniques for system-level design and modeling of complete multi-processor systems from specification down to implementation across hardware-software boundaries. Using the SpecC and SystemC languages and the System-On-Chip Environment (SCE), we will specify, simulate, analyze, model and design systems based on examples of typical embedded applications.

2) Expected Learning Outcomes:

1. Understand the basic concepts of embedded systems (Outcome a1).
2. Understand how to model, verify and synthesis a given embedded system (Outcome a1, b3).
3. Know how to investigate a given system with the required Math and software modelling (C, C++, VHDL…) (Outcome b1).
4. Investigate, describe and test a given system. (FPGA and its tools) (Outcome b1, c4).
5. Know how to test a given system according the real-life requirement (Outcome b2, b3).
6. Formulate and solve problems on embedded system area (Outcome b3).
7. Learn how to work in a teamwork group (Outcome c2).
8. Ability to write technical reports and work in teams (Outcome d1).

3) Course Contents

1. Embedded systems,
2. electronic system-level (ESL) design;
3. System-level design languages (SLDLs): SpecC, SystemC;
4. Models of Computation (MoCs): finite state machines (FSMs), dataflow, process networks, discrete event;
5. System specification, profiling, analysis and estimation;

6. System-level design: partitioning, scheduling, communication synthesis;
7. System-level modeling: processor and RTOS modeling, transaction-level modeling (TLM) for communication;
8. System-level synthesis: design space exploration (DSE);
9. Embedded hardware and software implementation:
10. synthesis and simulation;
11. System design examples and case studies.

4) Teaching Methods:

- Lectures
- Videos
- Discussion
- Self-learning
- Tutorial sheets
- Lab Work

5) Mode of Evaluation:

Course Assessment Methods

- Short quizzes on Blackboard
- Writing assignment
- Tutorial Sheets
- Mid-Term and Final Exams
- Tutorial Sheets
- In-Lab Discussion

Evaluation

- Mid-Term Tests (Not less than two Exams)…………………………….. (30 %)
- Practical Work and Assignments …………………………………………. (20 %)
- Final Exam. ………………………………………………………………………… (50 %)

6) Textbook(s):

– D. D. Gajski, S. Abdi, A. Gerstlauer, G. Schirner, Embedded System Design: Modeling, Synthesis, Verification, ISBN 978-1-4419-0503-1, Springer, 2009.

7) References:

– A. Gerstlauer, R. Doemer, J. Peng, D. Gajski, System Design: A Practical Guide with SpecC, ISBN 0-7923-7387-1, Kluwer, 2001,.
– T. Groetker, S. Liao, G. Martin, S. Swan, System Design with SystemC, ISBN 1-4020-7072-1, Kluwer, 2002.
– F. Vahid, T. Givargis, Embedded System Design: A Unified Hardware/Software Introduction, ISBN 978-0-471-38678-0, John Wiley & Sons, 2001.

Course Title	**VLSI Design**
Course Code	**554-EE-3**
No. of Credit Hrs (Lecture + Tutorial/Lab)	**3 (2+1+0)**
No. of Contact Hrs (Lecture + Tutorial/Lab)	**4 (2+ 2+0)**
Level-Year	**10 - 5**
Prerequisite (if any)	**413-EE-3**

1) Course Objectives:

At the end of this course the student should be able to:

1. Understand the concepts history of LSI integration
2. Understand the fabrications steps of IC
3. Understand the concepts of design rules
4. Layout and verify the different passive element and CMOS and BJTs.
5. Design a digital integrated circuit and characterize using simulators.
6. Implement a simple digital system on FPGA.

2) Expected Learning Outcomes:

1. Be able to use mathematical methods and circuit analysis models in analysis of CMOS digital electronics circuits, including logic components and their interconnect (Outcome a1).
2. Create models of moderately sized CMOS circuits that realize specified digital functions (Outcome b3).
3. Apply CMOS technology-specific layout rules in the placement and routing of transistors and interconnect, and to verify the functionality, timing, power, and parasitic effects (Outcome b1, b3).
4. Understand the characteristics of CMOS circuit construction and compare between different state-of-the-art CMOS technologies and processes (Outcome a1).
5. Be able to complete a significant VLSI design project having a set of objective criteria and design constraints (Outcome b3).
6. Learn how to work in a teamwork group (Outcome c2).
7. Ability to write technical reports and work in teams (Outcome d1).

3) Course Contents:

1. Introduction to VLSI Systems
2. CMOS logic, fabrication and layout

3. MOS Transistor theory
4. Layout Design Rules
5. Circuit characterization and performance estimation
6. Circuit Simulation
7. Combinational and sequential circuit design
8. Memory system design
9. Introduction about digital system implementation on FPGA

4) Teaching Methods:

- Lectures
- Videos
- Discussion
- Self-learning
- Tutorial sheets
- Lab Work

5) Mode of Evaluation:

Course Assessment Methods

- Short quizzes on Blackboard
- Writing assignment
- Tutorial Sheets
- Mid-Term Exams
- Final Exam
- In Lab Discussion

Evaluation

- Mid-Term Tests (Not less than two Exams)………………………………. (30 %)
- Practical Work and Assignments ……………………………………….…… (20 %)
- Final Exam. ……………………………………………………….…………………… (50 %)

6) Textbook(s):

– Weste & Harris, CMOS VLSI Design: A Circuits and Systems Perspective, 3rd ed, Addison Wesley, 2005

7) References:

– Digital Design, 3rd edition by M. Morris Mano.
– Principles of CMOS VLSI design by N H E Weste & K Eshraghian
– Modern VLSI Design: System on Silicon by Wayne Wolf

Course Title	Solar Cells and Photovoltaic Systems
Course Code	556-EE-3
No. of Credit Hrs (Lecture + Tutorial/Lab)	3 (2+1+0)
No. of Contact Hrs (Lecture + Tutorial/Lab)	4 (2+ 2+0)
Level-Year	10-5
Prerequisite (if any)	514-EE-3

1) Course Objectives:

Through this course, the students will gain awareness about the relevance of PV systems as an alternative energy source. The knowledge of the modelling, analysis, design and application of photovoltaic systems will also be acquired.

2) Expected Learning Outcomes:

By the end of this course the student will be able to:

1. Knowledge of Fundamental principles of semiconductor physics related to solar cells and photovoltaic generation (Outcome a1).
2. Awareness about the relevance of photovoltaic systems as an alternative energy source (Outcome a2).
3. To apply the knowledge of the modelling, analysis, design and application of photovoltaic systems (Outcome b1)
4. Knowledge of various parameters governing the construction and deployment of PV systems (Outcome b2)
5. Development of technical writing and team-working skills (Outcome c2)

3) Course Contents:

Solar Insolation (radiation); Generation, recombination, and basic equations of semiconductor device physics; P-N junction Diode solar cells: Operation and construction; Solar cell parameters; Design of Silicon solar Cells; Photovoltaic Modules, Arrays, and Systems; Balance of the System (BOS); Design of Stand-alone PV Systems; Other Devices Structure; Other Semiconductor Materials. Theory and operation of "Maximum Power Point Tracking" MPPT as used in solar electric charge controllers.

4) Teaching Methods:

- Lectures
- Videos
- Discussion

- Self-learning
- Tutorial sheets

5) Mode of Evaluation:
Course Assessment Methods

- Short quizzes on Blackboard
- Writing assignment
- Tutorial Sheets
- Mid-Term Exams
- Tutorial Sheets
- Final Exam

Evaluation

- Mid-Term Tests (Not less than two Exams)………………………………. (30 %)
- Practical Work and Assignments ……………………………………………. (20 %)
- Final Exam. ……………………………………………………………………… (50 %)

6) Textbook(s):

– "Microelectronic Circuit Design", 3rd ed., Jaeger and Balock, McGraw-Hill, 2008.

7) References:

– A. Goetzberger, V. U. Hoffmann, Photovoltaic Solar Energy Generation, Springer-Verlag, 2005.