# Communication and Computers Engineering Program (CCE)

## Regulation 2013

## Program Curriculum & Study plan & Course Syllabi

# 1. Program Curriculum

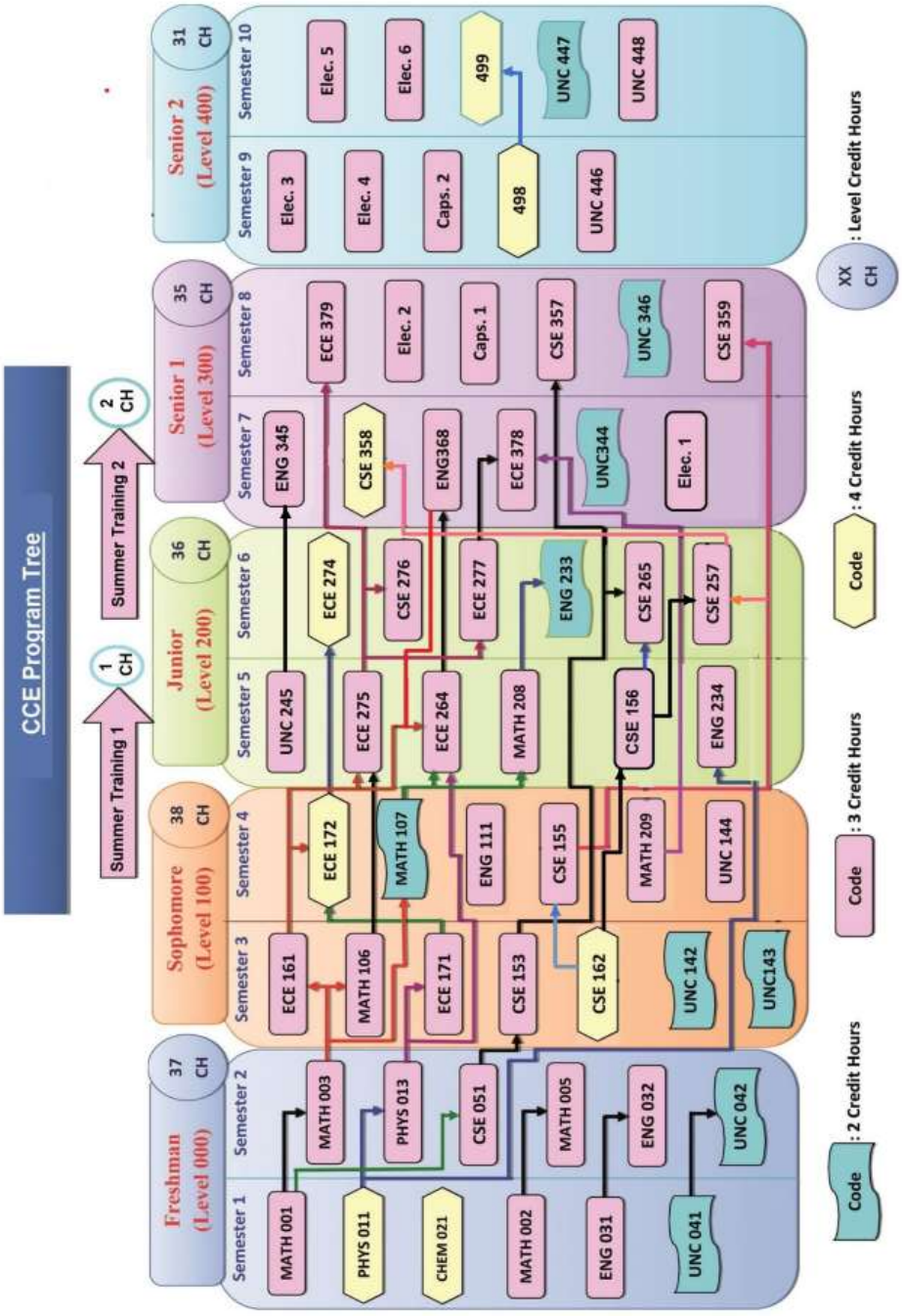
Table 5-1. Regulation 2013; CCE Program Curriculum

| Course Code | Course Name | Indicate Whether Course is Required, Elective or a Selected Elective by an R, an E or an SE.1 | Subject Area (Credit Hours) | | | Last Two Terms the Course was Offered: | Maximum Section Enrollment for the Last Two Terms the Course was Offered |
|---|---|---|---|---|---|---|---|
| YEAR (1-5)/ SEMESTER 1-10 | | | Math & Basic Sciences | Engineering Topics Check if Contains Significant Design (√) | Other | | |
| MATH 001 | Calculus 1 | R | 3 | | | F22, SP22 | 7, 3 |
| PHYS 011 | Physics-1 | R | 4 | | | F22, SP22 | 3,3 |
| UNC 041 | English 1 | R | | | 2 | F22, SP22 | 16,6 |
| ENG 031 | Engineering Fundamentals 1 | R | | | 3 | F22, SP22 | 18,19 |
| MTH021 | Engineering Chemistry Fundamentals | R | 4 | | | F22, SP22 | 8,8 |
| MATH 002 | Engineering Mechanics 1 | R | 3 | | | F22, SP22 | 12,6 |
| ENG 032 | Engineering Fundamentals 2 | R | | | 3 | F22, SP22 | 3,6 |
| CSE 051 | Computer Programming | R | | 3(√) | | F22, SP22 | 11,13 |
| MATH 003 | Calculus 2 | R | 3 | | | F22, SP22 | 6,8 |
| MATH 005 | Engineering Mechanics 2 | R | 3 | | | F22, SP22 | 7,14 |
| PHYS 013 | Physics-2 | R | 4 | | | F22, SP22 | 10,6 |
| UNC 042 | English 2 | R | | | 2 | F22, SP22 | 19,59 |
| MATH 106 | Differential Equations | R | 3 | | | F22, SP22 | 26,4 |
| ECE 161 | Electric Circuit Analysis | R | | 3 | | F22, SP22 | 30,11 |
| CSE 162 | Logic Digital Design | R | | 4(√) | | F22, F21 | *13,152* |
| ECE171 | Solid State Electronics | R | | 3 | | F22, SP21 | *29,3* |
| CSE 153 | Introduction to Data Structures and Software Engineering | R | | 3 | | F21, SP22 | 162,40 |
| UNC142 | Finance | R | | | 2 | F22, SP22 | 71,4 |
| UNC143 | Technical English Writing | R | | | 2 | F22, SP22 | 57,2 |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| MATH 107 | Multivariable Calculus | R | 2 | | | F22, SP22 | *8,29* |
| CSE 155 | Introduction to Computer Engineering | R | | 3 | | SP21, SP22 | *165,14* |
| UNC144 | Decision Support System | R | | | 3 | SP21, SP22 | 147,18 |
| ENG 111 | Introduction to Civil Engineering | R | | 3 | | F22, SP22 | 37,2 |
| ECE 172 | Electronics 1 | R | | 4(√) | | F22, SP22 | 3,53 |
| MATH 209 | Probability and Statistics | R | 3 | | | F22, SP22 | 1,22 |
| 501 | Summer Training -1 | R | | 1 | | F22, SP22 | 12,19 |
| CSE 156 | Computer Architecture | R | | 3 | | F22, SP22 | 34,*3* |
| ECE 275 | Signals and Systems | R | | 3 | | F22, SP22 | 152,34 |
| ECE264 | Electromagnetic Fields | R | | 3 | | F22, SP22 | 149,16 |
| MATH 208 | Discrete Mathematics | R | 3 | | | F22, SP22 | 188,11 |
| ENG 234 | Fundamentals of Thermo-Fluids | R | | 3 | | F22, SP22 | 184,20 |
| UNC 245 | Management Information Systems | R | | | 3 | F22, F21 | 192,103 |
| CSE 257 | Operating Systems | R | | 3 | | F22, SP22 | 1,171 |
| CSE 265 | Databases | R | | 3(√) | | F22, SP22 | 36,185 |
| ECE 274 | Electronics 2 | R | | 4(√) | | F22, SP22 | 2,120 |
| ECE 277 | Introduction to Communication Systems | R | | 3 | | F22, SP22 | 1,160 |
| ENG 233 | Engineering Economy | R | | | 2 | F22, SP22 | 13,184 |
| CSE 276 | Control System | R | | 3(√) | | F22, SP22 | 197,126 |
| ECE 378 | Analog and Digital Communications | R | | 3(√) | | F22, SP22 | 116,6 |
| CSE 358 | Computer Graphics | R | | 4(√) | | F22, SP21 | 152,30 |
| ENG 345 | Operation Research | R | | | 3 | F22, SP22 | 149,25 |
| ENG 368 | Electrical Energy Systems | R | | 3 | | F22, SP22 | 142,29 |
| UNC 344 | Law for Management | R | | | 2 | F22, SP22 | 149,6 |
| CSE 357 | Internet Programming | R | | 3(√) | | F22, SP22 | 1,135 |
| CSE 359 | Microprocessor Systems Design | R | | 3(√) | | SP21, SP22 | 144,102 |
| ECE 379 | Digital Signal Processing | R | | 3 | | F22, SP22 | 176,4 |
| UNC 346 | Marketing | R | | | 2 | F22, SP22 | 94,56 |
| CSE 301 | Software Engineering | SE | | 3(√) | | F21, SP22 | 100,48 |
| CSE 302 | Computer & Network Security fundamentals | SE | | 3(√) | | SP20, SP21 | 45,7 |
| CSE 303 | Foundations of Information's | SE | | 3 | | F22, F21 | 53,33 |
| CSE 304 | Distributed Systems | SE | | 3 | | F22, SP22 | 99,1 |
| ECE 301 | Electronics of Communications | SE | | 3(√) | | SP 17 | 2 |
| ECE 302 | Mobile Communication System | SE | | 3(√) | | F22, F21 | 4,2 |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| ECE 303 | Electromagnetic Waves | SE | | 3(√) | | F19, SP22 | 10, 61 |
| ECE 304 | Optoelectronics | SE | | 3(√) | | SP 19, 20 | 1, 3 |
| 502 | Summer Training - 2 | R | | | *2* | F22, SP22 | 50,66 |
| UNC446 | Quantitative Methods for Quality Control | R | | | 3 | F22, SP22 | 169,58 |
| UNC 447 | Professional & Communication Skills | R | | | 2 | F21, SP22 | 6,130 |
| UNC448 | Projects Management | R | | | 3 | F22, SP22 | 24,213 |
| 498 | Project and Report 1 | R | | 4(√) | | F22, SP22 | 141,65 |
| 499 | Project and Report 2 | R | | 4(√) | | F22, SP22 | 36,139 |
| CSE 401 | Human Computer Interaction | SE | | 3(√) | | F22, SP22 | 155,11 |
| CSE 402 | Web Based Information System | SE | | 3(√) | | SP22 | 27 |
| CSE 403 | Language Processors | SE | | 3 | | SP21 | 260, 64 |
| CSE 404 | Multimedia | SE | | 3 | | F 18, SP20 | 14, 1 |
| CSE 405 | Parallel Algorithms | SE | | 3 | | SP 19, SP21 | 125, 115 |
| CSE 406 | Embedded and Real Time System | SE | | 3 | | F22, F21 | 4,19 |
| CSE 407 | Decision Algorithms | SE | | 3 | | F22, SP22 | 3,91 |
| CSE 408 | Selected Topics in Computers and information | SE | | 3 | | F22, F21 | 110, 47 |
| ECE 401 | Integrated Circuit Design | SE | | 3(√) | | F 15, SP 16 | 8, 3 |
| ECE 402 | RF Circuits and Devices | SE | | 3(√) | | ... | …. |
| ECE 403 | Microwave Engineering | SE | | 3 | | SP 16 | 16 |
| ECE 404 | Antennas | SE | | 3(√) | | SP22, S22 | 19, 3 |
| ECE 405 | Communication Networks | SE | | 3 | | F22, F 20 | 185, 74 |
| ECE 406 | Telecommunication Systems | SE | | 3 | | .... | … |
| ECE 407 | Digital Image Processing | SE | | 3 | | F22, SP21 | 55,11 |
| ECE 408 | Selected Topics in Electronics and Communications | SE | | 3 | | SP20, SP21 | 50, 169 |
| ELEC 1 | German Language | SE | | 3 | | SP22 | 9 |
| HR0 | Human rights (Contemporary Social Issues) | R | | 0 | | | |
| | TOTALS (in terms of semester credit hours) | | 35 Hours | 106 Hours | 39 Hours | | |
| | Total must satisfy minimum credit hours | Minimum Semester Credit Hours | 30 Hours | 45 Hours | | | |

1. The following flow chart (course tree 2013) illustrates the prerequisites structure of the program's required courses.



Further, the study plan for regulation 2013 is separated among 10 semesters distributed as follows

- **Freshman Year-Fall Semester:**

| Code | Name | Total Hours | Class Work | Final Exam | Total | Prerequisites |
|---|---|---|---|---|---|---|
| MATH 001 | Calculus- 1 | 3 | 50 | 50 | 100 | ..... |
| PHYS 011 | Physics-1 | 4 | 50 | 50 | 100 | ..... |
| MATH 002 | Engineering Mechanics-1 | 3 | 50 | 50 | 100 | ..... |
| ENG 031 | Engineering Fundamentals -1 | 3 | 50 | 50 | 100 | ..... |
| MTH 021 | Engineering Chemistry Fundamentals | 4 | 50 | 50 | 100 | ..... |
| UNC 041 | English | 2 | 50 | 50 | 100 | ..... |
| **Total** | | 19 | 300 | 300 | 600 | |

- **Freshman-Spring Semester:**

| Code | Name | Total Hours | Class Work | Final Exam | Total | Prerequisites |
|---|---|---|---|---|---|---|
| MATH 003 | Calculus- 2 | 3 | 50 | 50 | 100 | MATH 001 |
| PHYS 013 | Physics-2 | 4 | 50 | 50 | 100 | PHYS 011 |
| MATH 005 | Engineering Mechanics-2 | 3 | 50 | 50 | 100 | MATH 002 |
| CSE 051 | computer programming | 3 | 50 | 50 | 100 | MATH 001 |
| ENG032 | Engineering Fundamentals -2 | 3 | 50 | 50 | 100 | ENG 031 |
| UNC 042 | English-2 | 2 | 50 | 50 | 100 | UNC 041 |
| **Total** | | 18 | 300 | 300 | 600 | |

- **Sophomore -Fall Semester:**

| Code | Name | Total Hours | Class Work | Final Exam | Total | Prerequisites |
|---|---|---|---|---|---|---|
| ECE161 | Electric Circuit Analysis | 3 | 50 | 50 | 100 | MATH003 |
| Math106 | Differential Equations | 3 | 50 | 50 | 100 | MATH003 |
| CSE 153 | Introduction to Data Structures and Software Engineering | 3 | 50 | 50 | 100 | CSE051 |
| ECE171 | Solid State Electronics | 3 | 50 | 50 | 100 | PHY 013 |
| CSE 162 | Logic Digital Design | 4 | 50 | 50 | 100 | ..... |
| UNC142 | Finance | 2 | 50 | 50 | 100 | ..... |
| UNC143 | Technical English Writing | 2 | 50 | 50 | 100 | ..... |
| **Total** | | 20 | 300 | 300 | 600 | |

- **Sophomore -Spring Semester:**

| Code | Name | Total Hours | Class Work | Final Exam | Total | Prerequisites |
|---|---|---|---|---|---|---|
| CSE155 | Introduction To Computer Engineering | 3 | 50 | 50 | 100 | CSE 162 |
| ECE172 | Electronics 1 | 4 | 50 | 50 | 100 | ECE 171 – ECE 161 |
| ENG 111 | Introduction to Civil Engineering | 3 | 50 | 50 | 100 | ..... |
| MATH 209 | Probability and Statistics | 3 | 50 | 50 | 100 | ..... |
| MATH 107 | Multivariable Calculus | 2 | 50 | 50 | 100 | MATH 001 , 003 |
| UNC144 | Decision Support Systems | 3 | 50 | 50 | 100 | ..... |
| **Total** | | 18 | 300 | 300 | 600 | |

- **Junior-Fall Semester:**

| Code | Name | Total Hours | Class Work | Final Exam | Total | Prerequisites |
|---|---|---|---|---|---|---|
| ENG234 | Fundamentals of Thermo-fluids | 3 | 50 | 50 | 100 | PHY 011 |
| ECE264 | Electromagnetic Fields | 3 | 50 | 50 | 100 | MATH 107, ECE 161, PHYS 013 |
| ECE 275 | Signal and Systems | 3 | 50 | 50 | 100 | MATH 106 – ECE 161 |
| MATH208 | Discrete Mathematics | 3 | 50 | 50 | 100 | MATH 107 |
| CSE 156 | Computer Architecture | 3 | 50 | 50 | 100 | CSE 162 |
| UNC245 | Management Information System | 3 | 50 | 50 | 100 | …… |
| **Total** | | 18 | 300 | 300 | 600 | |

- **Junior-Spring Semester:**

| Code | Name | Total Hours | Class Work | Final Exam | Total | Prerequisites |
|---|---|---|---|---|---|---|
| CSE 276 | Control Systems | 3 | 50 | 50 | 100 | ECE 275 |
| ECE274 | Electronics-2 | 4 | 50 | 50 | 100 | ECE 172 |
| CSE 265 | Databases | 3 | 50 | 50 | 100 | CSE 153, CSE 156 |
| ECE277 | Introduction to Communication Systems | 3 | 50 | 50 | 100 | ECE 275 |
| ENG233 | Engineering Economy | 2 | 50 | 50 | 100 | MATH 208 |
| CSE 257 | Operating Systems | 3 | 50 | 50 | 100 | CSE 155, CSE 156 |
| 501 | Summer Training1 | 1 | - | - | P/F | …… |
| **Total** | | 19 | 300 | 300 | 600 | |

- **Senior 1-Fall Semester:**

| | | Total Hours | Class Work | Final Exam | Total | |
|---|---|---|---|---|---|---|
| CSE358 | Computer Graphics | 4 | 50 | 50 | 100 | CSE 257 |
| ENG368 | Electrical Energy Systems | 3 | 50 | 50 | 100 | ECE 161, ECE 264 |
| ECE378 | Analog and Digital Communications | 3 | 50 | 50 | 100 | ECE 277, MATH 209 |
| | Elective course 1 | 3 | 50 | 50 | 100 | ..... |
| UNC344 | Law for Management | 2 | 50 | 50 | 100 | ..... |
| ENG 345 | Operation Research | 3 | 50 | 50 | 100 | UNC 245 |
| **Total** | | 18 | 300 | 300 | 600 | |

- **Senior 1-Spring Semester:**

| | | Total Hours | Class Work | Final Exam | Total | Prerequisi |
|---|---|---|---|---|---|---|
| CSE 359 | Microprocessor Systems Design | 3 | 50 | 50 | 100 | CSE 155 |
| ECE379 | Digital Signal Processing | 3 | 50 | 50 | 100 | ECE 275 |
| CSE357 | Internet Programming | 3 | 50 | 50 | 100 | CSE 051, CSE 153 |
| | Elective course 2 | 3 | 50 | 50 | 100 | ..... |
| | Capstone Design Elective 1 | 3 | 50 | 50 | 100 | ..... |
| UNC346 | Marketing | 2 | 50 | 50 | 100 | ..... |
| 502 | Summer Training 2 | 2 | - | - | P/F | ..... |
| **Total** | | 19 | 300 | 300 | 600 | |

- **Senior 2-Fall Semester:**

| | | Total Hours | Class Work | Final Exam | Total | Prerequisites |
|---|---|---|---|---|---|---|
| | Elective course 3 | 3 | 50 | 50 | 100 | ..... |
| | Elective course 4 | 3 | 50 | 50 | 100 | ..... |
| | Elective Design course | 3 | 40 | 50 | 100 | ..... |
| 498 | Project and Report 1 | 4 | 50 | 50 | 100 | ..... |
| UNC 446 | Quantitative Methods For Quality Control | 3 | 50 | 50 | 100 | ..... |
| **Total** | | 16 | 250 | 250 | 500 | |

- **Senior 2-Spring Semester:**

| | | Total Hours | Class Work | Final Exam | Total | Prerequisites |
|---|---|---|---|---|---|---|
| | Elective course 5 | 3 | 50 | 50 | 100 | ..... |
| | Elective course 6 | 3 | 50 | 50 | 100 | ..... |
| 499 | Project and Report 2 | 4 | 50 | 50 | 100 | 498 |
| UNC 447 | Professional & Communication Skills | 2 | 50 | 50 | 100 | ..... |
| UNC 448 | Project Management | 3 | 50 | 50 | 100 | ..... |
| **Total** | | 15 | 250 | 250 | 500 | |

## 3. Course Syllabi

Level 000

| 2 Cr | English (1) | UNC041 |
|---|---|---|
| **Prerequistes---- :** | | |
| Technology in use (listening)-Live in maintenance (reading)-Technical writing (paragraph)-Materials Technology (listening)-Industrial process monitoring (reading)-Technical writing (Essay)-Technical writing (report)-Technical writing (structure and types) | | |

| 2 Cr | English (2) | UNC042 |
|---|---|---|
| **Prerequistes---- : UNR041** | | |
| Analysis and interpretation of engineering issues - summarizing engineering issues - preparation for language tests | | |

| 3 Cr | Calculus 1 | MATH 001 |
|---|---|---|
| **Prerequistes---- :** | | |
| Transcendental Functions-Derivatives-Applications of Differentiation-Polynomial Functions-Partial Fractions-System of Linear Algebraic Equations-Partial Derivatives | | |

| 3 Cr | Calculus 2 | MATH 003 |
|---|---|---|
| **Prerequistes---- : MATH 001** | | |
| Techniques of integration -Integration by reduction -Definite integral ad its properties Improper integral -Applications of integration (area, volume, and arc length)-First order ordinary differential equations-Infinite series-Quadratic equation of two variables Conic sections -Parametric equation of conic sections-Coordinate systems in space-line and plane in space -Quadratic surfaces (cylinder, sphere, ellipsoid, hyperboloid, cone and paraboloid). | | |

| 3 Cr | Engineering Mechanics 1 | MATH 002 |
|---|---|---|
| **Prerequistes---- :** | | |
| Force Vectors – 3 Dimensions - Equilibrium of particles in 3 Dimensions Force System resultants -Equilibrium of Rigid Body in three dimensions -Centroids and Centers of gravity -Analysis of simple structures, Frames, and Machines. | | |

| 3 Cr | Engineering Mechanics 2 | MATH 005 |
|---|---|---|
| **Prerequistes---- : MATH 002** | | |

Distributed loads and Fluid statics –Simple Trusses, Method of Joints and Method of Sections Dry Friction and its application, Frictional forces on Screws and Wedges –Kinematics of a particle and General curvilinear motion –Curvilinear motion in different coordinates

| 4 Cr | Physics (1) | PHYS 011 |
|---|---|---|

**Prerequistes----:**

Units and dimensional analysis –Mechanical properties of metal Experiment: Determine the Young's modulus of materials. – Oscillations. Experiments: 1– Determine the gravity of acceleration by using the simple pendulum. 2– Determine the spring constant and the verification of Hook's law. The Wave and superposition principle –The Sound waves and Doppler effect Experiments: 1– Determine the speed of sound by using open air column and tuning forks. Temperature and thermometers. – Quantity of heat Experiments: Determine the melting point of wax. –Thermal expansion –Heat transfer The first law of thermodynamics –The entropy and the second law of thermodynamics.

| 4 Cr | Physics (2) | PHYS 013 |
|---|---|---|

**Prerequistes----: PHYS 011**

The Charge and the electric field – Coulomb's law – The electric flux and Gauss's law The electric potential – The capacitors and dielectrics The magnetic field –Boit– Savart's law – The magnetic flux Gauss's Law – Faraday's Law– Magnetic Induction. – Nature of light – Experiment: Determine the refractive index of the prism's material – Interference of light – Diffraction – Polarization –Experiment: Verification of Malus' law. – Early quantum theory – Special Relativity

| 4 Cr | Engineering Chemistry Fundamentals | MTH 021 |
|---|---|---|

**Prerequistes----:**

Equation of state. – Lab: Acid Base Titration – Chemical thermodynamics. – Lab: Oxidation Reduction Titration – Material and heat balance in fuel combustion and chemical processes. – Properties of solutions –Lab: Precipitation Titration (Chlorides) – Electrochemistry Introduction to corrosion engineering – Industries of Dyas & Chemistry of cement &fertilizer–Dynamic Equilibrium in Physical and Chemical Processes

| 3 Cr | Computer Programming | CSE 051 |
|---|---|---|

**Prerequistes----: MATH 001**

Problem solving techniques for engineering problems in the field of electrical, electronics and omputer Engineering. – Procedural programming concepts. – Object oriented programming, inheritance, overriding, and overloading. –Compiling, linking, and debugging using C++ and Java programming languages. – Case study 1: building a complete database application. – Case study 2: building a complete Network application using ports and sockets.

| 3 Cr | Engineering Fundamental 1 | ENG 031 |
|---|---|---|
| **Prerequistes----:** | | |
| History of Engineering – Engineering Fields of Specialization and Curricula.- The Engineering Profession: Professionalism, Problem Presentation and Solution, Ethics, Licensing.- Introduction to Drafting and Descriptive Geometry.- Basic Geometric Operations. - 2-D Sketching, Dimensioning - Isometric Pictorials. - Software application. | | |

| 3 Cr | Engineering Fundamental 2 | ENG 032 |
|---|---|---|
| **Prerequistes----: ENG 031** | | |
| Introductory to Drafting and Descriptive Geometry - Free-hand Sketching & Lettering- Geometric Constructions - Orthographic Projection- Pictorial Projection -Missing Views and Sectional Views - Software Application | | |

Level 100

| 3 Cr | Summer Training – 1 | 501 |
|---|---|---|
| **Prerequistes----:** | | |
| Safety implications of electrical equipments - Use of electronic measuring devices - Network basics and programming - Arduino systems and projects | | |

| 3 Cr | Introduction to Data Structures and Software Engineering | CSE 153 |
|---|---|---|
| **Prerequistes----: CSE 051** | | |
| Introduction to Data Structure and algorithm - Develop facility in thinking about abstract data types. Analyze the efficiency of algorithms - Abstract Data Types - Array one , two dimention (Declareation - dealing ) example - Linked List (usage - declaration - example - Functions - types) -Stack (Usage - declaration - implementation Functions - ) example - Tree ((Usage - declaration - implementation - Functions - )example -Search Algorithm (linear - Binary)<br>Sorting ( Bubble - quick - merge ---) -Evaluation and analysis of studied algorithms using a recent programming | | |

| 3 Cr | Introduction to Computer Engineering | CSE 155 |
|---|---|---|
| **Prerequistes----: CSE 162** | | |

| | | |
|---|---|---|
| An Introduction to the design and operation of digital computers- Information Representation Logic Design- Integrated Circuits- Register Transfer Description - Basic Computer Organization - Machine-Level Programming - An Introduction to the design and operation of digital computers | | |
| **4 Cr** | **Logic Digital Design** | **CSE 162** |
| **Prerequistes----:** | | |
| Numbering System and operations - Decimal Coding systems - Boolean Algebra Logic gates and implementations - Karnof map - Main Terms - combinational circuits design Adders, Sub-tractors, Decoder, encoder and multiplexer implementations | | |

| | | |
|---|---|---|
| **3 Cr** | **Electrical Circuit Analysis** | **ECE 161** |
| **Prerequistes----:** MATH 003 | | |
| Elements of electrical circuits - Simple resistive circuits - Analysis of DC circuits - Theories of electrical circuits - First-order circuits - steady AC sinusoidal circuits- Power and power factor Resonance circuits - Three-phase circuits | | |

| | | |
|---|---|---|
| **3 Cr** | **Solid State Electronics** | **ECE 171** |
| **Prerequistes----:** PHY 013 | | |
| Crystal Structures - Bonding and Imperfections in crystals Schrodinger Equation - Allowed and Forbidden Energy band-gaps Krong Penny Model - EK diagram- Materials and Density of States- Intrinsic and Extrinsic Semiconductors- Extrinsic Carrier Concentration- PN Junctions - Virtual Labs on Crystals, band structure and PN junction | | |

| | | |
|---|---|---|
| **3 Cr** | **Introduction to Civil Engineering** | **ENG 111** |
| **Prerequistes----:** | | |
| General classes of materials.- Testing, inspection, specifications of different types of materials. Mechanical Behaviors of metals, static tensions, static compression. - Building stones. - Mineral aggregates classifications.- Surveying – earth shape.- Types of surveying. Loads and reactions.- Internal forces. - Applications. | | |

| | | |
|---|---|---|
| **4 Cr** | **Electronics1** | **ECE 172** |
| **Prerequistes----:** ECE 161, ECE 171 | | |
| Revisions on , N type, P type semiconductors and PN junctions-Rectifier Diodes, Half, Full-Wave Rectifiers and Rectifier Filters- Diode limiting, clamping circuits and voltage multiplier Zener Diodes, and Their Applications- Optical Diodes and simulation for diode circuit applications- Bipolar Junction Transistors, Fundamentals- Bipolar Junction Transistors, Biasing circuits- Junction Field Effect Transistors, Fundamentals and Biasing circuits- MOSFET Field Effect Transistors, Fundamentals and Biasing circuits | | |

| 3 Cr | Differential Equations | MATH 106 |
|---|---|---|
| **Prerequistes----:** MATH003 | | |
| Applications of partial differentiation. -Maximum values of functions in more than one variable and applications- First order differential equations- Second order differential equations Laplace transform and its applications- Analytical geometry in space | | |

| 2 Cr | Multivariable Calculus | MATH 107 |
|---|---|---|
| **Prerequistes----:** MATH 001, MATH 003 | | |
| Fourier series -Fourier transform- Complex numbers- Functions of a complex variable- Complex integration- Residue theorem- Direction derivatives- Double integrals- Triple integrals- Line integrals- Surface integrals | | |

| 3 Cr | Probability and Statistics | MATH 209 |
|---|---|---|
| **Prerequistes----:** | | |
| Measures of tendency and dispersion.- Probability distributions Sampling theorem- Tests of hypothesis- Non-parametric tests- Regression and correlation - Time series. | | |

| 2 Cr | Finance | UNC142 |
|---|---|---|
| **Prerequistes----:** | | |
| Natural theory of cost-profit maximization- Capital investment.- Market structure. Production relations- Decision making.- Add economic project analysis and student presentations to practice for effective communication with listeners | | |

| 2 Cr | Technical English writing | UNC 143 |
|---|---|---|
| **Prerequistes----:** | | |
| Technical writing definition- audience analysis- Technical writing styles- Technical document characteristics Automated document organization- official and unofficial document types- Structure of different types of technical documents. | | |

| 3 Cr | Decision Support Systems | UNC 144 |
|---|---|---|
| **Prerequistes----:** | | |
| An overview of Decision support system (DSS).- An overview of Visual Basic.- The creation of a decision support system using automation. - Integrate Visual Basic with Microsoft Office object models.- Intermediate & advanced Visual Basic topics include ActiveX Documents, ActiveX Controls, ActiveX components, Active Server Pages.- Scientific research techniques and the ability to analyze and solve problems | | |

level 200

| CSE 257 | Operating Systems | 3 Cr |
|---|---|---|
| **Prerequistes** | CSE 155, CSE 156 | |
| Introduction to the operating system, background, and basics – Operating system history, and design issues File systems – Study of different data access methods –System resources management – Managing and scheduling tasks (CPU scheduling) –Memory hierarchy –Memory types – Different memory implementations – Memory management techniques Secondary storage management – Cache memory implementation –Implement simple cache memory using a programming language–Sequential execution – System selection consideration–Study of recent operating systems – Process synchronization–Threads–Interrupts Deadlock detection methods– Deadlock prevention and system recovery methods–Virtual memory concepts, paging, segmentation and address mapping–Secondary storage management, disk components, disk scheduling, and swap-space management–UNIX process control and management. | | |

| CSE 265 | Data Bases | 3 Cr |
|---|---|---|
| **Prerequistes** | CSE 153 , CSE 156 | |
| Basic database concepts –Data structures and operations –Data modeling–Database system architecture –Data definition and data manipulation languages –query languages including Algebra and SQL –software package training | | |

| CSE 156 | Computer Architecture | 3 Cr |
|---|---|---|
| **Prerequistes** | CSE 162 | |
| Computer arithmetic – design of ALU Pipelined ALU and processor – multiprocessors – multicomputers control unit –Instruction repertoires (RISC, CISC) – interrupt circuits Bus synchronization – I/O devices – channels – memory architectures Connection of computer peripherals – Distributed Systems scalable computer platforms –vector processors – vectorizing compilers systolic arrays – loosely and tightly coupled processors symmetric and CC–NUMA multiprocessors– data flow machines interconnectin networks–clustering – parallel processors architecture parallel programming performance evaluation – case studies | | |

| CSE 276 | Control Systems | 3 Cr |
|---|---|---|
| **Prerequistes** | ECE 275 | |
| Introduction to control systems - Open and closed loop control systems -Laplace transformation and transfer function -Block diagram reduction -Signal flow graph -Modeling of systems: (Electrical circuits, Mechanical systems, DC motors) -Modeling of systems: (AC servo motors, Synchro, Potentiometers, stepper motors – Hydraulicservo motor – Thermal systems – liquid level systems)-Linearization of nonlinear mathematical model - Time response analysis: (First order systems –steady state error)-Time response analysis: (second order systems) - Stability of control systems: (Routh stability analysis)-Stability of control systems: (Determining relative stability using Routh and root locus method)-Applications of the previous topics using MATLAB/Simulink toolboxes. | | |

| ECE 264 | Electromagnetic fields | 3 Cr |
|---|---|---|
| **Prerequistes** | MATH 107, ECE 161, phy 013 | |
| Vector analysis and Coordinate systems-electrostatic charges -Gauss Theorem-Laplace operator, Boundary conditions, PEC -Capacitors analysis using Q, V methods and simulation tools-moving charges and current carrying wires-Magnetic Field, Intensity, Flux and Coils-Faradat's, Lenz -Modified Ampere's Law and Maxwell's equations | | |

| ECE 274 | Electronic 2 | 4 Cr |
|---|---|---|
| **Prerequistes** | ECE 172 | |
| SCR, Triac, special diode -BJT/FET non-idealities -Small signal analysis -Single stage amplifier-Multiple stage amplifier -differential amplifier, OPAMPs, and linear digital ICs | | |

| ECE 275 | Signals and Systems | 3 Cr |
|---|---|---|
| **Prerequistes** | ECE 161, MATH 106 | |
| Introduction to signals-Linear time-invariant systems -Laplace Transform and Continuous-time signals-Z-Transform and discrete-time signals-Spectral analysis and Fourier Transform | | |

| ECE 277 | Introduction to Communications Systems | 3 Cr |
|---|---|---|
| Prerequistes | ECE 275 | |
| Introduction to communication systems–Power spectral density–Amplitude modulation (suppressed and large carrier)–Frequency modulation–Wide band FM–AM and FM receivers.–Noise in analog modulation systems.–An introduction to the structure and types of mobile comm. systems – the seven–layer communication model – network planning and design – and its applications. | | |

| ENG 233 | Engineering Economy | 2 Cr |
|---|---|---|
| Prerequistes | MATH 208 | |
| Introduction to engineering economy studies, balance sheet, income statement, cash flow statement–Time value of money with simple interest rate–Time value of money with compound interest rate–Economical evaluation and feasibility study of engineering projects–Payback period – Net present value concepts and applications–Equivalent annual – Net future value concepts and applications–Benefit – cost ratio concepts and applications–Inflation effects and applications of engineering projects–History of Engineering, Science and Technology, the role of engineering and technology in the development and emergence of civilizations, and analysis of economic projects (Gap analysis) | | |

| ENG 234 | Fundamentals of Thermo Fluids | 3 Cr |
|---|---|---|
| Prerequistes | Phy011 | |
| Introduction of thermodynamics concepts and definitions–Continuity, momentum and energy equations–Pure substance and ideal gases–Laminar and turbulent flows–First law of thermodynamics in closed systems–Laminar and turbulent flows–First law of thermodynamics in open systems–Flow in conduits–Second law of thermodynamics–Gas cycles–Turbo machinery–Heat transfer basics | | |

| MATH 208 | Discrete Mathematics | 3 Cr |
|---|---|---|
| Prerequistes | MATH 107 | |
| Introduction to logic and proof –Mathematical induction–Counting technique–Algorithms–Relations–Graphs and trees | | |

level 300

| CSE 301 | Software Engineering | 3 Cr |
|---|---|---|
| **Prerequistes** | | |
| An introduction to basic concepts of software engineering-Software development process (Waterfall models, Agile methods, Rapid application development)-System modeling using UML-Data flow diagram design, System architecting and design-Process Model: practical: implement a client server database model-Testing, validation, verification: practical: implement a client server model-Quality Assurance& Configuration Management-Software project management-Implement and design applications using recent design tools | | |

| CSE 302 | Computers Fundamental and Network Security | 3 Cr |
|---|---|---|
| **Prerequistes** | ECE 277 | |
| Introduction to computer Networks-Computer network and topology-Computer network and model-Security principles and security threats-Protocols for Security Services-Elements of cryptography-Advanced security issues and technologies-Network programming | | |

| CSE 303 | Foundmental of Information Systems | 3 Cr |
|---|---|---|
| **Prerequistes** | CSE 155, UNC 245 | |
| Introduction to Information Systems, dimensions of information systems-Global E-Business today-Data and Knowledge, Management information systems-Database, knowledge base Architecture-Information system approaches and complementary assets-Functional and cross functional Business processes, TPS and BI-Enterprise systems and social/electronic business-Supporting information systems-Organizational politics and structures -Social and political issues of information systems | | |

| CSE 304 | Distributed Systems | 3 Cr |
|---|---|---|
| **Prerequistes** | | |
| An introduction to distributed systems-System models (physical and architectural models)-Networking and internetworking-Network virtualization and communication -Peer-to-peer systems and web services-Cloud and grid computing -Design and implement Real distributed system projects | | |

| CSE 357 | Internet Programming | 3 Cr |
|---|---|---|
| Prerequistes | CSE 051, CSE 153 | |
| Client server programming models–Protocols – server design and constructions such as; fault tolerance, caching, proxying, and security–Web service–Programming network applications–Web based applications–Implementing database applications on the web–Introduction to Embedded programming and multi–threaded programming | | |

| CSE 358 | Computer Graphics | 3 Cr |
|---|---|---|
| Prerequistes | CSE 257 | |
| The principles of computer drawing, computer graphics, and introduction to computer graphics with programming language–Graphics algorithms and applications–Computer graphics with Java Applet–2D drawing methods and functions (Line, rectangle, circle, polygon, images) (Resolution – Brightness – Intensity)–Image formats, color systems (Gray, RGB, ….)–Animation, event handler–3D drawing methods and functions–Experimental projects with Java programming language and appropriate tools. | | |

| CSE 359 | Microprocessors System Design | 3 Cr |
|---|---|---|
| Prerequistes | CSE 155 | |
| Introduction to microprocessor system–Architecture of microprocessor and registers–Hardware connections, buffers and latches–Clocking and timing issues–Addressing modes–Memory management and interface circuit design–Input/output management and interface circuit design–PPI architecture and design examples.–Microprocessor projects design applications–Introduction to Assembly language programing | | |

| ECE 302 | Mobile Communication systems | 3 Cr |
|---|---|---|
| Prerequistes | ECE 378 | |
| Conventional telephone systems–Traffic theory–Conventional mobile system – Frequency spectral efficiency–Methods of increasing system capacity – System architecture–Multiple access schemes – Interference in cellular systems–Hand off – Fading and Doppler in cellular system –GSM system architecture – GSM channel coding–Ciphering and modulation–System management. | | |

| ECE 378 | Analog & Digital Communications | 3 Cr |
|---|---|---|
| **Prerequistes** | ECE 277 & MATH 209 | |
| Introduction to modern digital communication systems–Waveform Coding Systems –Base Band PCM transmission and probability of error –Information Theory, Coding, and Channel Capacity–Channel Coding for Error Detection and Correction–Digital Modulation/Demodulation–Spread Spectrum Communications–Seven–layer communication model and network planning, design and layers | | |

| ECE 379 | Digital Signal Processing | 3 Cr |
|---|---|---|
| **Prerequistes** | ECE 275 | |
| Converting analog signals to digital signals–IIR digital filter design – FIR digital filter design–implementation of digital filters–Wiener filter – adaptive filters–data compression and encryption–Applications on digital signals. | | |

| ECE 301 | Electronics for Communication | 3 Cr |
|---|---|---|
| **Prerequistes** | ECE 274 | |
| Passive network synthesis–Active network design–Data acquisition systems–Data converters–Logic families–Phase locked loops.–Communication circuits. | | |

| ECE 303 | Electromagnetic Waves | 3 Cr |
|---|---|---|
| **Prerequistes** | ECE 264 | |
| Time varying fields and Maxwell's equations, boundary conditions at different media interface, retarded potentials, plane wave propagation in free space–TEM transmission lines, transmission line equivalent circuit–transmission line circuit theory, Smith chart, lossy transmission lines, matching techniques–Parallel palate waveguides–Circular waveguides | | |

| ECE 304 | Optoelectronics | 3 Cr |
|---|---|---|
| **Prerequistes** | ECE 264 | |

Introduction, Photons & Electrons. Maxwell's equations, Wave nature light, Emission of and Absorption processes.–Fundamentals of Optics, Ray optics: reflection, refraction, critical and Brewster angles. Interference of light, Interferometers, Diffraction and Polarization–Light and matter: Emission, Propagation and Absorption Processes–Optical Coherence and Correlation: Definition, Measurement of coherence and Practical examples–Essential Physics of Radiation and Solids: Black body radiation, Classical results and Quantum results. Rate Equations and the Gain mechanism. Laser Structure, Mode locking and Q switching.–Electrons in solids: Laser sources (He=Ne Laser, Argon Laser and ND–YAG Laser), SC sources (LEDs and SLDs)–Optical Modulators: Internal modulation, External modulators: Electro optic, Magneto optic and Acousto–optic modulator–Photo detectors: photo–emissive, photoconductive and photovoltaic detectors–Testing of the basic characteristics of optical sources, detectors, and optical components.–Assignments Presentation and discussions.

| ENG 368 | Electrical Power Systems | 3 Cr |
|---|---|---|
| Prerequistes | ECE 161, ECE 264 | |
| Electrical power systems–three phase systems–Theory and models of transformers–Transmission line models–Voltage and frequency control, effective and ineffective power–Optimal work of power systems–The theory of operation – The construction of the Direct Current motors–The speed ،torque ،and current characteristics – applications of the DC motors–The theory of operation and construction of stepper motors – Permanent–magnet DC motor and Low–inertia DC Motors–The theory of operation ،construction of three phase induction motors. | | |

| 502 | Summer Training (2) | 2 Cr |
|---|---|---|
| Prerequistes | | |
| Embedded systems –Computer engineering basics –Communication measurements–Mobile communication devices troubleshooting –Computer engineering managements –Field practical training –Reports, and projects outputs | | |

| UNC 344 | Law for Management | 2 Cr |
|---|---|---|
| Prerequistes | | |
| Systems and laws of institutions–Introduction to Accounting–Labor legislation and laws governing engineering professions–Industrial security legislation and environment–Historical philosophical origins of human rights–international sources of human rights–national sources of human rights–global bodies based on the protection of human rights | | |

| UNC 345 | Operational Research | 3 Cr |
|---|---|---|
| Prerequistes | UNC 245 | |
| Introduction and history of Operations Research-Overview of Operations Research Modeling Approach-Introduction to Linear Programming-Graphical method -Simplex method-Transportation problem-Assignment problem-Integer programming-Network Analysis-Program Evaluation and Review Technique and Critical Path Method (PERT and CPM) | | |

| UNC 346 | Marketing | 2 Cr |
|---|---|---|
| Prerequistes | | |
| Principles of products marketing-Marketing research-Customers buying behavior-Marketing mix-Plotting marketing strategy-Building marketing plan-Pinpointing the target market-Marketing on the world wide web | | |

level 400

| 4 Cr | Project and Report (1) | 498 |
|---|---|---|
| Prerequistes----： 127 | | |
| Completion of a project using all previously learned sciences from different fields in order to solve a realistic problem in a team. The project ends with a technical report and a discussion. | | |

| 4 Cr | Project and Report (2) | 499 |
|---|---|---|
| Prerequistes----： 498 | | |
| Completion of a project using all previously learned sciences from different fields in order to solve a realistic problem in a team. The project ends with a technical report and a discussion. | | |

| 3 Cr | Human Computer Interaction | CSE 401 |
|---|---|---|
| Prerequistes----： | | |
| Interfacing and Map of Human Computer Interaction -Interfacing with python programming, data types, operators, numbers, decision making. -Python collections (lists, set, tuple, dictionary), loops -Interfacing with files (text and excel files) | | |

| |
|---|
| Functions, different types of function arguments - Object oriented programming (OOP) concepts with python -GUI programming with Tkinter |

| 3 Cr | Web based information Systems | CSE 402 |
|---|---|---|
| **Prerequistes----:** CSE 056 | | |
| Introduction to client programming- Illustrating HTTP protocol-Discussing major technologies used in building Web servers. -Explaining components of Windows-based IIS Server.- Implementing Windows-based IIS Server using ASP. NET along with C#-Explaining components of Apache Server.-Implementing Apache Server using PHP-SQL database servers-XML programming. | | |

| 3 Cr | Language Processors | CSE 403 |
|---|---|---|
| **Prerequistes----:** | | |
| Introduction to the theory of languages -Evolution of computer languages and translators formal specification of languages -context dependent and context free languages logical structure of a compiler -lexical, syntax and semantic analysis code generation and optimization -storage and register allocation - runtime considerations | | |

| 3 Cr | Multimedia systems | CSE 404 |
|---|---|---|
| **Prerequistes----:** ECE407, ECE379 | | |
| An introduction to multimedia -Multimedia presentation, Data compression, Data production Graphics and image data representation -Color in Image and Video -Multimedia data compression (Lossless, Lossy compression techniques, and Basic Video Compression Techniques) -Design and implement multimedia projects | | |

| 3 Cr | Parallel Algorithms | CSE 405 |
|---|---|---|
| **Prerequistes----:** | | |
| Parallel languages: general principles, parallel constructs, vectorizing compilers, issues - portability. Practical exposure to parallel programming -Parallel algorithms: general principles, recurrences, parallel approach to data structures and computational structures Future trends: technology, design limitations, future supercomputers. -Parallel algorithm implementations -Origins of parallelism, classification of algorithm designs, characterization of performance | | |

| 3 Cr | Decision Algorithms | CSE 407 |
|---|---|---|
| **Prerequistes----:** | | |
| Introduction to A.I. - Common application for A.I. -Importance of knowledge, knowledge representation -Reasoning methods and dealing with uncertainty -Search concepts -Rule based expert systems -Expert systems dealing with uncertainty -Prolog tutorial and A.I. programming concepts | | |

| 3 Cr | Embedded and real time System | CSE 406 |
|---|---|---|
| **Prerequistes----:** CSE 155 | | |
| An introduction to embedded systems -Embedded computing platform principles- Microcomputer systems -PIC18F Microcontroller Series -C programming Language Functions and Libraries in mikroC -System analysis and architecture design -Simple Projects with C Programming Language | | |

| 3 Cr | Integrated Circuits Design | ECE 401 |
|---|---|---|
| **Prerequistes----: ECE 274** | | |
| IC technology – Tuned amplifiers – Noise analysis -Operational amplifiers and applications – Waveform generation - Analog IC applications (analysis and design) -Evaluation of circuit performance by computer-aided circuit simulations -Phase locked loops - Electronic circuits in radio and television -Video recording | | |

| 3 Cr | RF Circuits and Devices | ECE 402 |
|---|---|---|
| **Prerequistes----: ECE 264, ECE 274** | | |
| Wiener filters, linear prediction -steepest-descent and stochastic gradient algorithms - frequency-domain adaptive filters - method of least squares, recursive least squares, fast fixed order and order-recursive (lattice) filters -Mis adjustment, convergence and tracking analyses, stability issues, finite precision effects -connections with Kalman filtering and nonlinear adaptive filters | | |

| 3 Cr | Microwave Engineering | ECE 403 |
|---|---|---|
| **Prerequistes----: ECE 264, ECE 274** | | |
| Rectangular and circular wave guides -Cavity resonators -Excitation of waveguides -Surface guiding and dielectric optical waveguides -Analysis of microstrip and strip lines -Scattering parameters -Wave propagation in ferrite media and passive microwave components | | |

| 3 Cr | Antennas | ECE404 |
|---|---|---|
| **Prerequistes----:** | **ECE 264** | |
| Maxwell's equations, and field analysis -Antenna parameters -Fundamental antennas - Antenna arrays -Introduction to wave propagation -Ground waves and Space waves -Antenna Array Synthesis | | |

| 3 Cr | Communications Networks | ECE405 |
|---|---|---|
| **Prerequistes----:** | **ECE 277** | |
| Introduction To Computer Networks -Experimental: NIC and UTP cable, installing. Introduction to Data Communication -Experimental: PCs on a Network -Network Components (HW- SW) - Network Architecture -Computer Network Classification and types -Network Layered Model for communication and different communication protocols -Network Design techniques and modeling – 7 Layers Model (ISO-OSI) - Experimental: PCs on the Internet. Application Layer protocol -Experimental: Wireless Networks and Mobile Systems. Transmission Layer Protocol -Network layer Protocol - Study Different Routing Algorithms Digital integrated network system -Experimental: interference between Bluetooth and 802.11b Routing -Ethernet and packet Decoding -Practical Study and Exercises -Experimental: Configure ICS and Trace the Operations of DHCP and NAT | | |

| 3 Cr | Telecommunications Systems | ECE 406 |
|---|---|---|
| **Prerequistes----:** | **ECE 277** | |
| Discrete Fourier Transform and its properties - Fading (fast, slow, and flat) -Frequency - selective and non-selective -Dual Multi-Tone (DMT ) - OFDM - Multi-path propagation - Delay spread values and Guard time and cyclic extension - OFDM parameters, OFDM versus single carrier modulation. - Spread Spectrum - PN sequence generators -Direct sequence Spread Spectrum - Probability of error – Frequency Hopping Spread Spectrum -CDMA –DS-CDMA | | |

| 3 Cr | Digital Image Processing | CCE 461 |
|---|---|---|
| **Prerequistes----:** | **ECE 379** | |
| Image Representation - Methods Of Image Processing -Enhancement - Data Compression - Reconstruction From Projection - Features Extraction - Image Analysis - Pattern Recognition - Computer Vision | | |

| 3 Cr | Quantitative Methods For Quality Assurance | UNC 446 |
|---|---|---|

| Prerequistes---- : |
|---|
| General Introduction – TQM and principals – TQM tools and techniques – Fundamental of statistics – Control chart for Variables – Control chart for attributes – Sampling plan – Introduction to all of the following processes (plumbing, blacksmithing and carpentry) and its effect on the quality of product |

| 3 Cr | Selected Topics in Electronics and Communications Engineering | ECE 408 |
|---|---|---|
| Prerequistes---- : | | |
| Neural Networks and Biomedical engineering – Cellular telephony – personal satellite communications – Voice telephony. – internet telephony and video conferencing – Advanced topics in the fields of electronics and Communications | | |

| 2 Cr | Professional & Communication Skills | UNC 447 |
|---|---|---|
| Prerequistes---- : | | |
| Communication skills – Presentation planning and preparation – Delivery skills such as eye contact, voice control, gestures, body language and appearance – Presenter's characteristics – Using visuals – Presentation structure – Elevator Pitch | | |

| 3 Cr | Project Management | UNC 448 |
|---|---|---|
| Prerequistes---- : | | |
| General introduction – Engineering Projects types and participants – Bar chart planning and scheduling methods – CPM method for planning and scheduling methods – PDM method for planning and scheduling methods – Resource smoothing and leveling | | |

The Communications and Computers Engineering program at Mansoura University fosters an academic environment that effectively contributes to its graduates having the choice, talents, and knowledge to:

1. PEO1: Pursue a variety of occupations in communications and computer engineering and related industries as engineers, consultants, and entrepreneurs.
2. PEO2: Earn postgraduate degrees in communications and computer engineering, as well as multidisciplinary subjects, in local and worldwide graduate programs to become thought leaders, academics, experts, and educators.
3. PEO3: Be lifelong learners and innovators in ever-changing global economic and technical contexts of the twenty first century.
4. PEO4: Exhibit effective communication, teamwork, entrepreneurial, leadership skills and engage in ethical and function professionally in the economic growth of Egyptian society.

## 5. Student and Learninf Outcomes

### A. Student Outcomes

The CCE program‘s student outcomes support the CCE program educational objectives. Attainment of these outcomes prepares CCE graduates to enter the professional practice of engineering. The CCE program adopts the EAC of ABET Student Outcomes (1) through (7) as follows:

1. An ability to identify, formulate, and solve complex engineering problems by applying principles of engineering, science, and mathematics.
2. An ability to apply engineering design to produce solutions that meet specified needs with consideration of public health, safety, and welfare, as well as global, cultural, social, environmental, and economic factors.
3. An ability to communicate effectively with a range of audiences.
4. An ability to recognize ethical and professional responsibilities in engineering situations and make informed judgments, which must consider the impact of engineering solutions in global, economic, environmental, and societal contexts.
5. An ability to function effectively on a team whose members together provide leadership, create a collaborative and inclusive environment, establish goals, plan tasks, and meet objectives.
6. An ability to develop and conduct appropriate experimentation, analyze and interpret data, and use engineering judgment to draw conclusions.
7. An ability to acquire and apply new knowledge as needed, using appropriate learning strategies.

The CCE program Student Outcomes are posted in the students 'handbooks and online on the program website:

https://engfac.mans.edu.eg/en/accred-4

Additionally, SOs are announced in the form of brochures available to students, as well as a billboard hung on the walls in the faculty building halls, classrooms and Laboratories.

### B. Learning outcomes, NARS 2018

The program is accredited from the National Authority for Quality Assurance and Accreditation of Education (NAQAAE) in February 2022. The program was adopted the academic reference standards (ARS 2015) and starting from June 2021, the program adopts national academic reference standards (NARS 2018). Table 3.1 clarifies the relation between the adopted learning outcomes (NARS2018) and the adopted student outcomes (ABET).

Table 3.1. Matching between the student outcomes and Learning Outcomes

| Program Student Outcomes (ABET) | Student Outcomes (NARS 2018) |
|---|---|
| SO1. An ability to identify, formulate, and solve complex engineering problems by applying principles of engineering, science, and mathematics | A1. Identify, formulate, and solve complex engineering problems by applying engineering fundamentals, basic science and mathematics |
| SO2. An ability to apply engineering design to produce solutions that meet specified needs with consideration of public health, safety, and welfare, as well as global, cultural, social, environmental, and economic factors | B2.Design, model and analyze an electrical/electronic/digital system or component for a specific application; and identify the tools required to optimize this design.<br>C2. Design and simulation of different applications using computers, multimedia, mobile and web applications<br>C3. Design electromagnetic applications as antennas, microwave resonators, optoelectronics and Fiber optics |
| SO3. An ability to communicate effectively with a range of audiences | A8. Communicate effectively – graphically, verbally and in writing – with a range of audiences using contemporary tools. |
| SO4. An ability to recognize ethical and professional responsibilities in engineering situations and make informed judgments, which must consider the impact of engineering solutions in global, economic, environmental, and societal contexts | A3. Apply engineering design processes to produce cost-effective solutions that meet specified needs with consideration for global, cultural, social, economic, environmental, ethical and other aspects as appropriate to the discipline and within the principles and contexts of sustainable design and development<br>A4. Utilize contemporary technologies, codes of practice and standards, quality guidelines, health and safety requirements, environmental issues and risk management Principles.<br>A6. Plan, supervise and monitor implementation of engineering projects, taking into consideration other trades requirements.<br>B5. Adopt suitable national and international standards and codes to: design, build, operate, inspect and maintain electrical/electronic/digital equipment, systems and services. |
| SO5. An ability to function effectively on a team whose members together provide leadership, create a collaborative and inclusive environment, establish goals, plan tasks, and meet objectives | A7. Function efficiently as an individual and as a member of multi-disciplinary and multicultural teams.<br>A9. Use creative, innovative and flexible thinking and acquire entrepreneurial and leadership skills to anticipate and respond to new situations. |
| SO6. An ability to develop and conduct appropriate experimentation, analyze and interpret data, and use engineering judgment to draw conclusions | A2. Develop and conduct appropriate experimentation and/or simulation, analyze and interpret data, assess and evaluate findings, and use statistical analyses and objective engineering judgment to draw conclusions.<br>B1. Select, model and analyze electrical power systems applicable to the specific discipline by applying the concepts of: generation, transmission and distribution of electrical power systems<br>B3. Design and implement: elements, modules, sub-systems or systems in electrical/electronic/digital engineering using technological and professional tools<br>B4. Estimate and measure the performance of an |

| | |
|---|---|
| | electrical/electronic/digital system and circuit under specific input excitation, and evaluate its suitability for a specific application.<br>C1. Design, analyze and measure the performance of communication and control systems, advanced electronics and communication networks. |
| SO7. An ability to acquire and apply new knowledge as needed, using appropriate learning strategies. | A10. Acquire and apply new knowledge; and practice self, lifelong and other learning strategies.<br>A5. Practice research techniques and methods of investigation as an inherent part of learning.<br>C4. Acquire the concepts of artificial intelligence and bioengineering including signal processing and image processing |