# *Undergraduate Program Specification of*

**Computers and Systems Engineering**

University**: Zagazig** Faculty**: Engineering**

**A - Basic Information**

1. **Program title:** B. Sc. in Electrical Engineering – Computers and Systems Section
2. **Program type:** Single √ Double Multiple Aa
3. **Faculty:** Engineering
4. **Department responsible for the program:** Computers and Systems Engineering
5. **Coordinator(s):** Dr. Ahmed Alenany
6. **External evaluator(s):** Prof. Dr. Ali Ali Fahmi
7. **Last date of program specifications approval: / /**

**B - Specialized Information**

**1- Program Attributes:**

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| As per the NARS for computer engineering, by the end of the program the students will be able to:   |  |  | | --- | --- | | 1. | Apply knowledge of mathematics, science and engineering concepts to the solution of engineering problems. | | 2. | Design a system, component and process to meet the required needs within realistic constraints. | | 3. | Design and conduct experiments as well as analyze and interpret data. | | 4. | Identify, formulate and solve fundamental engineering problems. | | 5. | Work effectively within multi-disciplinary teams. | | 6. | Communicate effectively. | | 7. | Consider the impacts of engineering solutions on society & environment. | | 8. | Demonstrate knowledge of contemporary engineering issues. | | 9. | Display professional and ethical responsibilities; and contextual understanding. | | 10. | Engage in self- and life- long learning. | | 11. | Demonstrate inductive reasoning abilities, figuring general rules and conclusions about seemingly unrelated events. | | 12. | Use current advanced techniques, skills, and tools necessary for computing practices to specify, design, and implement computer-based systems. | | 13. | Tackling business problems using system analysis tools and techniques. | | 14. | Managing projects related to computer systems in diverse fields of applications. | | 15. | Implementing phases of the computer system development life cycle, procurement and installation of hardware, software design, data manipulation and system operations. | |

**Intended learning outcomes (ILO’s):**

**a- Knowledge and understanding:**

The Computers and Systems engineering graduate should be able to:

|  |  |
| --- | --- |
| a1. | Recognize the main concepts and theories of mathematics and sciences, appropriate to the discipline. |
| a2. | Outline the main concepts, principles and theories of basic engineering science which strengthen the consciousness of the computers and systems engineering such as: electrical, civil, mechanical engineering. |
| a3. | Recognize the principles of electronic components, electrical and electronic circuit analysis, electrical power and machine, and communications. |
| a4. | Describe the concepts of programming, object-oriented design, data structures, algorithms, and software engineering. |
| a5. | Recognize the main concepts and design methods of digital circuits and systems. |
| a6. | Explain the different concepts of machine and assembly languages, computer architecture, computer interfacing, memory hierarchy, advanced computer architectures, embedded systems, signal processing, and real-time systems. |
| a7. | Outline the different concepts of automatic control engineering and system dynamics. |
| a8. | Recognize the principles of electrical measurements, measuring instruments, and testing of digital circuits. |
| a9. | List the basic concepts of operating systems concepts and design. |
| a10. | Explain the concepts of computer networks and internet |
| a11. | Recognize database systems design and its role in business enterprises. |
| a12. | Identify the different approaches to design intelligent system such as: pattern recognition and image processing, parallel processing system, fuzzy system, neural networks system, artificial intelligence, and robotics. |
| a13. | Recognize current advances in the field of computer software and hardware, and control systems. |
| a14. | Identify the general concepts of non-engineering fields that strengthen the consciousness of the engineer of the society and its culture. |

**b- Intellectual Skills:**

The Computers and Systems engineering graduate should be able to:

|  |  |
| --- | --- |
| b1. | Analyze and develop solutions to engineering problems on the basis of limited and possibly contradicting information. |
| b2. | Design and debug algorithms. |
| b3. | Assess and evaluate the characteristics and performance of components, systems and processes. |
| b4. | Select appropriate mathematical and computer-based methods for modeling and analyzing problems. |
| b5. | Select, synthesize, and apply suitable IT tools to computer engineering problems. |

**c- Professional and practical skills:**

The graduates of computers and systems engineering program should be able to:

|  |  |
| --- | --- |
| c1. | Apply knowledge of mathematics, science, information technology to solve engineering problems. |
| c2. | Apply numerical modeling methods to engineering problems. |
| c3. | Design and perform experiments related to computer and control systems, as well as observe record, analyze and interpret experimental results in laboratory as well as in the field. |
| c4. | Use computer-aided design tools, appropriate specialized professional computer software, computational tools and packages throughout  the phases of the life cycle of system development; |
| c5. | Create and/or re-design a process, component or system, and carry out specialized engineering designs. |
| c6. | Design and operate computer-based systems specifically designed for business applications. |
| c7. | Integrate electrical, electronic, and mechanical components and equipment with transducers, actuators, and controllers in creatively computer-controlled systems. |

**d- General and transferable skills:**

The graduates of computers and systems engineering program should be able to:

|  |  |
| --- | --- |
| d1. | Communicate effectively with clear, critical thinking and skills. |
| d2. | Write technical reports referring to the relevant literature. |
| d3. | Collaborate effectively within multidisciplinary team. |
| d4. | Effectively manage tasks, time, and resources. |
| d5. | Function professionally and with ethical responsibility. |

**Academic standards**

**3a External references for standards (benchmarks):**

The external references for standards considered in the development of this program are the National Academic Reference Standards (NARS) prepared by the engineering education sector of the supreme council of universities in Egypt.

**3b Comparison of provision to external references:**

The following table explains how the ILO’s of the current program compare to the requirements of the NARS criterion for program outcomes and assessment (please note that Annex 1 of this document shows the relationship between the program courses and the program ILO’s and Annex 2 shows the program attributes versus the program ILO’s):

|  |  |
| --- | --- |
| **Attributes of program graduates as per NARS Requirements for engineering programs, in general** | **Corresponding ILO’s in Current program** |
| (a) Ability to apply knowledge of mathematics, science and engineering, concepts to the solution of complex engineering problems. | a1-a13, b1–b5, c1-c7 |
| (b) Ability to design and conduct experiments and to analyze and interpret data. | b1, b3, b4, c2-c4, c7 |
| (c) Ability to design a system, component, or process to meet required needs. | b2, b3, b5, c1, c4-c7 |
| (d) Ability to function on multi-disciplinary teams | d1, d3-d5 |
| (e) Ability to identify, formulate and solve engineering problems | b1- b5 |
| (f) Understanding of professional ethical responsibilities | a14, d5 |
| (g) Ability to communicate effectively | d1, d3 |
| (h) Ability to consider and avoid the detrimental impact of engineering solutions within social or global measures | a14, d5 |
| (i) Ability to use the techniques, skills, and modern engineering tools necessary for engineering practice | b4, b5, c4 |

**4- Curriculum Structure and Contents:**

**4.a- Program duration:** 5 academic years

**4.b- Program structure: (**Please refer to tables (a) and (b) below)

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **4.b.i-** | **Total No. of hours:** | **300** |  | **Lect. +Tut.** | | **259** | **Lab** | **41** |
|  |  |  |  |  |  |  |  |  |
| **4.b.ii-** | **No. of hours (Humanities and Social Sciences)** | **14** |  | **4.7%** |  |  |  |  |
|  |  |  |  |  |  |  |  |  |
| **4.b.iii-** | **No. of hours (Mathematics and Basic Sciences):** | **74** |  | **24.7%** |  |  |  |  |
|  |  |  |  |  |  |  |  |  |
| **4.b.iv-** | **No. of hours (basic engineering sciences):** | **71** |  | **23.7%** |  |  |  |  |
|  |  |  |  |  |  |  |  |  |
| **4.b.v-** | **No. of hours (Applied Engineering and Design):** | **82** |  | **27.3%** |  |  |  |  |
|  |  |  |  |  |  |  |  |  |
| **4.b.vi-** | **No. of hours (Computer Applications and ICT):** | **29** |  | **9.7%** |  |  |  |  |
|  |  |  |  |  |  |  |  |  |
| **4.b.vii-** | **Projects and Practice** | **30** |  | **10%** |  |  |  |  |
|  |  |  | | | | | | |
| **4.b.viii-** | **Field Training:**  Summer engineering drawing training in the preparatory year, and field training in the second and third years. | | | | | | | |
| **4.b.ix-** | **Program Levels**  **(in credit-hours system):** | **NA** |  |  |  |  |  |  |

**Table (a):**

|  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Year** | **No. hours/week** | | | | | | **Average hours/week** | | | **Total/week** |
| **First Term**  **15 weeks** | | | **Second Term**  **15 weeks** | | |
| **Lec** | **Tu** | **Lab** | **Lec** | **Tu** | **Lab** | **Lec** | **Tu** | **Lab** |
| **Preparatory** | 15 | 12 | 3 | 14 | 9 | 7 | 14.5 | 10.5 | 5 | **30** |
| **First** | 16 | 8 | 6 | 18 | 7 | 5 | 17 | 7.5 | 5.5 | **30** |
| **Second** | 21 | 10 | 1 | 17 | 6 | 7 | 18 | 8 | 4 | **31** |
| **Third** | 19 | 8 | 3 | 19 | 8 | 3 | 19 | 8 | 3 | **30** |
| **Fourth** | 20 | 7 | 3 | 18 | 7 | 3 | 19 | 7 | 3 | **29** |
| **Total** | 91 | 45 | 16 | 86 | 37 | 25 | 88.5 | 41 | 20.5 | **150** |

**Table (b)**

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Year** | **Humanities and Social Sciences** | | **Mathematics and Basic Sciences** | | **Basic Engineering Sciences** | | **Applied Engineering and Design** | | **Computer Applications and ICT** | | **Projects**  **and Practice** | | **Total** |
| **1st Term** | **2nd Term** | **1st Term** | **2nd Term** | **1st Term** | **2nd Term** | **1st Term** | **2nd Term** | **1st Term** | **2nd Term** | **1st Term** | **2nd Term** |
| **Prep.** | **5** | **-** | **22.5** | **17.5** | **2.5** | **4.5** | **-** | **-** | **-** | **4** | **-** | **4** | **60** |
| **First** | **3** | **2** | **17** | **5** | **5** | **18** | **-** | **-** | **5** | **5** | **-** | **-** | **60** |
| **Second** | **2** | **2** | **6** | **-** | **23** | **12** | **-** | **5** | **-** | **6** | **1** | **5** | **62** |
| **Third** | **-** | **-** | **6** | **-** | **-** | **6** | **21** | **17** | **-** | **4** | **3** | **3** | **60** |
| **Fourth** | **-** | **-** | **-** | **-** | **-** | **-** | **24** | **15** | **-** | **5** | **6** | **8** | **58** |
| **Total** | **14** | | **74** | | **71** | | **82** | | **29** | | **30** | | **300** |
| **%** | **4.7** | | **24.7** | | **23.7** | | **27.3** | | **9.7** | | **10** | | **100** |
| **NARS** | **11**  **(9-12%)** | | **21**  **(20-26%)** | | **21**  **(20-23%)** | | **21**  **(20-22%)** | | **10**  **(9-11%)** | | **9**  **(8-10%)** | |  |

**5- Program courses**

**5.1 Year of program 1 (Preparatory Year) - Semester 1**

**(*All courses are compulsory*)**

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **Program ILOs**  **Covered (By no.)** | **Hours/week** | | | | **Course** | **Code** |
| **Total** | **Lab** | **Tut** | **Lec** |
| **a1, b1, c1, c2, d1** | **4** | **1** | **1** | **2** | **Mechanics (1), Continuing** | **EMP 001** |
| **a1, b1, c1, c2, d1** | **6** | **-** | **2** | **4** | **Mathematics (1), Continuing** | **EMP 002** |
| **a1, b1, c1, c2, d1** | **5** | **1** | **1** | **3** | **Physics (1), Continuing** | **EMP 003** |
| **a2** | **5** | **-** | **4** | **1** | **Engineering drawing projection, Continuing** | **EMP 004** |
| **a1, b1** | **5** | **1** | **2** | **2** | **Chemistry** | **ENE 001** |
| **a14, d1** | **3** | **-** | **2** | **1** | **Technical foreign language (1)** | **TFL 001** |
| **a14, d5** | **2** | **-** | **-** | **2** | **History of engineering and technology** | **HUM 001** |

**Year of program 1 (Preparatory Year) - Semester 2**

**(*All courses are compulsory*)**

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **Program ILOs**  **Covered (By no.)** | **Hours/week** | | | | **Course** | **Code** |
| **Total** | **Lab** | **Tut** | **Lec** |
| **a1, b1, c1** | **4** | **1** | **1** | **2** | **Mechanics (1)** | **EMP 001** |
| **a1, b1** | **6** | **-** | **2** | **4** | **Mathematics (1)** | **EMP 002** |
| **a1, b1** | **5** | **1** | **1** | **3** | **Physics (1),** | **EMP 003** |
| **a2** | **5** | **-** | **4** | **1** | **Engineering drawing projection** | **EMP 004** |
| **a2** | **6** | **4** | **-** | **2** | **Basics of production technology** | **DPE 002** |
| **a4, b1, b2** | **4** | **1** | **1** | **2** | **Computer and programming (1)** | **CSE 001** |

**5.2 Year of program 2 (First Year Electrical Engineering) - Semester 1**

**(*All courses are compulsory*)**

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **Program ILOs**  **Covered (By no.)** | **Hours/week** | | | | **Course** | **Code** |
| **Total** | **Lab** | **Tut** | **Lec** |
| **a1, b1, c1** | **5** | **1** | **1** | **3** | **Mechanics (2)** | **EMP 103** |
| **a1, b1** | **5** | **1** | **1** | **3** | **Physics (2)** | **EMP 105** |
| **a2** | **5** | **1** | **1** | **3** | **Electrical Engineering Materials** | **MTE 103** |
| **a4, b1, b2** | **5** | **2** | **1** | **2** | **Computer programming** | **CSE 121a** |
| **a3, c1** | **7** | **1** | **2** | **4** | **Electric circuits (1)** | **EPE 121** |
| **a14, d1** | **3** | **-** | **2** | **1** | **Technical foreign language (2)** | **TFL 101** |

**Year of program 2 (First Year Electrical Engineering) - Semester 2**

**(*All courses are compulsory*)**

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **Program ILOs**  **Covered (By no.)** | **Hours/week** | | | | **Course** | **Code** |
| **Total** | **Lab** | **Tut** | **Lec** |
| **a1, b1** | **5** | **-** | **2** | **3** | **Mathematics (2)** | **EMP 101** |
| **a3, c1** | **7** | **1** | **2** | **4** | **Electronic Engineering (1)** | **ECE 121** |
| **a2, b1, c1** | **5** | **1** | **1** | **3** | **Civil structures (1)** | **STE 101** |
| **a4, b1, b2** | **5** | **2** | **1** | **2** | **Computer programming** | **CSE 121b** |
| **a2, b4, c1** | **6** | **1** | **1** | **4** | **Thermodynamics & fluids** | **MPE 101** |
| **a14, d5** | **2** | **-** | **-** | **2** | **Humanities (1)** | **HUM** |

**5.3 Year of program 3 (Second Year Electrical Engineering) - Semester 1**

**(*All courses are compulsory*)**

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **Program ILOs**  **Covered (By no.)** | **Hours/week** | | | | **Course** | **Code** |
| **Total** | **Lab** | **Tut** | **Lec** |
| **a1, b1** | **6** | **-** | **2** | **4** | **Mathematics (3)** | **EMP 201** |
| **a2, b1, c1** | **3** | **-** | **1** | **2** | **Civil structures (2)** | **STE 201** |
| **a3, c1** | **4** | **1** | **1** | **2** | **Electronic engineering (2)** | **ECE 221** |
| **a5, b1, b3, c1, c5** | **6** | **-** | **2** | **4** | **Logic design** | **CSE 221** |
| **a3** | **6** | **-** | **2** | **4** | **Electrical machines (1)** | **EPE 221** |
| **a8, b1, b3, c1, c3, c5** | **5** | **-** | **2** | **3** | **Electrical Measurements** | **EPE/ECE 222** |
| **a14, d5** | **2** | **-** | **-** | **2** | **Civil Rights** | **HUM** |

**Year of program 3 (Second Year Electrical Engineering) - Semester 2**

**(*All courses are compulsory*)**

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **Program ILOs**  **Covered (By no.)** | **Hours/week** | | | | **Course** | **Code** |
| **Total** | **Lab** | **Tut** | **Lec** |
| **a3, c1** | **6** | **-** | **2** | **4** | **Electric circuits (2)** | **EPE 223** |
| **a3** | **6** | **-** | **2** | **4** | **Electric fields** | **EPE 224** |
| **a4, b1, b2, b5, c4** | **6** | **2** | **1** | **3** | **Applied programming** | **CSE 222** |
| **a8, b5, c3, c4, c5** | **4** | **4** | **-** | **-** | **Electrical devices and testing** | **ELE 221** |
| **a2, b4, c1** | **6** | **1** | **1** | **4** | **Thermo-fluid machines** | **MPE 201** |
| **a14, d5** | **2** | **-** | **-** | **2** | **Humanities (2)** | **HUM** |

**5.4 Year of program 4 (Third Year Computers and Systems Engineering) - Semester 1**

**Compulsory**

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **Program ILOs**  **Covered (By no.)** | **Hours/week** | | | | **Course** | **Code** |
| **Total** | **Lab** | **Tut** | **Lec** |
| **a1, b1** | **6** | **-** | **2** | **4** | **Mathematics (4)** | **EMP 301** |
| **a3, b1, b3, c4, c5, d2** | **4** | **-** | **1** | **3** | **Digital Electronic Circuits** | **ECE 301** |
| **a6, b1, b3, c4, c5, d2** | **4** | **-** | **1** | **3** | **Computer Organization** | **CSE 321a** |
| **a7, b1, b3, b4, c1, c2, c4, c5, d2** | **6** | **-** | **2** | **4** | **Automatic Control Systems** | **CSE 322** |
| **a8, b3, c3-c5, c7, d1, d2** | **6** | **3** | **1** | **2** | **Measurements and Testing (1)** | **CSE 323a** |
| **Please see table below** | **4** | **-** | **1** | **3** | **Elective Course (1)** | **CSE 33X** |

**Elective**

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **Program ILOs**  **Covered (By no.)** | **Hours/week** | | | | **Courses for**  **Elective course (1)** | **Code** |
| **Total** | **Lab** | **Tut** | **Lec** |
| **a4, b1, b2, c1** | **4** | **-** | **1** | **3** | **Algorithms and Data Structures** | **CSE 331** |
| **a6, b1, b3, c4, c5, d2** | **4** | **-** | **1** | **3** | **Computer Circuit Design** | **CSE 332** |
| **a6, b1, c1, c3, c4, c5** | **4** | **-** | **1** | **3** | **Computer Interfacing** | **CSE 333** |

**Year of program 4 (Third Year Computers and Systems Engineering) - Semester 2**

**Compulsory**

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **Program ILOs**  **Covered (By no.)** | **Hours/week** | | | | **Course** | **Code** |
| **Total** | **Lab** | **Tut** | **Lec** |
| **a3, b3, c1** | **6** | **-** | **2** | **4** | **Communications Engineering** | **ECE 302** |
| **a6, b1, b3, c4, c5, d2** | **4** | **-** | **1** | **3** | **Computer Organization** | **CSE 321b** |
| **a8, b3, c3-c5, c7, d1, d2** | **6** | **3** | **1** | **2** | **Measurements and Testing (1)** | **CSE 323b** |
| **a6, b1, b3, c4, c5, d2** | **6** | **-** | **2** | **4** | **Computer Integrated Circuits** | **CSE 324** |
| **a9, b1, b2, b5, c4, c6** | **4** | **-** | **1** | **3** | **Operating Systems** | **CSE 325** |
| **Please see table below** | **4** | **-** | **1** | **3** | **Elective Course (2)** | **---------** |

**Elective**

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **Program ILOs**  **Covered (By no.)** | **Hours/week** | | | | **Courses for**  **Elective course (2)** | **Code** |
| **Total** | **Lab** | **Tut** | **Lec** |
| **a3, b3, c1** | **4** | **-** | **1** | **3** | **Electrical power and machines** | **EPE 313** |
| **a3, b3, c1** | **4** | **-** | **1** | **3** | **Energy conversion** | **EPE 314** |
| **a3, b3, c1** | **4** | **-** | **1** | **3** | **Power electronics** | **ECE 311** |
| **a14, d5** | **4** | **-** | **1** | **3** | **Safety engineering** | **ENE 312** |
| **a14, d5** | **4** | **-** | **1** | **3** | **Corrosion and equipment protection engineering** | **ENE 313** |

**5.5 Year of program 5 (Fourth Year Computers and Systems Engineering) - Semester 1**

**Compulsory**

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **Program ILOs**  **Covered (By no.)** | **Hours/week** | | | | **Course** | **Code** |
| **Tot** | **Lab** | **Tut** | **Lec** |
| **a3, b3, c1** | **4** | **-** | **1** | **3** | **Digital communication systems** | **ECE 401** |
| **a7, b1, b3, b4, c1, c2, c4, c5, d2** | **6** | **-** | **2** | **4** | **Digital control** | **CSE 421** |
| **a10, b1, b5, c5, d1-d3** | **6** | **-** | **2** | **4** | **Computer networks** | **CSE 422** |
| **a8, b3, c3-c5, c7, d1, d2** | **4** | **3** | **-** | **1** | **Measurements and testing (2)** | **CSE 423a** |
| **Please see table below** | **4** | **-** | **1** | **3** | **Elective Course (3)** | **CSE 4XX** |
| **Please see table below** | **4** | **-** | **1** | **3** | **Elective Course (4)** | **--------** |
| **a14, b1-b5, c1-c7, d1-d5** | **2** | **-** | **-** | **2** | **Project** | **CSE 400** |

**Elective**

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **Program ILOs**  **Covered (By no.)** | **Hours/week** | | | | **Courses for**  **Elective course (3)** | **Code** |
| **Total** | **Lab** | **Tut** | **Lec** |
| **a4, b1-b3, b5, c1, c4-c6** | **4** | **-** | **1** | **3** | **Software engineering** | **CSE 431** |
| **a4, b1, b2, b3, c1, c4** | **4** | **-** | **1** | **3** | **Interpreters** | **CSE 432** |
| **a12, b1, b4, b5, c1, c4** | **4** | **-** | **1** | **3** | **Artificial intelligence** | **CSE 433** |
| **a12, b1, b4, b5, c1, c4** | **4** | **-** | **1** | **3** | **Pattern recognition** | **CSE 434** |
| **a12, b1, b4, b5, c1, c4** | **4** | **-** | **1** | **3** | **Expert systems** | **CSE 435** |
| **a12, b1, b4, b5, c1, c4** | **4** | **-** | **1** | **3** | **Fuzzy logic** | **CSE 436** |
| **a4, b1, b2, b3, b5, c1, c4** | **4** | **-** | **1** | **3** | **Computer languages** | **CSE 437** |

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| --- | --- | --- | --- | --- | --- | --- |
| **Program ILOs**  **Covered (By no.)** | **Hours/week** | | | | **Courses for**  **Elective course (4)** | **Code** |
| **Total** | **Lab** | **Tut** | **Lec** |
| **a3, b3, c1** | **4** | **-** | **1** | **3** | **Microwaves** | **ECE 411** |
| **a3, b3, c1** | **4** | **-** | **1** | **3** | **Mobile communication systems** | **ECE 412** |
| **a3, b1, b3, b4, c2, c4** | **4** | **-** | **1** | **3** | **Digital signal processing** | **ECE 413** |
| **a14, d5** | **4** | **-** | **1** | **3** | **Radioactive pollution** | **ENE 417** |

**Year of program 5 (Fourth Year Computers and Systems Engineering) - Semester 2**

**Compulsory**

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **Program ILOs**  **Covered (By no.)** | **Hours/week** | | | | **Course** | **Code** |
| **Total** | **Lab** | **Tut** | **Lec** |
| **a3, b3, c1** | **6** | **-** | **2** | **4** | **Opto-communication electronics** | **ECE 402** |
| **a8, b3, c3-c5, c7, d1, d2** | **4** | **3** | **-** | **1** | **Measurements and testing (2)** | **CSE 423b** |
| **a4, b1-b3, b5, c1, c4, c5, c6** | **5** | **-** | **2** | **3** | **Database systems** | **CSE 424** |
| **a7, b1,b3, b4, c1,c2, c4,c5,c7,d2** | **5** | **-** | **2** | **3** | **Industrial process control** | **CSE 425** |
| **Please see table below** | **4** | **-** | **1** | **3** | **Elective Course (5)** | **CSE 4XX** |
| **a14, b1-b5, c1-c7, d1-d5** | **4** | **-** | **-** | **4** | **Project** | **CSE 400** |

**Elective:**

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **Program ILOs**  **Covered (By no.)** | **Hours/week** | | | | **Courses for**  **Elective course (5)** | **Code** |
| **Total** | **Lab** | **Tut** | **Lec** |
| **a6, b1, b3, c4, c5, d2** | **4** | **-** | **1** | **3** | **Microcomputer systems** | **CSE 438** |
| **a6, b1, b3, c4, c5, d2** | **4** | **-** | **1** | **3** | **Distributed and parallel processing** | **CSE 439** |
| **a12, b1, b4, b5, c1, c4** | **4** | **-** | **1** | **3** | **Neural networks & genetic algorithms** | **CSE 4310** |
| **a10, b5, c5, d1-d3** | **4** | **-** | **1** | **3** | **Internet** | **CSE 4311** |
| **a7, b1,b3,b4, c1, c2, c4, c5, d2** | **4** | **-** | **1** | **3** | **Optimal control** | **CSE 4312** |
| **a7, b1,b3,b4, c1, c2, c4, c5, d2** | **4** | **-** | **1** | **3** | **Nonlinear control** | **CSE 4313** |
| **a7, b1, b3,b4, c1,c2, c4, c5, d2** | **4** | **-** | **1** | **3** | **Adaptive control systems** | **CSE 4314** |
| **a7, b1, b3, b4, c1,c2,c4, c5, d2** | **4** | **-** | **1** | **3** | **Intelligent control systems** | **CSE 4315** |
| **a7, b1, b3, b4, c1,c2, c4,c5, d2** | **4** | **-** | **1** | **3** | **Robotics** | **CSE 4316** |
| **a12, b1, b4, b5, c2, c4, c5** | **4** | **-** | **1** | **3** | **Automata theory** | **CSE 4317** |
| **a3, b1, b3, b4, c4, c5** | **4** | **-** | **1** | **3** | **Navigation and guidance** | **CSE 4318** |

**6- Program admission requirements**

**Admission to the preparatory year:** High school certificate with major in Mathematics and achieving the minimum grades determined by the National Admission Office

**Admission to the Electrical Engineering Department:** According to the regulations set by the Faculty Council.

**Admission to the Computers and Systems Engineering Division:** According to the regulations set by the Department Council.

**7- Regulations for progression and program completion First Year/ Level/ Semester**

**All Years (except the last year)**

* The student must get a minimum of 50% to pass each course.
* The student is considered successful if he passes the examinations in all courses of his class.
* The student is promoted to the next higher level (Year) if he fails in not more than two subjects of his class or from lower classes.
* The referred student has to sit the examination in the courses in which he has failed together with the students studying the same courses. The student gets a pass grade when he passes the examination successfully. In case the student was considered absent with acceptable excuse in a course, he gets the actual grade.

**Last year**

* To be graduated, the student must pass all the courses.
* If he fails one or two courses, not including the project, he has the opportunity to be retested in September, and he must pass these courses to be graduated.
* If the student fails in the project; he must repeat it during the next academic year.

**Grades**

* The grades of the successful student in a course and in the general grade are evaluated as follows
  + Distinction: from 85% of the total mark and upwards.
  + Very good from 75% to less than 85% of the total mark.
  + Good from 65% to less than 75% of the total mark.
  + Pass: from 50% to less than 65% of the total mark.
* The grades of a failing student in a course are estimated in one of the following grades:
  + Weak: from 30% to less than 50% of the total mark
  + Very weak: less than 30% of the total mark.
* The B.Sc. general grade for students is based on the cumulative marks obtained during all the years of study.
* The student is awarded an honor degree if his cumulative sum is distinction or very good provided that he gets a grade not less than very good in any class of study other than the preparatory year. Moreover, he should not have failed in any course examination in any class other than the preparatory year.

**8- Methods and rules of evaluating students attending the Program**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Target ILO’s Evaluated** | | | | **Method** |
| **General & Transferable skills** | **Professional & Practical Skills** | **Intellectual skills** | **Knowledge and Understanding Skills** |
|  |  | **√** | **√** | Periodic exams  (mid-terms, quiz’s) |
|  | **√** | **√** |  | Practical exams |
| **√** |  | **√** | **√** | Oral exams |
|  |  | **√** | **√** | Final exams (written) |

**9- Evaluation of Program Intended Learning Outcomes**

|  |  |  |
| --- | --- | --- |
| **Sample** | **Tool** | **Evaluator** |
| **50%** | Meeting  Questionnaire | Senior students |
| **5%** | Meeting  Questionnaire | Alumni |
| **5** | Meeting  Report | Stakeholders (Employers) |
| **2** | Report | External evaluator(s) (External Examiner(s)) |
|  | **NA** | Other |

**Program coordinator:**

**Name:** Dr. Ahmed Mahmoud Alenany

**Signature:**

**Acting Department Head: Associate Prof. Dr. Nesreen Ibrahim Ziedan**

**Signature:**

**Date: / /**

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
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| **ANNEX 1:**  **The ILO’s (of the current program) – Course (main ILO’s) matrix.** | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| **Program ILOs** | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | **Course** | |
| **(d) General & Trans. skills** | | | | | **(c) Professional & Practical Skills** | | | | | | | **(b) Intellectual Skills** | | | | | **(a) Knowledge & Understanding** | | | | | | | | | | | | | | **Course Name** | **Course**  **Code** |
| **d5** | **d4** | **d3** | **d2** | **d1** | **c7** | **c6** | **c5** | **c4** | **c3** | **c2** | **c1** | **b5** | **b4** | **b3** | **b2** | **b1** | **a14** | **a13** | **a12** | **a11** | **a10** | **a9** | **a8** | **a7** | **a6** | **a5** | **a4** | **a3** | **a2** | **a1** |
| **Year of Program 1** | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
|  |  |  |  | **•** |  |  |  |  |  | **•** | **•** |  |  |  |  | **•** |  |  |  |  |  |  |  |  |  |  |  |  |  | **•** | **Mechanics (1)** | **EMP 001** |
|  |  |  |  | **•** |  |  |  |  |  | **•** | **•** |  |  |  |  | **•** |  |  |  |  |  |  |  |  |  |  |  |  |  | **•** | **Mathematics (1)** | **EMP 002** |
|  |  |  |  | **•** |  |  |  |  |  | **•** | **•** |  |  |  |  | **•** |  |  |  |  |  |  |  |  |  |  |  |  |  | **•** | **Physics (1)** | **EMP 003** |
|  |  |  |  | **•** |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  | **•** |  | **Engineering drawing projection, Continuing** | **EMP 004** |
|  |  |  |  | **•** |  |  |  |  |  |  |  |  |  |  |  | **•** |  |  |  |  |  |  |  |  |  |  |  |  |  | **•** | **Chemistry** | **ENE 001** |
|  |  |  |  | **•** |  |  |  |  |  |  |  |  |  |  |  |  | **•** |  |  |  |  |  |  |  |  |  |  |  |  |  | **Technical foreign language (1)** | **TFL 001** |
| **•** |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  | **•** |  |  |  |  |  |  |  |  |  |  |  |  |  | **History of engineering and technology** | **HUM 001** |
|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  | **•** |  | **Basics of production technology** | **DPE 002** |
|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  | **•** | **•** |  |  |  |  |  |  |  |  |  |  | **•** |  |  |  | **Computer and programming (1)** | **CSE 001** |
| **Year of Program 2** | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
|  |  |  |  |  |  |  |  |  |  |  | **•** |  |  |  |  | **•** |  |  |  |  |  |  |  |  |  |  |  |  |  | **•** | **Mechanics (2)** | **EMP 103** |
|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  | **•** |  |  |  |  |  |  |  |  |  |  |  |  |  | **•** | **Physics (2)** | **EMP 105** |
|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  | **•** |  | **Electrical Engineering Materials** | **MTE 103** |
|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  | **•** | **•** |  |  |  |  |  |  |  |  |  |  | **•** |  |  |  | **Computer programming** | **CSE 121a** |
|  |  |  |  |  |  |  |  |  |  |  | **•** |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  | **•** |  |  | **Electric circuits (1)** | **EPE 121** |
|  |  |  |  | **•** |  |  |  |  |  |  |  |  |  |  |  |  | **•** |  |  |  |  |  |  |  |  |  |  |  |  |  | **Technical foreign language (2)** | **TFL 101** |
|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  | **•** |  |  |  |  |  |  |  |  |  |  |  |  |  | **•** | **Mathematics (2)** | **EMP 101** |
|  |  |  |  |  |  |  |  |  |  |  | **•** |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  | **•** |  |  | **Electronic Engineering (1)** | **ECE 121** |
|  |  |  |  |  |  |  |  |  |  |  | **•** |  |  |  |  | **•** |  |  |  |  |  |  |  |  |  |  |  |  | **•** |  | **Civil structures (1)** | **STE 101** |
|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  | **•** | **•** |  |  |  |  |  |  |  |  |  |  | **•** |  |  |  | **Computer programming** | **CSE 121b** |
|  |  |  |  |  |  |  |  |  |  |  | **•** |  | **•** |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  | **•** |  | **Thermodynamics & fluids** | **MPE 101** |
| **•** |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  | **•** |  |  |  |  |  |  |  |  |  |  |  |  |  | **Humanities (1)** | **HUM** |

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
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| **Year of Program 3** | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| **d5** | **d4** | **d3** | **d2** | **d1** | **c7** | **c6** | **c5** | **c4** | **c3** | **c2** | **c1** | **b5** | **b4** | **b3** | **b2** | **b1** | **a14** | **a13** | **a12** | **a11** | **a10** | **a9** | **a8** | **a7** | **a6** | **a5** | **a4** | **a3** | **a2** | **a1** |  |  |
|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  | **•** |  |  |  |  |  |  |  |  |  |  |  |  |  | **•** | **Mathematics (3)** | **EMP 201** |
|  |  |  |  |  |  |  |  |  |  |  | **•** |  |  |  |  | **•** |  |  |  |  |  |  |  |  |  |  |  |  | **•** |  | **Civil structures (2)** | **STE 201** |
|  |  |  |  |  |  |  |  |  |  |  | **•** |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  | **•** |  |  | **Electronic engineering (2)** | **ECE 221** |
|  |  |  |  |  |  |  | **•** |  |  |  | **•** |  |  | **•** |  | **•** |  |  |  |  |  |  |  |  |  | **•** |  |  |  |  | **Logic design** | **CSE 221** |
|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  | **•** |  |  | **Electrical machines (1)** | **EPE 221** |
|  |  |  |  |  |  |  | **•** |  | **•** |  | **•** |  |  | **•** |  | **•** |  |  |  |  |  |  | **•** |  |  |  |  |  |  |  | **Electrical Measurements** | **EPE/ECE 222** |
| **•** |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  | **•** |  |  |  |  |  |  |  |  |  |  |  |  |  | **Civil Rights** | **HUM** |
|  |  |  |  |  |  |  |  |  |  |  | **•** |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  | **•** |  |  | **Electric circuits (2)** | **EPE 223** |
|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  | **•** |  |  | **Electric fields** | **EPE 224** |
|  |  |  |  |  |  |  |  | **•** |  |  |  | **•** |  |  | **•** | **•** |  |  |  |  |  |  |  |  |  |  | **•** |  |  |  | **Applied programming** | **CSE 222** |
|  |  |  | **•** |  |  |  |  | **•** | **•** |  |  | **•** |  |  |  |  |  |  |  |  |  |  | **•** |  |  |  |  |  |  |  | **Electrical devices and testing** | **ELE 221** |
|  |  |  |  |  |  |  |  |  |  |  | **•** |  | **•** |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  | **•** |  | **Thermo-fluid machines** | **MPE 201** |
| **•** |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  | **•** |  |  |  |  |  |  |  |  |  |  |  |  |  | **Humanities (2)** | **HUM** |
| **Year of Program 4** | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  | **•** |  |  |  |  |  |  |  |  |  |  |  |  |  | **•** | **Mathematics (4)** | **EMP 301** |
|  |  |  | **•** |  |  |  | **•** | **•** |  |  |  |  |  | **•** |  | **•** |  |  |  |  |  |  |  |  |  |  |  | **•** |  |  | **Digital Electronic Circuits** | **ECE 301** |
|  |  |  | **•** |  |  |  | **•** | **•** |  |  |  |  |  | **•** |  | **•** |  |  |  |  |  |  |  |  | **•** |  |  |  |  |  | **Computer Organization** | **CSE 321a, b** |
|  |  |  | **•** |  |  |  | **•** | **•** |  | **•** | **•** |  | **•** | **•** |  | **•** |  |  |  |  |  |  |  | **•** |  |  |  |  |  |  | **Automatic Control Systems** | **CSE 322** |
|  |  |  | **•** | **•** | **•** |  | **•** | **•** | **•** |  |  |  |  | **•** |  |  |  |  |  |  |  |  | **•** |  |  |  |  |  |  |  | **Measurements and Testing (1)** | **CSE 323a, b** |
|  |  |  |  |  |  |  |  |  |  |  | **•** |  |  |  | **•** | **•** |  |  |  |  |  |  |  |  |  |  | **•** |  |  |  | **Algorithms and Data Structures** | **CSE 331** |
|  |  |  | **•** |  |  |  | **•** | **•** |  |  |  |  |  | **•** |  | **•** |  |  |  |  |  |  |  |  | **•** |  |  |  |  |  | **Computer Circuit Design** | **CSE 332** |
|  |  |  |  |  |  |  | **•** | **•** | **•** |  | **•** |  |  |  |  | **•** |  |  |  |  |  |  |  |  | **•** |  |  |  |  |  | **Computer Interfacing** | **CSE 333** |
|  |  |  |  |  |  |  |  |  |  |  | **•** |  |  | **•** |  |  |  |  |  |  |  |  |  |  |  |  |  | **•** |  |  | **Communications Engineering** | **ECE 302** |
|  |  |  | **•** |  |  |  | **•** | **•** |  |  |  |  |  | **•** |  | **•** |  |  |  |  |  |  |  |  | **•** |  |  |  |  |  | **Computer Integrated Circuits** | **CSE 324** |
|  |  |  |  |  |  | **•** |  | **•** |  |  |  | **•** |  |  | **•** | **•** |  |  |  |  |  | **•** |  |  |  |  |  |  |  |  | **Operating Systems** | **CSE 325** |
|  |  |  |  |  |  |  |  |  |  |  | **•** |  |  | **•** |  |  |  |  |  |  |  |  |  |  |  |  |  | **•** |  |  | **Electrical power and machines** | **EPE 313** |
|  |  |  |  |  |  |  |  |  |  |  | **•** |  |  | **•** |  |  |  |  |  |  |  |  |  |  |  |  |  | **•** |  |  | **Energy conversion** | **EPE 314** |
|  |  |  |  |  |  |  |  |  |  |  | **•** |  |  | **•** |  |  |  |  |  |  |  |  |  |  |  |  |  | **•** |  |  | **Power electronics** | **ECE 311** |
| **•** |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  | **•** |  |  |  |  |  |  |  |  |  |  |  |  |  | **Safety engineering** | **ENE 312** |
| **•** |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  | **•** |  |  |  |  |  |  |  |  |  |  |  |  |  | **Corrosion & equipment protection eng.** | **ENE 313** |

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
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| **Year of Program 5** | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| **d5** | **d4** | **d3** | **d2** | **d1** | **c7** | **c6** | **c5** | **c4** | **c3** | **c2** | **c1** | **b5** | **b4** | **b3** | **b2** | **b1** | **a14** | **a13** | **a12** | **a11** | **a10** | **a9** | **a8** | **a7** | **a6** | **a5** | **a4** | **a3** | **a2** | **a1** |  |  |
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|  |  |  |  |  |  |  |  |  |  |  | **•** |  |  | **•** |  |  |  |  |  |  |  |  |  |  |  |  |  | **•** |  |  | **Digital communication systems** | **ECE 401** |
|  |  |  | **•** |  |  |  | **•** | **•** |  | **•** | **•** |  | **•** | **•** |  | **•** |  |  |  |  |  |  |  | **•** |  |  |  |  |  |  | **Digital control** | **CSE 421** |
|  |  | **•** | **•** | **•** |  |  | **•** |  |  |  |  | **•** |  |  |  | **•** |  |  |  |  | **•** |  |  |  |  |  |  |  |  |  | **Computer networks** | **CSE 422** |
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|  |  |  |  |  |  | **•** | **•** | **•** |  |  | **•** | **•** |  | **•** | **•** | **•** |  |  |  |  |  |  |  |  |  |  | **•** |  |  |  | **Software engineering** | **CSE 431** |
|  |  |  |  |  |  |  |  | **•** |  |  | **•** |  |  | **•** | **•** | **•** |  |  |  |  |  |  |  |  |  |  | **•** |  |  |  | **Interpreters** | **CSE 432** |
|  |  |  |  |  |  |  |  | **•** |  |  | **•** | **•** | **•** |  |  | **•** |  |  | **•** |  |  |  |  |  |  |  |  |  |  |  | **Artificial intelligence** | **CSE 433** |
|  |  |  |  |  |  |  |  | **•** |  |  | **•** | **•** | **•** |  |  | **•** |  |  | **•** |  |  |  |  |  |  |  |  |  |  |  | **Pattern recognition** | **CSE 434** |
|  |  |  |  |  |  |  |  | **•** |  |  | **•** | **•** | **•** |  |  | **•** |  |  | **•** |  |  |  |  |  |  |  |  |  |  |  | **Expert systems** | **CSE 435** |
|  |  |  |  |  |  |  |  | **•** |  |  | **•** | **•** | **•** |  |  | **•** |  |  | **•** |  |  |  |  |  |  |  |  |  |  |  | **Fuzzy logic** | **CSE 436** |
|  |  |  |  |  |  |  |  | **•** |  |  | **•** | **•** |  | **•** | **•** | **•** |  |  |  |  |  |  |  |  |  |  | **•** |  |  |  | **Computer languages** | **CSE 437** |
|  |  |  |  |  |  |  |  |  |  |  | **•** |  |  | **•** |  |  |  |  |  |  |  |  |  |  |  |  |  | **•** |  |  | **Microwaves** | **ECE 411** |
|  |  |  |  |  |  |  |  |  |  |  | **•** |  |  | **•** |  |  |  |  |  |  |  |  |  |  |  |  |  | **•** |  |  | **Mobile communication systems** | **ECE 412** |
|  |  |  |  |  |  |  |  | **•** |  | **•** |  |  | **•** | **•** |  | **•** |  |  |  |  |  |  |  |  |  |  |  | **•** |  |  | **Digital signal processing** | **ECE 413** |
| **•** |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  | **•** |  |  |  |  |  |  |  |  |  |  |  |  |  | **Radioactive pollution** | **ENE 417** |
|  |  |  |  |  |  |  |  |  |  |  | **•** |  |  | **•** |  |  |  |  |  |  |  |  |  |  |  |  |  | **•** |  |  | **Opto-communication electronics** | **ECE 402** |
|  |  |  |  |  |  | **•** | **•** | **•** |  |  | **•** | **•** |  | **•** | **•** | **•** |  |  |  | **•** |  |  |  |  |  |  |  |  |  |  | **Database systems** | **CSE 424** |
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|  |  |  | **•** |  |  |  | **•** | **•** |  |  |  |  |  | **•** |  | **•** |  |  |  |  |  |  |  |  | **•** |  |  |  |  |  | **Microcomputer systems** | **CSE 438** |
|  |  |  | **•** |  |  |  | **•** | **•** |  |  |  |  |  | **•** |  | **•** |  |  |  |  |  |  |  |  | **•** |  |  |  |  |  | **Distributed and parallel processing** | **CSE 439** |
|  |  |  |  |  |  |  |  | **•** |  |  | **•** | **•** | **•** |  |  | **•** |  |  | **•** |  |  |  |  |  |  |  |  |  |  |  | **Neural networks & genetic algorithms** | **CSE 4310** |
|  |  | **•** | **•** | **•** |  |  | **•** |  |  |  |  | **•** |  |  |  |  |  |  |  |  | **•** |  |  |  |  |  |  |  |  |  | **Internet** | **CSE 4311** |
|  |  |  | **•** |  |  |  | **•** | **•** |  | **•** | **•** |  | **•** | **•** |  | **•** |  |  |  |  |  |  |  | **•** |  |  |  |  |  |  | **Optimal control** | **CSE 4312** |
|  |  |  | **•** |  |  |  | **•** | **•** |  | **•** | **•** |  | **•** | **•** |  | **•** |  |  |  |  |  |  |  | **•** |  |  |  |  |  |  | **Nonlinear control** | **CSE 4313** |
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|  |  |  | **•** |  |  |  | **•** | **•** |  | **•** | **•** |  | **•** | **•** |  | **•** |  |  |  |  |  |  |  | **•** |  |  |  |  |  |  | **Intelligent control systems** | **CSE 4315** |
|  |  |  | **•** |  |  |  | **•** | **•** |  | **•** | **•** |  | **•** | **•** |  | **•** |  |  |  |  |  |  |  | **•** |  |  |  |  |  |  | **Robotics** | **CSE 4316** |
|  |  |  |  |  |  |  | **•** | **•** |  | **•** |  | **•** | **•** |  |  | **•** |  |  | **•** |  |  |  |  |  |  |  |  |  |  |  | **Automata theory** | **CSE 4317** |
|  |  |  |  |  |  |  | **•** | **•** |  |  |  |  | **•** | **•** |  | **•** |  |  |  |  |  |  |  |  |  |  |  | **•** |  |  | **Navigation and guidance** | **CSE 4318** |

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
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| **ANNEX 2:**  **Program Attributes versus Program ILOs Matrix** | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| **Program ILOs** | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |  |
| **(d) General & Transferable skills** | | | | | **(c) Professional & Practical Skills** | | | | | | | **(b) Intellectual Skills** | | | | | **(a) Knowledge & Understanding** | | | | | | | | | | | | | | **Program Attribute** |
| **d5** | **d4** | **d3** | **d2** | **d1** | **c7** | **c6** | **c5** | **c4** | **c3** | **c2** | **c1** | **b5** | **b4** | **b3** | **b2** | **b1** | **a14** | **a13** | **a12** | **a11** | **a10** | **a9** | **a8** | **a7** | **a6** | **a5** | **a4** | **a3** | **a2** | **a1** |
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| **•** | **•** | **•** |  | **•** |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  | **5** |
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