# Course Specifications

# Advanced Programming

# 2025\2026

## 1. Basic Information

| | | | | | |
|---|---|---|---|---|---|
| **Course Title** | **Advanced Programming** | | | | |
| **Course Code** | **ELC421** | | | | |
| **Department participating in delivery of the course** | **Communications and Electronics Engineering Department** | | | | |
| **Number of credit hours of the course** | **Credit Hours** | **Theoretical** | | **Self-Learning** | **SWL** |
| | | **Lectures** | **Practical** | | |
| | **3** | **2** | **2** | **6** | **10** |
| **Course Type** | **Minor Requirements (Compulsory)** | | | | |
| **Academic level at which the course is taught** | **Level 400** | | | | |
| **Academic Program** | **– Communications & Computer Engineering** | | | | |
| **Institute** | **Misr Higher Institute of Engineering and Technology** | | | | |
| **University/Academy** | **Ministry of Higher Education and Scientific Research** | | | | |
| **Semester** | **Fall Semester** | | | | |
| **Prerequisite** | **BAS212: Statistics and Probability Theory**<br>**ELC221: Object-Oriented Programming** | | | | |
| **Name of Course Coordinator** | | | | | |
| **Course Specification Approval Date** | **18/8/2025**<br>**8/9/2025** | | | | |
| **Course Specification Approval** | **Communications and Electronics Engineering Department Council, Institute Council** | | | | |

## 2. Course Overview (Brief summary of scientific content)

Programming Techniques in Network and various Media Types – New Programming Techniques (e.g., Internet programming-Web based applications – workflow automation – multithreaded programming – intro to embedded programming– Languages for Internetworking programming and Data Transfer.

## 3. Course Learning Outcomes CLOs

| Program Outcomes (NARS/ARS) (according to the matrix in the program specs) | | Course Learning Outcomes Upon completion of the course, the student will be able to: | |
|---|---|---|---|
| Code | Text | Code | Text |
| A1 | Identify, formulate, and solve complex engineering problems by applying engineering fundamentals, basic science and mathematics | CLO1 | Master specialized programming skills to apply abstract theories in solving real-life networked and multimedia software challenges. |
| A6 | Planning, supervision and monitoring of engineering projects | CLO2 | Plan and supervise the development phases of a complex software project involving workflow automation and web services. |
| B3 | Design and implement: elements, modules, sub-systems or systems in electrical/electronic/digital engineering using technological and professional tools | CLO3 | Apply computing and mathematical principles to solve engineering problems related to multithreading and data transfer efficiency. |
| C1 | Design/ analyze/ measure the performance of a computer systems, Database systems, software systems, computer networks, and Microprocessors with identifying the software tools and mathematical methods required to optimize their performance | CLO4 | Design and analyze the performance of software systems and database interfaces using specialized mathematical methods for optimization. |
| A1 | Identify, formulate, and solve complex engineering problems by applying engineering fundamentals, basic science and mathematics | CLO5 | Use advanced knowledge of internetworking languages to develop innovative solutions for high-speed data exchange. |

## 4. Teaching and Learning Methods

1. Face to face lectures\tutorials.
2. Blended Learning (Synchronous\Asynchronous sessions)
3. Active Learning (Interactive Discussions - Case studies -Brainstorming – Presentations)
4. Self-learning.

### Course Schedule

| Number of the Week | Scientific content of the course (Course Topics) | Total Weekly Hours | Expected number of the Learning Hours | | | |
|---|---|---|---|---|---|---|
| | | | Theoretical teaching (lectures/discussion groups/ .....) | | Training (Practical) | Self-learning (Tasks/ Assignments/ Projects) |
| | | | Lectures | Tutorial | | |
| 1 | Advanced Software Design for Networked Environments. | 4 | 2 | 0 | 2 | 6 |
| 2 | Programming with Various Media Types (Multimedia Integration). | 4 | 2 | 0 | 2 | 6 |
| 3 | Internet Programming Fundamentals and Web Standards. | 4 | 2 | 0 | 2 | 6 |
| 4 | Developing Web-Based Applications and Services. | 4 | 2 | 0 | 2 | 6 |
| 5-6 | Architecting Workflow A00utomation Systems. | 8 | 4 | 0 | 4 | 12 |
| 7 | Advanced Multithreaded Programming Concepts. | 4 | 2 | 0 | 2 | 6 |
| 8 | Midterm + Revision | 4 | 2 | 0 | 2 | 6 |
| 9 | Concurrency, Synchronization, and Thread Safety. | 4 | 2 | 0 | 2 | 6 |
| 10 | Introduction to Embedded Programming and Cross-Compilation. | 4 | 2 | 0 | 2 | 6 |
| 11 | High-Level Languages for Internetworking (e.g., Java, Python). | 4 | 2 | 0 | 2 | 6 |
| 12 | Data Transfer Protocols: API Design and Implementation. | 4 | 2 | 0 | 2 | 6 |
| 13 | Data Serialization Formats (JSON, XML) for System Interoperability. | 4 | 2 | 0 | 2 | 6 |
| 14 | Network Security and Data Encryption in Programming. | 4 | 2 | 0 | 2 | 6 |

| | | | | | | |
|---|---|---|---|---|---|---|
| 15 | Real-time Data Streaming and Communication Techniques. | 4 | 2 | 0 | 2 | 6 |
| 16 | Final Exam | | | | | |

## 5. Methods of students' assessment

| No. | Assessment Methods | Assessment Timing (Week Number) | Marks/ Scores | Percentage of total course Marks |
|---|---|---|---|---|
| 1 | Assignments | Every 3 weeks | 5 | 5% |
| 2 | Quizzes | Every 2 weeks | 5 | 5% |
| 3 | Proctored exams: Midterm Exam | 8 | 20 | 20% |
| 4 | Practical/Oral Exam | 15 | 20 | 20% |
| 5 | Proctored exams: Final Exam | 16 | 50 | 50% |
| 6 | Formative assessment | 5 | 0 | 0% |

## 6. Learning Resources and Supportive Facilities *

| | | |
|---|---|---|
| Learning resources (books, scientific references, etc.) * | **The main (essential) reference for the course** (must be written in full according to the scientific documentation method) | • Schildt, H. Java: The Complete Reference. 12th ed., McGraw-Hill Education, 2021. |
| | **Other References** | • |
| | **Electronic Sources** (Links must be added) | Egyptian Knowledge Bank \| بنك المعرفة المصري https://www.ekb.eg/ar/home |
| | **Learning Platforms** (Links must be added) | • www.els.engmet.edu.eg Google Classroom(https://classroom.google.com) |
| | **Other** (to be mentioned) | • Instructor PowerPoint presentations |

| | | |
|---|---|---|
| **Supportive facilities & equipment for teaching and learning** * | **Devices/Instruments** | • - |
| | **Supplies** | • Whiteboard<br>• Presenter<br>• Data show system<br>• Sound System |
| | **Electronic Programs** | - |
| | **Skill Labs/ Simulators** | - |
| | **Virtual Labs** | - |
| | **Other** (to be mentioned) | - |

**Course Coordinator** **Program Coordinator**

**Dr. Yasser El-Awady**

# Course Specifications

# System Analysis and Design

# 2025\2026

## 1. Basic Information

| | | | | | |
|---|---|---|---|---|---|
| **Course Title** | **System Analysis and Design** | | | | |
| **Course Code** | **ELC451** | | | | |
| **Department participating in delivery of the course** | **Communications and Electronics Engineering Department** | | | | |
| **Number of credit hours of the course** | **Credit Hours** | **Theoretical** | | **Self-Learning** | **SWL** |
| | | **Lectures** | **Practical** | | |
| | **2** | **1** | **2** | **6** | **9** |
| **Course Type** | **Minor Requirements (Compulsory)** | | | | |
| **Academic level at which the course is taught** | **Level 400** | | | | |
| **Academic Program** | **– Communications & Computer Engineering** | | | | |
| **Institute** | **Misr Higher Institute of Engineering and Technology** | | | | |
| **University/Academy** | **Ministry of Higher Education and Scientific Research** | | | | |
| **Semester** | **Fall Semester** | | | | |
| **Prerequisite** | **ELC341 - Data Structures and Algorithms** | | | | |
| **Name of Course Coordinator** | | | | | |
| **Course Specification Approval Date** | **18/8/2025**<br>**8/9/2025** | | | | |
| **Course Specification Approval** | **Communications and Electronics Engineering Department Council, Institute Council** | | | | |

## 2. Course Overview (Brief summary of scientific content)

Algorithms Design and analysis- examples - Techniques for designing efficient algorithms - analysis of complexity - complexity bounds of fundamental problems, graph problems and combinatorial problems – Balanced binary search trees – Dynamic programming - Divide-and conquer - Search - Branch-and-bound - Fundamentals of parallel algorithms - Applications (approximate string matching, data compression, computational geometry) - NP-completeness - NP-hardness.

## 3. Course Learning Outcomes CLOs

| Program Outcomes (NARS/ARS) (according to the matrix in the program specs) | | Course Learning Outcomes Upon completion of the course, the student will be able to: | |
|---|---|---|---|
| Code | Text | Code | Text |
| A3 | Application of engineering design to achieve cost-effective solutions that meet specific needs. Taking into account global, cultural, social, economic, environmental and ethical aspects. These applications are within the principles of sustainable design and development | CLO1 | Use modern engineering tools and algorithmic techniques necessary for efficient software system practice. |
| A6 | Planning, supervision and monitoring of engineering projects | CLO2 | Plan, supervise, and monitor the development of complex algorithmic solutions within engineering projects. |
| 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 | CLO3 | Model and analyze digital systems by designing efficient algorithms for specific application requirements. |
| B3 | Design and implement: elements, modules, sub-systems or systems in electrical/electronic/digital engineering using technological and professional tools | CLO4 | Apply computing and mathematical principles (Complexity Theory) to solve engineering and combinatorial problems. |
| C1 | Design/ analyze/ measure the performance of a computer systems, Database systems, software systems, computer | CLO5 | Design and measure the performance of software systems and algorithms |

| | | | |
|---|---|---|---|
| | networks, and Microprocessors with identifying the software tools and mathematical methods required to optimize their performance | | using specialized mathematical methods to optimize performance. |

## 4. Teaching and Learning Methods

1. Face to face lectures\tutorials.
2. Blended Learning (Synchronous\Asynchronous sessions)
3. Active Learning (Interactive Discussions - Case studies -Brainstorming – Presentations)
4. Self-learning.

### Course Schedule

| Number of the Week | Scientific content of the course (Course Topics) | Total Weekly Hours | Expected number of the Learning Hours | | | |
|---|---|---|---|---|---|---|
| | | | Theoretical teaching (lectures/discussion groups/ .....) | | Training (Practical) | Self-learning (Tasks/ Assignments/ Projects) |
| | | | Lectures | Tutorial | | |
| 1 | Introduction to Algorithm Design and Empirical Analysis. | 3 | 1 | 0 | 2 | 6 |
| 2 | Asymptotic Notation and Analysis of Time/Space Complexity. | 3 | 1 | 0 | 2 | 6 |
| 3 | Complexity Bounds for Fundamental and Combinatorial Problems. | 3 | 1 | 0 | 2 | 6 |
| 4 | Graph Algorithms: Traversal, Shortest Paths, and Connectivity. | 3 | 1 | 0 | 2 | 6 |
| 5 | Advanced Data Structures: Balanced Binary Search Trees. | 3 | 1 | 0 | 2 | 6 |
| 6-7 | The Divide-and-Conquer Paradigm and Master Theorem. | 6 | 2 | 0 | 4 | 12 |
| 8 | Midterm + Revision | 3 | 1 | 0 | 2 | 6 |
| 9 | Dynamic Programming: Optimization and Sub-problem Overlap. | 3 | 1 | 0 | 2 | 6 |
| 10 | Search Strategies and State-Space Exploration. | 3 | 1 | 0 | 2 | 6 |
| 11 | Branch-and-Bound Techniques for Optimization. | 3 | 1 | 0 | 2 | 6 |

| | | | | | | |
|---|---|---|---|---|---|---|
| 12 | Fundamentals of Parallel Algorithm Design and Speedup. | 3 | 1 | 0 | 2 | 6 |
| 13 | Applied Algorithms: String Matching and Data Compression. | 3 | 1 | 0 | 2 | 6 |
| 14 | Computational Geometry and Spatial Data Processing. | 3 | 1 | 0 | 2 | 6 |
| 15 | Theory of Computation: NP-Completeness and NP-Hardness. | 3 | 1 | 0 | 2 | 6 |
| 16 | **Final Exam** | | | | | |

## 5. Methods of students' assessment

| No. | Assessment Methods | Assessment Timing (Week Number) | Marks/ Scores | Percentage of total course Marks |
|---|---|---|---|---|
| 1 | Assignments | Every 3 weeks | 5 | 5% |
| 2 | Quizzes | Every 2 weeks | 5 | 5% |
| 3 | Proctored exams: Midterm Exam | 8 | 20 | 20% |
| 4 | Practical/Oral Exam | 15 | 20 | 20% |
| 5 | Proctored exams: Final Exam | 16 | 50 | 50% |
| 6 | Formative assessment | 5 | 0 | 0% |

## 6. Learning Resources and Supportive Facilities *

| | | |
|---|---|---|
| Learning resources (books, scientific references, etc.) * | **The main (essential) reference for the course** (must be written in full according to the scientific documentation method) | • Satzinger, J. W., Jackson, R. B., & Burd, S. D. Systems Analysis and Design in a Changing World. 7th ed., Cengage Learning, 2016. |
| | **Other References** | • |
| | **Electronic Sources** (Links must be added) | Egyptian Knowledge Bank \| بنك المعرفة المصري https://www.ekb.eg/ar/home |

| | | |
|---|---|---|
| | **Learning Platforms** (Links must be added) | • www.els.engmet.edu.eg<br>Google Classroom(https://classroom.google.com) |
| | **Other** (to be mentioned) | • Instructor PowerPoint presentations |
| | | |
| **Supportive facilities & equipment for teaching and learning** * | **Devices/Instruments** | • - |
| | **Supplies** | • Whiteboard<br>• Presenter<br>• Data show system<br>• Sound System |
| | **Electronic Programs** | - |
| | **Skill Labs/ Simulators** | - |
| | **Virtual Labs** | - |
| | **Other** (to be mentioned) | - |

**Course Coordinator**

**Program Coordinator**

**Dr. Yasser El-Awady**

# Course Specifications

# Elective Course (7) - Microcontroller

# 2025\2026

## 1. Basic Information

| | | | | | |
|---|---|---|---|---|---|
| **Course Title** | **Elective Course (7) - Microcontroller** | | | | |
| **Course Code** | **ELC461** | | | | |
| **Department participating in delivery of the course** | **Communications and Electronics Engineering Department** | | | | |
| **Number of credit hours of the course** | **Credit Hours** | **Theoretical** | | **Self-Learning** | **SWL** |
| | | **Lectures** | **Practical** | | |
| | **3** | **2** | **2** | **6** | **10** |
| **Course Type** | **Elective Requirements (Institute Compulsory)** | | | | |
| **Academic level at which the course is taught** | **Level 400** | | | | |
| **Academic Program** | **– Communications & Computer Engineering** | | | | |
| **Institute** | **Misr Higher Institute of Engineering and Technology** | | | | |
| **University/Academy** | **Ministry of Higher Education and Scientific Research** | | | | |
| **Semester** | **Fall Semester** | | | | |
| **Prerequisite** | **ELC361 - Embedded Systems** | | | | |
| **Name of Course Coordinator** | | | | | |
| **Course Specification Approval Date** | **18/8/2025**<br>**8/9/2025** | | | | |
| **Course Specification Approval** | **Communications and Electronics Engineering Department Council, Institute Council** | | | | |

## 2. Course Overview (Brief summary of scientific content)

Typical architecture and internal units of a microcontroller, different types of memory. Interfacing of analogue and digital signals, including basics of electronics. Serial communications. Low level programming in C, drivers, interrupts service routines. Management of parallel processes without the aid of an operating system, process priority, timing analysis, finite state machines. Instruction and register sets and addressing modes for a

given microcontroller family. Efficiency aspects on different data types and code snippets in C. Development tools. Planning and realization of a microcontroller-based project.

## 3. Course Learning Outcomes CLOs

| Program Outcomes (NARS/ARS) (according to the matrix in the program specs) | | Course Learning Outcomes Upon completion of the course, the student will be able to: | |
|---|---|---|---|
| Code | Text | Code | Text |
| A1 | Identify, formulate, and solve complex engineering problems by applying engineering fundamentals, basic science and mathematics | CLO1 | Master a wide spectrum of engineering knowledge regarding microcontroller internals and apply abstract thinking to design embedded systems. |
| B3 | Design and implement: elements, modules, sub-systems or systems in electrical/electronic/digital engineering using technological and professional tools | CLO2 | Apply computing and mathematical principles to perform timing analysis and optimize data types for limited hardware resources. |
| C1 | Design/ analyze/ measure the performance of a computer systems, Database systems, software systems, computer networks, and Microprocessors with identifying the software tools and mathematical methods required to optimize their performance | CLO3 | Select and apply appropriate digital hardware and low-level software tools to implement serial communication drivers. |
| A1 | Identify, formulate, and solve complex engineering problems by applying engineering fundamentals, basic science and mathematics | CLO4 | Design and realize a complete microcontroller-based project using specialized skills in hardware/software co-design. |

## 4. Teaching and Learning Methods

1. Face to face lectures\tutorials.
2. Blended Learning (Synchronous\Asynchronous sessions)
3. Active Learning (Interactive Discussions - Case studies -Brainstorming – Presentations)

4. Self-learning.

## Course Schedule

| Number of the Week | Scientific content of the course (Course Topics) | Total Weekly Hours | Expected number of the Learning Hours | | | |
|---|---|---|---|---|---|---|
| | | | Theoretical teaching (lectures/discussion groups/ .....) | | Training (Practical) | Self-learning (Tasks/ Assignments/ Projects) |
| | | | Lectures | Tutorial | | |
| 1 | Overview of Microcontroller Architectures (e.g., Harvard vs. von Neumann). | 4 | 2 | 0 | 2 | 6 |
| 2 | Internal Units: ALU, CPU, Timers, and Specialized Peripherals. | 4 | 2 | 0 | 2 | 6 |
| 3 | Memory Organization: Flash, RAM, EEPROM, and Register Files. | 4 | 2 | 0 | 2 | 6 |
| 4 | General Purpose I/O (GPIO) and Digital Signal Interfacing. | 4 | 2 | 0 | 2 | 6 |
| 5 | Analog Interfacing: Analog-to-Digital Converters (ADC) and Sensors. | 4 | 2 | 0 | 2 | 6 |
| 6-7 | Serial Communication Protocols | 4 | 2 | 0 | 2 | 6 |
| 7 | UART, SPI, and I2C V | 4 | 2 | 0 | 2 | 6 |
| 8 | Midterm + Revision | 4 | 2 | 0 | 2 | 6 |
| 9 | Low-Level Programming: C-language for Embedded Systems. | 4 | 2 | 0 | 2 | 6 |
| 10 | Interrupt Controllers and Interrupt Service Routines (ISR). | 4 | 2 | 0 | 2 | 6 |
| 11 | Bare-Metal Programming: Parallel Process Management without an OS. | 4 | 2 | 0 | 2 | 6 |
| 12 | Timing Analysis, Process Priority, and Real-Time Constraints. | 4 | 2 | 0 | 2 | 6 |
| 13 | Implementation of Finite State Machines (FSM) for Control Logic. | 4 | 2 | 0 | 2 | 6 |
| 14 | Optimization: Data Type Efficiency and Code Snippets in C. | 4 | 2 | 0 | 2 | 6 |
| 15 | Toolchains: Using IDEs, Compilers, Debuggers, and Simulation Tools. | 4 | 2 | 0 | 2 | 6 |
| 16 | **Final Exam** | | | | | |

## 5. Methods of students' assessment

| No. | Assessment Methods | Assessment Timing (Week Number) | Marks/ Scores | Percentage of total course Marks |
|---|---|---|---|---|
| 1 | Assignments | Every 3 weeks | 5 | 5% |
| 2 | Quizzes | Every 2 weeks | 5 | 5% |
| 3 | Proctored exams: Midterm Exam | 8 | 20 | 20% |
| 4 | Practical/Oral Exam | 15 | 20 | 20% |
| 5 | Proctored exams: Final Exam | 16 | 50 | 50% |
| 6 | Formative assessment | 5 | 0 | 0% |

## 6. Learning Resources and Supportive Facilities *

| | | |
|---|---|---|
| Learning resources (books, scientific references, etc.) * | **The main (essential) reference for the course** (must be written in full according to the scientific documentation method) | • |
| | **Other References** | • |
| | **Electronic Sources** (Links must be added) | Egyptian Knowledge Bank \| بنك المعرفة المصري https://www.ekb.eg/ar/home |
| | **Learning Platforms** (Links must be added) | • www.els.engmet.edu.eg Google Classroom(https://classroom.google.com) |
| | **Other** (to be mentioned) | • Instructor PowerPoint presentations |
| | | |
| Supportive facilities & equipment for teaching and learning * | **Devices/Instruments** | • - |
| | **Supplies** | • Whiteboard • Presenter • Data show system • Sound System |

| | | |
|---|---|---|
| | **Electronic Programs** | - |
| | **Skill Labs/ Simulators** | - |
| | **Virtual Labs** | - |
| | **Other** (to be mentioned) | - |

**Course Coordinator**

**Program Coordinator**

**Dr. Yasser El-Awady**

# Course Specifications

# Elective Course (7) - Advanced Computer Architecture

# 2025\2026

## 1. Basic Information

| | | | | | |
|---|---|---|---|---|---|
| **Course Title** | **Elective Course (7) - Advanced Computer Architecture** | | | | |
| **Course Code** | **ELC462** | | | | |
| **Department participating in delivery of the course** | **Communications and Electronics Engineering Department** | | | | |
| **Number of credit hours of the course** | **Credit Hours** | **Theoretical** | | **Self-Learning** | **SWL** |
| | | **Lectures** | **Practical** | | |
| | **3** | **2** | **2** | **6** | **10** |
| **Course Type** | **Elective Requirements (Institute Compulsory)** | | | | |
| **Academic level at which the course is taught** | **Level 400** | | | | |
| **Academic Program** | **– Communications & Computer Engineering** | | | | |
| **Institute** | **Misr Higher Institute of Engineering and Technology** | | | | |
| **University/Academy** | **Ministry of Higher Education and Scientific Research** | | | | |
| **Semester** | **Fall Semester** | | | | |
| **Prerequisite** | **ELC361 - Embedded Systems** | | | | |
| **Name of Course Coordinator** | | | | | |
| **Course Specification Approval Date** | **18/8/2025**<br>**8/9/2025** | | | | |
| **Course Specification Approval** | **Communications and Electronics Engineering Department Council, Institute Council** | | | | |

## 2. Course Overview (Brief summary of scientific content)

Review of Computer Organization and Architecture RISC and CISC architecture, Pipelining, Branch Prediction, Advanced Caches, Memory Protection, Multithreading, Parallel Programming, Vector Processors and GPUs, Superscalar, Superscalar & Exceptions, Very-long instruction word (VLIW) processors, large computer systems (array processors – multicore processors).

## 3. Course Learning Outcomes CLOs

| Program Outcomes (NARS/ARS) (according to the matrix in the program specs) | | Course Learning Outcomes Upon completion of the course, the student will be able to: | |
|---|---|---|---|
| Code | Text | Code | Text |
| A1 | Identify, formulate, and solve complex engineering problems by applying engineering fundamentals, basic science and mathematics | CLO1 | Master a wide spectrum of specialized architectural knowledge and apply abstract theories to optimize CPU performance in real-life computing scenarios. |
| B3 | Design and implement: elements, modules, sub-systems or systems in electrical/electronic/digital engineering using technological and professional tools | CLO2 | Apply computing and mathematical principles to analyze throughput, speedup (Amdahl's Law), and the efficiency of parallel systems. |
| C1 | Design/ analyze/ measure the performance of a computer systems, Database systems, software systems, computer networks, and Microprocessors with identifying the software tools and mathematical methods required to optimize their performance | CLO3 | Select and apply appropriate hardware components (Vector units, GPUs, Multicore) to design and manage high-performance computer systems. |
| A1 | Identify, formulate, and solve complex engineering problems by applying engineering fundamentals, basic science and mathematics | CLO4 | Use specialized skills to evaluate the trade-offs between static (VLIW) and dynamic (Superscalar) scheduling techniques. |

## 4. Teaching and Learning Methods

1. Face to face lectures\tutorials.
2. Blended Learning (Synchronous\Asynchronous sessions)
3. Active Learning (Interactive Discussions - Case studies -Brainstorming – Presentations)

4. Self-learning.

### Course Schedule

| Number of the Week | Scientific content of the course (Course Topics) | Total Weekly Hours | Expected number of the Learning Hours | | | |
|---|---|---|---|---|---|---|
| | | | Theoretical teaching (lectures/discussion groups/ .....) | | Training (Practical) | Self-learning (Tasks/ Assignments/ Projects) |
| | | | Lectures | Tutorial | | |
| 1-2 | Fundamental Review: Contrasting RISC (Reduced Instruction Set Computer) vs. CISC (Complex Instruction Set Computer). | 8 | 4 | 0 | 4 | 12 |
| 3 | Instruction-Level Parallelism (ILP): Advanced Pipelining stages and hazards. | 4 | 2 | 0 | 2 | 6 |
| 4 | Dynamic Branch Prediction: Reducing control hazards using Branch Target Buffers (BTB) and 2-bit predictors. | 4 | 2 | 0 | 2 | 6 |
| 5 | Advanced Cache Hierarchies: Multi-level caches, non-blocking caches, and cache coherence protocols. | 4 | 2 | 0 | 2 | 6 |
| 6 | Memory Protection & Management: Virtual memory, TLBs, and protection rings. | 4 | 2 | 0 | 2 | 6 |
| 7 | Hardware Multithreading: Fine-grained, coarse-grained, and Simultaneous Multithreading (SMT). | 4 | 2 | 0 | 2 | 6 |
| 8 | Midterm + Revision | 4 | 2 | 0 | 2 | 6 |
| 9 | Parallel Programming Models: Shared memory vs. message passing architectures. | 4 | 2 | 0 | 2 | 6 |
| 10 | Data Parallelism: Vector Processors and the architecture of Graphics Processing Units (GPUs). | 4 | 2 | 0 | 2 | 6 |
| 11 | Superscalar Execution: Out-of-order execution, renaming, and dispatching multiple instructions per cycle. | 4 | 2 | 0 | 2 | 6 |
| 12 | Exception Handling: Managing precise and imprecise exceptions in superscalar environments. | 4 | 2 | 0 | 2 | 6 |
| 13 | VLIW Processors: Static scheduling and compiler-driven Instruction-Level Parallelism. | 4 | 2 | 0 | 2 | 6 |

| | | | | | | |
|---|---|---|---|---|---|---|
| **14** | Array Processors: SIMD (Single Instruction, Multiple Data) architectures for large-scale computation. | **4** | **2** | **0** | **2** | **6** |
| **15** | Multicore & Multiprocessors: Interconnection networks and scalability in large computer systems. | **4** | **2** | **0** | **2** | **6** |
| **16** | **Final Exam** | | | | | |

## 5. Methods of students' assessment

| No. | Assessment Methods | Assessment Timing (Week Number) | Marks/ Scores | Percentage of total course Marks |
|---|---|---|---|---|
| **1** | Assignments | Every 3 weeks | 5 | 5% |
| **2** | Quizzes | Every 2 weeks | 5 | 5% |
| **3** | Proctored exams: Midterm Exam | 8 | 20 | 20% |
| **4** | Practical/Oral Exam | 15 | 20 | 20% |
| **5** | Proctored exams: Final Exam | 16 | 50 | 50% |
| **6** | Formative assessment | 5 | 0 | 0% |

## 6. Learning Resources and Supportive Facilities *

| | | |
|---|---|---|
| **Learning resources (books, scientific references, etc.) *** | **The main (essential) reference for the course** (must be written in full according to the scientific documentation method) | • **Patterson, D. A., & Hennessy, J. L. Computer Organization and Design: The Hardware/Software Interface. 6th ed., Morgan Kaufmann, 2020.** |
| | **Other References** | • |
| | **Electronic Sources** (Links must be added) | Egyptian Knowledge Bank \| بنك المعرفة المصري https://www.ekb.eg/ar/home |
| | **Learning Platforms** (Links must be added) | • www.els.engmet.edu.eg |

| | | |
|---|---|---|
| | | Google Classroom(https://classroom.google.com) |
| | **Other** (to be mentioned) | • Instructor PowerPoint presentations |
| | | |
| **Supportive facilities & equipment for teaching and learning** * | **Devices/Instruments** | • - |
| | **Supplies** | • Whiteboard<br>• Presenter<br>• Data show system<br>• Sound System |
| | **Electronic Programs** | - |
| | **Skill Labs/ Simulators** | - |
| | **Virtual Labs** | - |
| | **Other** (to be mentioned) | - |

**Course Coordinator**

**Program Coordinator**

**Dr. Yasser El-Awady**

# Course Specifications

# Elective Course (7) -Robotics

# 2025\2026

## 1. Basic Information

| | | | | | |
|---|---|---|---|---|---|
| **Course Title** | **Elective Course (7) -Robotics** | | | | |
| **Course Code** | **ELC463** | | | | |
| **Department participating in delivery of the course** | **Communications and Electronics Engineering Department** | | | | |
| **Number of credit hours of the course** | **Credit Hours** | **Theoretical** | | **Self-Learning** | **SWL** |
| | | **Lectures** | **Practical** | | |
| | **3** | **2** | **2** | **6** | **10** |
| **Course Type** | **Elective Requirements (Institute Compulsory)** | | | | |
| **Academic level at which the course is taught** | **Level 400** | | | | |
| **Academic Program** | **– Communications & Computer Engineering** | | | | |
| **Institute** | **Misr Higher Institute of Engineering and Technology** | | | | |
| **University/Academy** | **Ministry of Higher Education and Scientific Research** | | | | |
| **Semester** | **Fall Semester** | | | | |
| **Prerequisite** | **ELC361 -Embedded Systems** | | | | |
| **Name of Course Coordinator** | | | | | |
| **Course Specification Approval Date** | **18/8/2025**<br>**8/9/2025** | | | | |
| **Course Specification Approval** | **Communications and Electronics Engineering Department Council, Institute Council** | | | | |

## 2. Course Overview (Brief summary of scientific content)

Robot Mechanics and dynamics – Introduction to Computational Engineering – Route planning – sensing instruments – control the robot (strength – Movement) – robotic vision – hardware and software for the robot.

## 3. Course Learning Outcomes CLOs

| Program Outcomes (NARS/ARS) (according to the matrix in the program specs) | | Course Learning Outcomes Upon completion of the course, the student will be able to: | |
|---|---|---|---|
| Code | Text | Code | Text |
| A1 | Identify, formulate, and solve complex engineering problems by applying engineering fundamentals, basic science and mathematics | CLO1 | Master a wide spectrum of engineering knowledge in mechanics and dynamics to design complex robotic armatures. |
| B3 | Design and implement: elements, modules, sub-systems or systems in electrical/electronic/digital engineering using technological and professional tools | CLO2 | Apply computing and mathematical principles (Linear Algebra and Calculus) to solve Kinematic and Dynamic equations. |
| C1 | Design/ analyze/ measure the performance of a computer systems, Database systems, software systems, computer networks, and Microprocessors with identifying the software tools and mathematical methods required to optimize their performance | CLO3 | Select and apply appropriate digital hardware and software tools (Sensors, Actuators, and ROS) to design and manage robotic systems. |
| A1 | Identify, formulate, and solve complex engineering problems by applying engineering fundamentals, basic science and mathematics | CLO4 | Use specialized skills in robotic vision and computational engineering to implement autonomous route planning. |

## 4. Teaching and Learning Methods

1. Face to face lectures\tutorials.
2. Blended Learning (Synchronous\Asynchronous sessions)
3. Active Learning (Interactive Discussions - Case studies -Brainstorming – Presentations)
4. Self-learning.

## Course Schedule

| Number of the Week | Scientific content of the course (Course Topics) | Total Weekly Hours | Expected number of the Learning Hours | | | |
|---|---|---|---|---|---|---|
| | | | Theoretical teaching (lectures/discussion groups/ .....) | | Training (Practical) | Self-learning (Tasks/ Assignments/ Projects) |
| | | | Lectures | Tutorial | | |
| 1 | Introduction to Robotics: Definitions, Classification, and Applications. | 4 | 2 | 0 | 2 | 6 |
| 2 | Spatial Descriptions and Transformations: Rotation Matrices and Homogeneous Transforms. | 4 | 2 | 0 | 2 | 6 |
| 3 | Robot Mechanics: Forward and Inverse Kinematics (Denavit-Hartenberg parameters). | 4 | 2 | 0 | 2 | 6 |
| 4 | Robot Dynamics: Analyzing forces, torques, and acceleration in motion. | 4 | 2 | 0 | 2 | 6 |
| 5 | Introduction to Computational Engineering for Robotic Systems. | 4 | 2 | 0 | 2 | 6 |
| 6-7 | Route Planning: Pathfinding algorithms and trajectory generation. | 8 | 4 | 0 | 4 | 12 |
| 8 | Midterm + Revision | 4 | 2 | 0 | 2 | 6 |
| 9 | Sensing Instruments: Integration of ultrasonic, infrared, encoders, and IMUs. | 4 | 2 | 0 | 2 | 6 |
| 10 | Actuators and Control: DC motors, Servos, and Stepper motor control. | 4 | 2 | 0 | 2 | 6 |
| 11 | Control Theory: PID control for movement and strength (Force control). | 4 | 2 | 0 | 2 | 6 |
| 12 | Robotic Vision: Image processing basics, object detection, and tracking. | 4 | 2 | 0 | 2 | 6 |
| 13 | Hardware Architectures: Microcontrollers and FPGAs for robotic control. | 4 | 2 | 0 | 2 | 6 |
| 14 | Software Frameworks: Introduction to ROS (Robot Operating System) and Embedded C. | 4 | 2 | 0 | 2 | 6 |
| 15 | System Integration: Building and testing an autonomous robotic prototype. | 4 | 2 | 0 | 2 | 6 |
| 16 | **Final Exam** | | | | | |

## 5. Methods of students' assessment

| No. | Assessment Methods | Assessment Timing (Week Number) | Marks/ Scores | Percentage of total course Marks |
|---|---|---|---|---|
| 1 | Assignments | Every 3 weeks | 5 | 5% |
| 2 | Quizzes | Every 2 weeks | 5 | 5% |
| 3 | Proctored exams: Midterm Exam | 8 | 20 | 20% |
| 4 | Practical/Oral Exam | 15 | 20 | 20% |
| 5 | Proctored exams: Final Exam | 16 | 50 | 50% |
| 6 | Formative assessment | 5 | 0 | 0% |

## 6. Learning Resources and Supportive Facilities *

| | | |
|---|---|---|
| Learning resources (books, scientific references, etc.) * | **The main (essential) reference for the course** (must be written in full according to the scientific documentation method) | • Siciliano, B., Sciavicco, L., Villani, L., & Oriolo, G. Robotics: Modelling, Planning and Control. Springer, 2009. |
| | **Other References** | • |
| | **Electronic Sources** (Links must be added) | Egyptian Knowledge Bank \| بنك المعرفة المصري https://www.ekb.eg/ar/home |
| | **Learning Platforms** (Links must be added) | • www.els.engmet.edu.eg Google Classroom(https://classroom.google.com) |
| | **Other** (to be mentioned) | • Instructor PowerPoint presentations |
| | | |
| Supportive facilities & equipment for teaching and learning * | **Devices/Instruments** | • - |
| | **Supplies** | • Whiteboard<br>• Presenter<br>• Data show system<br>• Sound System |

| | | |
|---|---|---|
| | **Electronic Programs** | - |
| | **Skill Labs/ Simulators** | - |
| | **Virtual Labs** | - |
| | **Other** (to be mentioned) | - |

**Course Coordinator**

**Program Coordinator**

**Dr. Yasser El-Awady**

# Course Specifications

# Elective Course (7) - Mechatronics Engineering

# 2025\2026

## 1. Basic Information

| | | | | | |
|---|---|---|---|---|---|
| **Course Title** | **Elective Course (7) - Mechatronics Engineering** | | | | |
| **Course Code** | **ELC464** | | | | |
| **Department participating in delivery of the course** | **Communications and Electronics Engineering Department** | | | | |
| **Number of credit hours of the course** | **Credit Hours** | **Theoretical** | | **Self-Learning** | **SWL** |
| | | **Lectures** | **Tutorial** | | |
| | **3** | **2** | **2** | **6** | **10** |
| **Course Type** | **Elective Requirements (Institute Compulsory)** | | | | |
| **Academic level at which the course is taught** | **Level 400** | | | | |
| **Academic Program** | **– Communications & Computer Engineering** | | | | |
| **Institute** | **Misr Higher Institute of Engineering and Technology** | | | | |
| **University/Academy** | **Ministry of Higher Education and Scientific Research** | | | | |
| **Semester** | **Fall Semester** | | | | |
| **Prerequisite** | **ELC361 - Embedded Systems** | | | | |
| **Name of Course Coordinator** | | | | | |
| **Course Specification Approval Date** | **18/8/2025**<br>**8/9/2025** | | | | |
| **Course Specification Approval** | **Communications and Electronics Engineering Department Council, Institute Council** | | | | |

## 2. Course Overview (Brief summary of scientific content)

This course is an introduction to designing mechatronic systems, which require integration of the mechanical and electrical engineering disciplines within a unified framework. There are significant laboratory-based design experiences. Topics covered in the course include: Low-level interfacing of software with hardware; use of high-level graphical programming tools to implement real-time computation tasks; digital logic; analog interfacing and power amplifiers;

measurement and sensing; electromagnetic and optical transducers; control of mechatronic systems.

## 3. Course Learning Outcomes CLOs

| Program Outcomes (NARS/ARS) (according to the matrix in the program specs) | | Course Learning Outcomes Upon completion of the course, the student will be able to: | |
|---|---|---|---|
| Code | Text | Code | Text |
| A1 | Identify, formulate, and solve complex engineering problems by applying engineering fundamentals, basic science and mathematics | CLO1 | Master a wide spectrum of engineering knowledge by integrating mechanical and electrical disciplines into a single mechatronic design framework. |
| B3 | Design and implement: elements, modules, sub-systems or systems in electrical/electronic/digital engineering using technological and professional tools | CLO2 | Apply computing and mathematical principles to model the dynamics of mechatronic systems and implement real-time control algorithms. |
| C1 | Design/ analyze/ measure the performance of a computer systems, Database systems, software systems, computer networks, and Microprocessors with identifying the software tools and mathematical methods required to optimize their performance | CLO3 | Select and apply appropriate digital hardware (PLCs, Microcontrollers) and software tools to manage integrated computer-controlled systems. |
| A1 | Identify, formulate, and solve complex engineering problems by applying engineering fundamentals, basic science and mathematics | CLO4 | Utilize specialized skills to design and implement analog interfaces and power amplifiers for varied industrial transducers. |

## 4. Teaching and Learning Methods

1. Face to face lectures\tutorials.
2. Blended Learning (Synchronous\Asynchronous sessions)
3. Active Learning (Interactive Discussions - Case studies -Brainstorming – Presentations)

4. Self-learning.

### Course Schedule

| Number of the Week | Scientific content of the course (Course Topics) | Total Weekly Hours | Expected number of the Learning Hours | | | |
|---|---|---|---|---|---|---|
| | | | Theoretical teaching (lectures/discussion groups/ .....) | | Training (Practical) | Self-learning (Tasks/ Assignments/ Projects) |
| | | | Lectures | Tutorial | | |
| 1 | Introduction to Mechatronics: Evolution and the "Unified Framework" design philosophy. | 4 | 2 | 0 | 2 | 6 |
| 2 | Low-Level Software/Hardware Interfacing: Driver development and register-level control. | 4 | 2 | 0 | 2 | 6 |
| 3 | Real-Time Computation: Using high-level graphical programming tools (e.g., LabVIEW or Simulink). | 4 | 2 | 0 | 2 | 6 |
| 4-5 | Digital Logic in Mechatronics: Sequential and combinational logic for system sequencing. | 8 | 4 | 0 | 4 | 12 |
| 6 | Analog Interfacing: Signal conditioning, Op-Amps, and noise reduction techniques. | 4 | 2 | 0 | 2 | 6 |
| 7 | Power Amplifiers: Driving high-power loads and motor drive circuits (H-Bridges). | 4 | 2 | 0 | 2 | 6 |
| 8 | Midterm + Revision | 4 | 2 | 0 | 2 | 6 |
| 9 | Measurement Systems: Error analysis and static/dynamic characteristics of instruments. | 4 | 2 | 0 | 2 | 6 |
| 10 | Sensing Technologies: Displacement, velocity, and force sensors. | 4 | 2 | 0 | 2 | 6 |
| 11 | Electromagnetic Transducers: DC motors, BLDC motors, and Stepper motors. | 4 | 2 | 0 | 2 | 6 |
| 12 | Optical Transducers: Encoders, photo-interrupters, and laser sensors. | 4 | 2 | 0 | 2 | 6 |
| 13 | Control of Mechatronic Systems: PID control, logic-based control, and feedback loops. | 4 | 2 | 0 | 2 | 6 |
| 14 | Actuation Systems: Integration of hydraulic, pneumatic, and electrical actuators. | 4 | 2 | 0 | 2 | 6 |

| | | | | | | |
|---|---|---|---|---|---|---|
| **15** | Laboratory Design Experience: Prototyping a complete integrated mechatronic system. | **4** | **2** | **0** | **2** | **6** |
| **16** | **Final Exam** | | | | | |

## 5. Methods of students' assessment

| No. | Assessment Methods | Assessment Timing (Week Number) | Marks/ Scores | Percentage of total course Marks |
|---|---|---|---|---|
| **1** | Assignments | Every 3 weeks | 5 | 5% |
| **2** | Quizzes | Every 2 weeks | 5 | 5% |
| **3** | Proctored exams: Midterm Exam | 8 | 20 | 20% |
| **4** | Practical/Oral Exam | 15 | 20 | 20% |
| **5** | Proctored exams: Final Exam | 16 | 50 | 50% |
| **6** | Formative assessment | 5 | 0 | 0% |

## 6. Learning Resources and Supportive Facilities *

| | | |
|---|---|---|
| **Learning resources (books, scientific references, etc.) *** | **The main (essential) reference for the course** (must be written in full according to the scientific documentation method) | • **Bolton, W. Mechatronics: Electronic Control Systems in Mechanical and Electrical Engineering. 7th ed., Pearson, 2021.** |
| | **Other References** | • |
| | **Electronic Sources** (Links must be added) | Egyptian Knowledge Bank \| بنك المعرفة المصري https://www.ekb.eg/ar/home |
| | **Learning Platforms** (Links must be added) | • **www.els.engmet.edu.eg** Google Classroom(https://classroom.google.com) |
| | **Other** (to be mentioned) | • Instructor PowerPoint presentations |

| | | |
|---|---|---|
| **Supportive facilities & equipment for teaching and learning** * | **Devices/Instruments** | • - |
| | **Supplies** | • Whiteboard<br>• Presenter<br>• Data show system<br>• Sound System |
| | **Electronic Programs** | - |
| | **Skill Labs/ Simulators** | - |
| | **Virtual Labs** | - |
| | **Other** (to be mentioned) | - |

**Course Coordinator**

**Program Coordinator**

**Dr. Yasser El-Awady**

# Course Specifications

# Artificial Intelligence

# 2025\2026

## 1. Basic Information

| | | | | | |
|---|---|---|---|---|---|
| **Course Title** | **Artificial Intelligence** | | | | |
| **Course Code** | **ELC471** | | | | |
| **Department participating in delivery of the course** | **Communications and Electronics Engineering Department** | | | | |
| **Number of credit hours of the course** | **Credit Hours** | **Theoretical** | | **Self-Learning** | **SWL** |
| | | **Lectures** | **Practical** | | |
| | **3** | **2** | **2** | **6** | **10** |
| **Course Type** | **Minor Requirements (Compulsory)** | | | | |
| **Academic level at which the course is taught** | **Level 400** | | | | |
| **Academic Program** | **– Communications & Computer Engineering** | | | | |
| **Institute** | **Misr Higher Institute of Engineering and Technology** | | | | |
| **University/Academy** | **Ministry of Higher Education and Scientific Research** | | | | |
| **Semester** | **Fall Semester** | | | | |
| **Prerequisite** | **BAS212: Statistics and Probability Theory**<br>**ELC221: Object-Oriented Programming** | | | | |
| **Name of Course Coordinator** | | | | | |
| **Course Specification Approval Date** | **18/8/2025**<br>**8/9/2025** | | | | |
| **Course Specification Approval** | **Communications and Electronics Engineering Department Council, Institute Council** | | | | |

## 2. Course Overview (Brief summary of scientific content)

Introduction to artificial intelligence concepts and definitions, Search: Graph search– Metaheuristic Algorithms, Machine Learning (Supervised and unsupervised learning): (Decision trees – Support Vector Machine – K_Nearest neighbour algorithms ….),

Introduction to Neural Networks, Genetic Algorithm, Fuzzy logic systems, Application fields that need intelligence (Decision support systems- Intelligent agents – Semantic web ….).

## 3. Course Learning Outcomes CLOs

| Program Outcomes (NARS/ARS) (according to the matrix in the program specs) | | Course Learning Outcomes Upon completion of the course, the student will be able to: | |
|---|---|---|---|
| Code | Text | Code | Text |
| A1 | Identify, formulate, and solve complex engineering problems by applying engineering fundamentals, basic science and mathematics | CLO1 | Master specialized AI engineering knowledge to apply abstract theories (like Fuzzy Logic and Neural Nets) in real-life situations. |
| A2 | Develop and conduct experiments and / or simulations, analyze and interpret data, evaluate and derive results and use statistical analyzes to arrive at conclusions | CLO2 | Apply analytic and systemic thinking to identify and diagnose complex engineering problems solvable by machine learning. |
| A5 | Practice research and investigation methods as an integral part of learning | CLO3 | Demonstrate ability to manage AI projects while considering environmental and social impacts of intelligent systems. |
| B3 | Design and implement: elements, modules, sub-systems or systems in electrical/electronic/digital engineering using technological and professional tools | CLO4 | Apply computing and mathematical principles (like Graph Theory and Probability) to solve engineering problems. |
| C3 | Synthesize different computer systems, measure their performance and analyze the obtained results using mathematical models | CLO5 | Synthesize different computer systems (Intelligent Agents), measure their performance, and analyze results using mathematical models. |

## 4. Teaching and Learning Methods

1. Face to face lectures\tutorials.

2. Blended Learning (Synchronous\Asynchronous sessions)
3. Active Learning (Interactive Discussions - Case studies -Brainstorming – Presentations)
4. Self-learning.

## Course Schedule

| Number of the Week | Scientific content of the course (Course Topics) | Total Weekly Hours | Expected number of the Learning Hours | | | |
|---|---|---|---|---|---|---|
| | | | Theoretical teaching (lectures/discussion groups/ .....) | | Training (Practical) | Self-learning (Tasks/ Assignments/ Projects) |
| | | | Lectures | Tutorial | | |
| 1 | Core Concepts, Definitions, and History of Artificial Intelligence. | 4 | 2 | 0 | 2 | 6 |
| 2 | State-Space Representation and Graph Search Strategies. | 4 | 2 | 0 | 2 | 6 |
| 3 | Metaheuristic Algorithms: Local Search and Optimization. | 4 | 2 | 0 | 2 | 6 |
| 4 | Foundations of Machine Learning: Supervised vs. Unsupervised Learning. | 4 | 2 | 0 | 2 | 6 |
| 5-6 | Classification Techniques: Decision Trees and Information Gain. | 8 | 4 | 0 | 4 | 12 |
| 7 | Support Vector Machines (SVM): Hyperplanes and Kernel Tricks. | 4 | 2 | 0 | 2 | 6 |
| 8 | Midterm + Revision | 4 | 2 | 0 | 2 | 6 |
| 9 | Instance-Based Learning: K-Nearest Neighbor (KNN) Algorithms. | 4 | 2 | 0 | 2 | 6 |
| 10 | Introduction to Biological and Artificial Neural Networks. | 4 | 2 | 0 | 2 | 6 |
| 11 | Evolutionary Computing: Genetic Algorithms and Selection Operators. | 4 | 2 | 0 | 2 | 6 |
| 12 | Fuzzy Logic Systems: Membership Functions and Fuzzy Inference. | 4 | 2 | 0 | 2 | 6 |
| 13 | Design and Architecture of Intelligent Agents. | 4 | 2 | 0 | 2 | 6 |
| 14 | Knowledge Representation and the Semantic Web. | 4 | 2 | 0 | 2 | 6 |
| 15 | Real-world Applications in Decision Support Systems. | 4 | 2 | 0 | 2 | 6 |
| 16 | Final Exam | | | | | |

## 5. Methods of students' assessment

| No. | Assessment Methods | Assessment Timing (Week Number) | Marks/ Scores | Percentage of total course Marks |
|---|---|---|---|---|
| 1 | Assignments | Every 3 weeks | 5 | 5% |
| 2 | Quizzes | Every 2 weeks | 5 | 5% |
| 3 | Proctored exams: Midterm Exam | 8 | 20 | 20% |
| 4 | Practical/Oral Exam | 15 | 20 | 20% |
| 5 | Proctored exams: Final Exam | 16 | 50 | 50% |
| 6 | Formative assessment | 5 | 0 | 0% |

## 6. Learning Resources and Supportive Facilities *

| | | |
|---|---|---|
| **Learning resources (books, scientific references, etc.) *** | **The main (essential) reference for the course** (must be written in full according to the scientific documentation method) | • **Russell, S., & Norvig, P. Artificial Intelligence: A Modern Approach. 4th ed., Pearson, 2021.** |
| | **Other References** | • |
| | **Electronic Sources** (Links must be added) | Egyptian Knowledge Bank \| بنك المعرفة المصري https://www.ekb.eg/ar/home |
| | **Learning Platforms** (Links must be added) | • www.els.engmet.edu.eg Google Classroom(https://classroom.google.com) |
| | **Other** (to be mentioned) | • Instructor PowerPoint presentations |
| | | |
| | **Devices/Instruments** | • - |

| | | |
|---|---|---|
| **Supportive facilities & equipment for teaching and learning** * | **Supplies** | • Whiteboard<br>• Presenter<br>• Data show system<br>• Sound System |
| | **Electronic Programs** | - |
| | **Skill Labs/ Simulators** | - |
| | **Virtual Labs** | - |
| | **Other** (to be mentioned) | - |

**Course Coordinator**

**Program Coordinator**

**Dr. Yasser El-Awady**

# Course Specifications

# Project (1)

# 2025\2026

## 1. Basic Information

| | | | | | |
|---|---|---|---|---|---|
| **Course Title** | **Project (1)** | | | | |
| **Course Code** | **ELC481** | | | | |
| **Department participating in delivery of the course** | **Communications and Electronics Engineering Department** | | | | |
| **Number of credit hours of the course** | **Credit Hours** | **Theoretical** | | **Self-Learning** | **SWL** |
| | | **Lectures** | **Practical** | | |
| | **2** | **1** | **2** | **5** | **8** |
| **Course Type** | **Minor Requirements (Compulsory)** | | | | |
| **Academic level at which the course is taught** | **Level 400** | | | | |
| **Academic Program** | **– Communications & Computer Engineering** | | | | |
| **Institute** | **Misr Higher Institute of Engineering and Technology** | | | | |
| **University/Academy** | **Ministry of Higher Education and Scientific Research** | | | | |
| **Semester** | **Fall Semester** | | | | |
| **Prerequisite** | **Completing 128 credits** | | | | |
| **Name of Course Coordinator** | | | | | |
| **Course Specification Approval Date** | **18/8/2025**<br>**8/9/2025** | | | | |
| **Course Specification Approval** | **Communications and Electronics Engineering Department Council, Institute Council** | | | | |

## 2. Course Overview (Brief summary of scientific content)

The aim of the project is to give students a major design experience that will both develop and demonstrate the knowledge and skills acquired in earlier course work and will incorporate engineering standards and realistic constraints including economic – environmental – sustainability – manufacturability – ethical and safety considerations. In addition – the project should represent an actual problem or need of the industry or the community. The purpose of Part 1 of the Graduation Project is to explore a chosen topic and to discover and define the project problem. After initial introductory lectures – students will perform research work to

explore different approaches to the problem at hand. Based on this research study – students will perform system level analysis to explore project feasibility and reach an initial high level design or system architecture and specifications. The output of Project 1 is a major report outlining the project feasibility results and laying the ground for the detailed design and implementation phase to be conducted in Project 2. This document should include a detailed project plan indicating major project implementation milestones with clear assignment of tasks among project team members.

## 3. Course Learning Outcomes CLOs

| Program Outcomes (NARS/ARS) (according to the matrix in the program specs) | | Course Learning Outcomes Upon completion of the course, the student will be able to: | |
|---|---|---|---|
| Code | Text | Code | Text |
| A2 | Develop and conduct experiments and / or simulations, analyze and interpret data, evaluate and derive results and use statistical analyzes to arrive at conclusions | CLO1 | Execute system-level evaluation metrics and preliminary prototyping tests to collect baseline data for architectural verification. |
| A3 | Application of engineering design to achieve cost-effective solutions that meet specific needs. Taking into account global, cultural, social, economic, environmental and ethical aspects. These applications are within the principles of sustainable design and development | CLO2 | Appraise high-level system designs against legal constraints, engineering safety codes, environmental impacts, and strict professional ethics. |
| A5 | Practice research and investigation methods as an integral part of learning | CLO3 | Investigate multiple computer engineering methodologies through structured research to adapt existing solutions to novel industrial needs. |
| A6 | Planning, supervision and monitoring of engineering projects | CLO4 | Analyze complex operational data and systemic patterns to diagnose baseline constraints and formulate comprehensive technical feasibility reports. |

| | | | |
|---|---|---|---|
| A7 | Work efficiently as an individual and as a member of a multidisciplinary and multicultural working group. | CLO5 | Manage shared task schedules, project management resources, and engineering role assignments effectively within a heterogeneous team environment. |
| A10 | Acquisition and application of new knowledge; and pursuit of self-learning, lifelong learning | CLO6 | Formulate comprehensive engineering proposals and research syntheses using specialized terminology to communicate technical findings with project sponsors. |

## 4. Teaching and Learning Methods

1. Face to face lectures\tutorials.
2. Blended Learning (Synchronous\Asynchronous sessions)
3. Active Learning (Interactive Discussions - Case studies -Brainstorming – Presentations)
4. Self-learning.

### Course Schedule

| Number of the Week | Scientific content of the course (Course Topics) | Total Weekly Hours | Expected number of the Learning Hours | | | |
|---|---|---|---|---|---|---|
| | | | Theoretical teaching (lectures/discussion groups/ .....) | | Training (Practical) | Self-learning (Tasks/ Assignments/ Projects) |
| | | | Lectures | Tutorial | | |
| 1 | Introduction to Capstone Project Methodologies and Objectives. | 3 | 1 | 0 | 2 | 5 |
| 2 | Identification of Industry or Community Needs and Problem Definition. | 3 | 1 | 0 | 2 | 5 |
| 3 | Incorporating Engineering Standards (IEEE, ISO) in Design. | 3 | 1 | 0 | 2 | 5 |
| 4 | Analyzing Realistic Constraints: Economic and Environmental Impacts. | 3 | 1 | 0 | 2 | 5 |
| 5 | Sustainability and Manufacturability Considerations in Engineering. | 3 | 1 | 0 | 2 | 5 |
| 6 | Ethical Responsibilities and Safety Standards in Project Design. | 3 | 1 | 0 | 2 | 5 |

| | | | | | | |
|---|---|---|---|---|---|---|
| 7 | Literature Review and Research for Problem Exploration. | 3 | 1 | 0 | 2 | 5 |
| 8 | Comparative Analysis of Different Technical Approaches. | 3 | 1 | 0 | 2 | 5 |
| 9 | Feasibility Study: Technical, Operational, and Financial. | 3 | 1 | 0 | 2 | 5 |
| 10 | System-Level Analysis and Functional Requirements. | 3 | 1 | 0 | 2 | 5 |
| 11 | Development of Initial High-Level System Architecture. | 3 | 1 | 0 | 2 | 5 |
| 12 | Technical Specification Writing and Milestone Definition. | 3 | 1 | 0 | 2 | 5 |
| 13 | Project Management: Task Assignment and Implementation Planning. | 3 | 1 | 0 | 2 | 5 |

## 5. Methods of students' assessment

| No. | Assessment Methods | Assessment Timing (Week Number) | Marks/ Scores | Percentage of total course Marks |
|---|---|---|---|---|
| 1 | Tasks/Reports | Monthly | 25 | 25% |
| 2 | Meetings | Monthly | 25 | 25% |
| 3 | Oral/practical/ Presentation | After first term final Exam | 50 | 50% |

## 6. Learning Resources and Supportive Facilities *

| | | |
|---|---|---|
| **Learning resources (books, scientific references, etc.) *** | **The main (essential) reference for the course** (must be written in full according to the scientific documentation method) | • **Dym, C. L., Little, P., Orwin, E. J., & Spjut, R. E. (2014). *Engineering design: A project-based introduction* (4th ed.). Wiley.** |
| | **Other References** | • |
| | **Electronic Sources** (Links must be added) | Egyptian Knowledge Bank \| بنك المعرفة المصري https://www.ekb.eg/ar/home |
| | **Learning Platforms** (Links must be added) | • **www.els.engmet.edu.eg** Google Classroom(https://classroom.google.com) |
| | **Other** (to be mentioned) | • Instructor PowerPoint presentations |
| | | |
| **Supportive facilities & equipment for teaching and learning *** | **Devices/Instruments** | • - |
| | **Supplies** | • Whiteboard<br>• Presenter<br>• Data show system<br>• Sound System |
| | **Electronic Programs** | - |
| | **Skill Labs/ Simulators** | - |
| | **Virtual Labs** | - |
| | **Other** (to be mentioned) | - |

**Course Coordinator**

**Program Coordinator**

**Dr. Yasser El-Awady**

Yasser Alawady

# Course Specifications

# Environmental Impact of Projects
# 2025\2026

## 1. Basic Information

| | | | | | |
|---|---|---|---|---|---|
| **Course Title** | **Environmental Impact of Projects** | | | | |
| **Course Code** | **ENG411** | | | | |
| **Department participating in delivery of the course** | **Communications and Electronics Engineering Department** | | | | |
| **Number of credit hours of the course** | **Credit Hours** | **Theoretical** | | **Self-Learning** | **SWL** |
| | | **Lectures** | **Tutorial** | | |
| | **1** | **1** | **0** | **2** | **3** |
| **Course Type** | **Major Requirements (Institute Compulsory)** | | | | |
| **Academic level at which the course is taught** | **Level 400** | | | | |
| **Academic Program** | **– Communications & Computer Engineering** | | | | |
| **Institute** | **Misr Higher Institute of Engineering and Technology** | | | | |
| **University/Academy** | **Ministry of Higher Education and Scientific Research** | | | | |
| **Semester** | **Fall Semester** | | | | |
| **Prerequisite** | **Completing 90 CH** | | | | |
| **Name of Course Coordinator** | | | | | |
| **Course Specification Approval Date** | **18/8/2025**<br>**8/9/2025** | | | | |
| **Course Specification Approval** | **Communications and Electronics Engineering Department Council, Institute Council** | | | | |

## 2. Course Overview (Brief summary of scientific content)

Introduction: Availability of natural resources, Natural cycles for some basic elements (carbon, oxygen, nitrogen, sulfur, phosphorous…). Conflicts between developments, Economics and environments. Defining emissions sources, Impacts, Standards and precautions. Water, Air and soil pollution and measurements. Historical development for recognizing the need for environmental impact assessment. Assessing the impacts on health, Social, Cultural and economic activities. Procedures of the environmental impact assessment: Screening, Scoping, Defining impacts, Comparing alternatives, Plans for mitigation and alleviation, Environmental auditing. Public participation. Environmental impact statement and

reporting, Contents and forms. Examples for assessing the impacts of water resources projects on the environment and impacts of different activities on the water environment.

## 3. Course Learning Outcomes CLOs

| Program Outcomes (NARS/ARS) (according to the matrix in the program specs) | | Course Learning Outcomes Upon completion of the course, the student will be able to: | |
|---|---|---|---|
| Code | Text | Code | Text |
| A4 | Use of contemporary technologies, standards, specifications and codes of practice, principles of quality, health and safety requirements, environmental issues, principles of risk management | CLO1 | Analyze how engineering projects and natural cycles (like carbon and nitrogen) interact within the ecosystem to ensure sustainability. |
| A6 | Planning, supervision and monitoring of engineering projects | CLO2 | Evaluate project impacts against current environmental standards and historical assessment developments. |
| B3 | Design and implement: elements, modules, sub-systems or systems in electrical/electronic/digital engineering using technological and professional tools | CLO3 | Identify uncertain environmental risks during the screening and scoping phases of a project. |

## 4. Teaching and Learning Methods

1. Face to face lectures\tutorials.
2. Blended Learning (Synchronous\Asynchronous sessions)
3. Active Learning (Interactive Discussions - Case studies -Brainstorming – Presentations)
4. Self-learning.

## Course Schedule

| Number of the Week | Scientific content of the course (Course Topics) | Total Weekly Hours | Expected number of the Learning Hours | | | |
|---|---|---|---|---|---|---|
| | | | Theoretical teaching (lectures/discussion groups/ .....) | | Training (Practical) | Self-learning (Tasks/ Assignments/ Projects) |
| | | | Lectures | Tutorial | | |
| 1 | Overview of natural resources availability and management. | 1 | 1 | 0 | 0 | 2 |
| 2 | Analysis of natural cycles (Carbon, Oxygen, Nitrogen, Sulfur, Phosphorous). | 1 | 1 | 0 | 0 | 2 |
| 3 | Economic development vs. environmental conservation conflicts. | 1 | 1 | 0 | 0 | 2 |
| 4 | Identification and classification of emission sources. | 1 | 1 | 0 | 0 | 2 |
| 5 | Environmental standards and precautionary measures. | 1 | 1 | 0 | 0 | 2 |
| 6-7 | Pollution measurements for water, air, and soil. | 2 | 2 | 0 | 0 | 4 |
| 8 | Midterm + Revision | 1 | 1 | 0 | 0 | 2 |
| 9 | History and evolution of Environmental Impact Assessment (EIA). | 1 | 1 | 0 | 0 | 2 |
| 10 | Impact assessment on health and social-cultural activities. | 1 | 1 | 0 | 0 | 2 |
| 11 | EIA Procedures: Screening and Scoping. | 1 | 1 | 0 | 0 | 2 |
| 12 | Evaluation of project alternatives and defining impacts. | 1 | 1 | 0 | 0 | 2 |
| 13 | Mitigation and alleviation planning for environmental risks. | 1 | 1 | 0 | 0 | 2 |
| 14 | Environmental auditing and public participation processes. | 1 | 1 | 0 | 0 | 2 |
| 15 | Reporting: Contents and forms of Environmental Impact Statements. | 1 | 1 | 0 | 0 | 2 |
| 16 | **Final Exam** | | | | | |

## 5. Methods of students' assessment

| No. | Assessment Methods | Assessment Timing (Week Number) | Marks/ Scores | Percentage of total course Marks |
|---|---|---|---|---|
| 1 | Assignments | Every 3 weeks | 13 | 13% |
| 2 | Quizzes | Every 2 weeks | 12 | 12% |
| 3 | Proctored exams: Midterm Exam | 8 | 25 | 25% |
| 4 | Proctored exams: Final Exam | 15 | 50 | 50% |
| 5 | Formative assessment | 5 | 0 | 0% |

## 6. Learning Resources and Supportive Facilities *

| | | |
|---|---|---|
| **Learning resources (books, scientific references, etc.) *** | **The main (essential) reference for the course** (must be written in full according to the scientific documentation method) | • **Glasson, J., Therivel, R., & Chadwick, A. (2019). Introduction to environmental impact assessment (5th ed.). Routledge.** |
| | **Other References** | • |
| | **Electronic Sources** (Links must be added) | Egyptian Knowledge Bank \| بنك المعرفة المصري https://www.ekb.eg/ar/home |
| | **Learning Platforms** (Links must be added) | • www.els.engmet.edu.eg Google Classroom(https://classroom.google.com) |
| | **Other** (to be mentioned) | • Instructor PowerPoint presentations |
| | | |
| **Supportive facilities & equipment for teaching and learning *** | **Devices/Instruments** | • - |
| | **Supplies** | • Whiteboard • Presenter • Data show system • Sound System |
| | **Electronic Programs** | - |

| | | |
|---|---|---|
| | **Skill Labs/ Simulators** | - |
| | **Virtual Labs** | - |
| | **Other** (to be mentioned) | - |

**Course Coordinator**

**Program Coordinator**

**Dr. Yasser El-Awady**

# Course Specifications

# Software Engineering

# 2025\2026

## 1. Basic Information

| | | | | | |
|---|---|---|---|---|---|
| **Course Title** | **Software Engineering** | | | | |
| **Course Code** | **ELC422** | | | | |
| **Department participating in delivery of the course** | **Communications and Electronics Engineering Department** | | | | |
| **Number of credit hours of the course** | **Credit Hours** | **Theoretical** | | **Self-Learning** | **SWL** |
| | | **Lectures** | **Practical** | | |
| | **3** | **2** | **2** | **5** | **9** |
| **Course Type** | **Minor Requirements (Compulsory)** | | | | |
| **Academic level at which the course is taught** | **Level 400** | | | | |
| **Academic Program** | **– Communications & Computer Engineering** | | | | |
| **Institute** | **Misr Higher Institute of Engineering and Technology** | | | | |
| **University/Academy** | **Ministry of Higher Education and Scientific Research** | | | | |
| **Semester** | **Spring Semester** | | | | |
| **Prerequisite** | **ELC421 - Advanced Programming** | | | | |
| **Name of Course Coordinator** | | | | | |
| **Course Specification Approval Date** | **18/8/2025**<br>**8/9/2025** | | | | |
| **Course Specification Approval** | **Communications and Electronics Engineering Department Council, Institute Council** | | | | |

## 2. Course Overview (Brief summary of scientific content)

Software Development Life Cycles (SDLCs) Traditional and recent models. Software engineering tools primer, Planning and managing requirements, Software Analysis and Design, Business Model Engineering, from analysis and design to software architectures, Building Software, Software Verification and Validation, Software Quality and Security.

## 3. Course Learning Outcomes CLOs

| Program Outcomes (NARS/ARS) (according to the matrix in the program specs) | | Course Learning Outcomes Upon completion of the course, the student will be able to: | |
|---|---|---|---|
| Code | Text | Code | Text |
| A2 | Develop and conduct experiments and / or simulations, analyze and interpret data, evaluate and derive results and use statistical analyzes to arrive at conclusions | CLO1 | Apply analytic critical and systemic thinking to identify and solve complex software engineering problems during the requirement phase. |
| C1 | Design/ analyze/ measure the performance of a computer systems, Database systems, software systems, computer networks, and Microprocessors with identifying the software tools and mathematical methods required to optimize their performance | CLO2 | Design and analyze the performance of software systems by identifying the professional tools required for architectural optimization. |
| A2 | Develop and conduct experiments and / or simulations, analyze and interpret data, evaluate and derive results and use statistical analyzes to arrive at conclusions | CLO3 | Diagnose and resolve variations in software quality and security using systemic thinking and analysis. |
| C1 | Design/ analyze/ measure the performance of a computer systems, Database systems, software systems, computer networks, and Microprocessors with identifying the software tools and mathematical methods required to optimize their performance | CLO4 | Measure the efficiency of software verification and validation processes using specialized mathematical methods. |

| | | | |
|---|---|---|---|
| A2 | Develop and conduct experiments and / or simulations, analyze and interpret data, evaluate and derive results and use statistical analyzes to arrive at conclusions | CLO5 | Evaluate traditional and recent SDLC models to diagnose the best fit for specific engineering projects. |

## 4. Teaching and Learning Methods

1. Face to face lectures\tutorials.
2. Blended Learning (Synchronous\Asynchronous sessions)
3. Active Learning (Interactive Discussions - Case studies -Brainstorming – Presentations)
4. Self-learning.

### Course Schedule

| Number of the Week | Scientific content of the course (Course Topics) | Total Weekly Hours | Expected number of the Learning Hours | | | |
|---|---|---|---|---|---|---|
| | | | Theoretical teaching (lectures/discussion groups/ .....) | | Training (Practical) | Self-learning (Tasks/ Assignments/ Projects) |
| | | | Lectures | Tutorial | | |
| 1 | Introduction to Software Engineering Principles and Ethics. | 4 | 2 | 0 | 2 | 5 |
| 2 | Analysis of Traditional SDLC Models (Waterfall, V-Model). | 4 | 2 | 0 | 2 | 5 |
| 3 | Modern Agile Methodologies and Iterative Development. | 4 | 2 | 0 | 2 | 5 |
| 4 | Software Engineering Tools (CASE tools) Primer. | 4 | 2 | 0 | 2 | 5 |
| 5 | Requirements Engineering: Elicitation, Specification, and Management. | 4 | 2 | 0 | 2 | 5 |
| 6-7 | System Modeling and Software Analysis Techniques. | 8 | 4 | 0 | 4 | 10 |
| 8 | Midterm + Revision | 4 | 2 | 0 | 2 | 5 |
| 9 | Software Architecture Design and Patterns. | 4 | 2 | 0 | 2 | 5 |
| 10 | Business Model Engineering and Process Alignment. | 4 | 2 | 0 | 2 | 5 |
| 11 | Transitioning from Detailed Design to Software Construction. | 4 | 2 | 0 | 2 | 5 |

| | | | | | | |
|---|---|---|---|---|---|---|
| 12 | Software Building: Coding Standards and Configuration Management. | 4 | 2 | 0 | 2 | 5 |
| 13 | Verification and Validation (V&V) Strategies. | 4 | 2 | 0 | 2 | 5 |
| 14 | Software Quality Assurance (SQA) and Metrics. | 4 | 2 | 0 | 2 | 5 |
| 15 | Incorporating Security into the Software Development Life Cycle. | 4 | 2 | 0 | 2 | 5 |
| 16 | **Final Exam** | | | | | |

## 5. Methods of students' assessment

| No. | Assessment Methods | Assessment Timing (Week Number) | Marks/ Scores | Percentage of total course Marks |
|---|---|---|---|---|
| 1 | Assignments | Every 3 weeks | 5 | 5% |
| 2 | Quizzes | Every 2 weeks | 5 | 5% |
| 3 | Proctored exams: Midterm Exam | 8 | 20 | 20% |
| 4 | Practical/Oral Exam | 15 | 20 | 20% |
| 5 | Proctored exams: Final Exam | 16 | 50 | 50% |
| 6 | Formative assessment | 5 | 0 | 0% |

## 6. Learning Resources and Supportive Facilities *

| | | |
|---|---|---|
| Learning resources (books, scientific references, etc.) * | **The main (essential) reference for the course** (must be written in full according to the scientific documentation method) | • Pressman, R. S., & Maxim, B. R. Software Engineering: A Practitioner's Approach. 9th ed., McGraw-Hill Education, 2019. |
| | **Other References** | • |
| | **Electronic Sources** | Egyptian Knowledge Bank \| بنك المعرفة المصري |

| | | |
|---|---|---|
| | (Links must be added) | https://www.ekb.eg/ar/home |
| | **Learning Platforms** (Links must be added) | • www.els.engmet.edu.eg<br>Google Classroom(https://classroom.google.com) |
| | **Other** (to be mentioned) | • Instructor PowerPoint presentations |
| | | |
| **Supportive facilities & equipment for teaching and learning** * | **Devices/Instruments** | • - |
| | **Supplies** | • Whiteboard<br>• Presenter<br>• Data show system<br>• Sound System |
| | **Electronic Programs** | - |
| | **Skill Labs/ Simulators** | - |
| | **Virtual Labs** | - |
| | **Other** (to be mentioned) | - |

**Course Coordinator**

**Program Coordinator**

**Dr. Yasser El-Awady**

Yasser Alawady

# Course Specifications

# Elective Course (8)-Digital Image Processing

# 2025\2026

## 1. Basic Information

| | | | | | | |
|---|---|---|---|---|---|---|
| **Course Title** | **Elective Course (8)-Digital Image Processing** | | | | | |
| **Course Code** | **ELC472** | | | | | |
| **Department participating in delivery of the course** | **Communications and Electronics Engineering Department** | | | | | |
| **Number of credit hours of the course** | **Credit Hours** | **Theoretical** | | **Self-Learning** | **SWL** | |
| | **3** | **Lectures** | **Practical** | **5** | **9** | |
| | | **2** | **2** | | | |
| **Course Type** | **Elective Requirements (Compulsory)** | | | | | |
| **Academic level at which the course is taught** | **Level 400** | | | | | |
| **Academic Program** | **– Communications & Computer Engineering** | | | | | |
| **Institute** | **Misr Higher Institute of Engineering and Technology** | | | | | |
| **University/Academy** | **Ministry of Higher Education and Scientific Research** | | | | | |
| **Semester** | **Spring Semester** | | | | | |
| **Prerequisite** | **BAS212 (Statistics and Probability Theory)**<br>**ELC221 -Object-Oriented Programming** | | | | | |
| **Name of Course Coordinator** | | | | | | |
| **Course Specification Approval Date** | **18/8/2025**<br>**8/9/2025** | | | | | |
| **Course Specification Approval** | **Communications and Electronics Engineering Department Council, Institute Council** | | | | | |

## 2. Course Overview (Brief summary of scientific content)

Introduction to digital signal processing – Discrete Fourier Transform – Inverse Discrete Fourier Transform - Image acquisition and sampling - types of digital images - point processing - image histograms - neighborhood processing - edge sharpening - 2D-Fourier transform - transform processing - image restoration in spatial and frequency domains - image

segmentation - edge detection - Hough transform - morphological operations - processing of color images - feature extraction - pattern recognition.

## 3. Course Learning Outcomes CLOs

| Program Outcomes (NARS/ARS) (according to the matrix in the program specs) | | Course Learning Outcomes Upon completion of the course, the student will be able to: | |
|---|---|---|---|
| Code | Text | Code | Text |
| A1 | Identify, formulate, and solve complex engineering problems by applying engineering fundamentals, basic science and mathematics | CLO1 | Apply mathematical expressions of 2D Fourier transforms and spatial convolution matrix operations to evaluate and manipulate digital image representations. |
| B3 | Design and implement: elements, modules, sub-systems or systems in electrical/electronic/digital engineering using technological and professional tools | CLO2 | Identify and manage pixel-level noise, data degradation uncertainties, and compression artifacts by selecting appropriate spatial and frequency restoration filters. |
| C1 | Design/ analyze/ measure the performance of a computer systems, Database systems, software systems, computer networks, and Microprocessors with identifying the software tools and mathematical methods required to optimize their performance | CLO3 | Configure hardware-constrained image capture setups and maintain image acquisition pipelines within standard engineering memory limitations. |
| C2 | Develop innovative solutions for practical industrial problems in Computer Engineering | CLO4 | Design and analyze specialized computer software algorithms for morphological operations, Hough transforms, and pattern recognition tasks to solve vision-based problems. |
| C3 | Synthesize different computer systems, measure their performance and analyze the | CLO5 | Maintain high standards of professional practice and code optimization while developing |

| | | | |
|---|---|---|---|
| | obtained results using mathematical models | | complex feature extraction and image enhancement applications. |
| C4 | Design and compare between the different specifications for computer-based systems, multimedia and computer graphics | CLO6 | Integrate computer vision software layers with optical sensors and targeted processing hardware components to deploy operational edge-detection systems. |

## 4. Teaching and Learning Methods

1. Face to face lectures\tutorials.
2. Blended Learning (Synchronous\Asynchronous sessions)
3. Active Learning (Interactive Discussions - Case studies -Brainstorming – Presentations)
4. Self-learning.

### Course Schedule

| Number of the Week | Scientific content of the course (Course Topics) | Total Weekly Hours | Expected number of the Learning Hours | | | |
|---|---|---|---|---|---|---|
| | | | Theoretical teaching (lectures/discussion groups/ .....) | | Training (Practical) | Self-learning (Tasks/ Assignments/ Projects) |
| | | | Lectures | Tutorial | | |
| 1 | Fundamentals of Digital Signal Processing for Images. | 4 | 2 | 0 | 2 | 5 |
| 2 | Mathematical Foundations: Discrete and Inverse Fourier Transforms. | 4 | 2 | 0 | 2 | 5 |
| 3 | Principles of Image Acquisition, Sampling, and Quantization. | 4 | 2 | 0 | 2 | 5 |
| 4 | Classification and Analysis of Digital Image Types. | 4 | 2 | 0 | 2 | 5 |
| 5-6 | Point Processing and Intensity Transformations. | 8 | 4 | 0 | 4 | 10 |
| 7 | Image Enhancement using Histograms. | 4 | 2 | 0 | 2 | 5 |
| 8 | Midterm + Revision | 4 | 2 | 0 | 2 | 5 |
| 9 | Spatial Domain Filtering and Neighborhood Processing. | 4 | 2 | 0 | 2 | 5 |
| 10 | Techniques for Edge Sharpening and Smoothing. | 4 | 2 | 0 | 2 | 5 |

| | | | | | | |
|---|---|---|---|---|---|---|
| **11** | Frequency Domain Analysis using 2D-Fourier Transforms. | **4** | **2** | **0** | **2** | **5** |
| **12** | Image Restoration and Noise Reduction in Spatial/Frequency Domains. | **4** | **2** | **0** | **2** | **5** |
| **13** | Image Segmentation and Advanced Edge Detection Techniques. | **4** | **2** | **0** | **2** | **5** |
| **14** | Geometric Transformations and Morphological Operations. | **4** | **2** | **0** | **2** | **5** |
| **15** | Color Image Processing, Feature Extraction, and Pattern Recognition. | **4** | **2** | **0** | **2** | **5** |
| **16** | **Final Exam** | | | | | |

## 5. Methods of students' assessment

| No. | Assessment Methods | Assessment Timing (Week Number) | Marks/ Scores | Percentage of total course Marks |
|---|---|---|---|---|
| **1** | Assignments | Every 3 weeks | 5 | 5% |
| **2** | Quizzes | Every 2 weeks | 5 | 5% |
| **3** | Proctored exams: Midterm Exam | 8 | 20 | 20% |
| **4** | Practical/Oral Exam | 15 | 20 | 20% |
| **5** | Proctored exams: Final Exam | 16 | 50 | 50% |
| **6** | Formative assessment | 5 | 0 | 0% |

## 6. Learning Resources and Supportive Facilities *

| | | |
|---|---|---|
| **Learning resources (books, scientific references, etc.) *** | **The main (essential) reference for the course** **(must be written in full according to the scientific documentation method)** | • **Gonzalez, R. C., & Woods, R. E. Digital Image Processing. 4th ed., Pearson, 2018.** |
| | **Other References** | • |

| | | |
|---|---|---|
| | **Electronic Sources** (Links must be added) | Egyptian Knowledge Bank \| بنك المعرفة المصري https://www.ekb.eg/ar/home |
| | **Learning Platforms** (Links must be added) | • **www.els.engmet.edu.eg** Google Classroom(https://classroom.google.com) |
| | **Other** (to be mentioned) | • Instructor PowerPoint presentations |
| | | |
| **Supportive facilities & equipment for teaching and learning** * | **Devices/Instruments** | • - |
| | **Supplies** | • Whiteboard<br>• Presenter<br>• Data show system<br>• Sound System |
| | **Electronic Programs** | - |
| | **Skill Labs/ Simulators** | - |
| | **Virtual Labs** | - |
| | **Other** (to be mentioned) | - |

**Course Coordinator**

**Program Coordinator**

**Dr. Yasser El-Awady**

# Course Specifications

# Elective Course (8) -Neural Networks

# 2025\2026

## 1. Basic Information

| | | | | | |
|---|---|---|---|---|---|
| **Course Title** | **Elective Course (8) -Neural Networks** | | | | |
| **Course Code** | **ELC473** | | | | |
| **Department participating in delivery of the course** | **Communications and Electronics Engineering Department** | | | | |
| **Number of credit hours of the course** | **Credit Hours** | **Theoretical** | | **Self-Learning** | **SWL** |
| | | **Lectures** | **Practical** | | |
| | **3** | **2** | **2** | **5** | **9** |
| **Course Type** | **Elective Requirements (Compulsory)** | | | | |
| **Academic level at which the course is taught** | **Level 400** | | | | |
| **Academic Program** | **– Communications & Computer Engineering** | | | | |
| **Institute** | **Misr Higher Institute of Engineering and Technology** | | | | |
| **University/Academy** | **Ministry of Higher Education and Scientific Research** | | | | |
| **Semester** | **Spring Semester** | | | | |
| **Prerequisite** | **BAS212 (Statistics and Probability Theory)**<br>**ELC221 (Object-Oriented Programming)** | | | | |
| **Name of Course Coordinator** | | | | | |
| **Course Specification Approval Date** | **18/8/2025**<br>**8/9/2025** | | | | |
| **Course Specification Approval** | **Communications and Electronics Engineering Department Council, Institute Council** | | | | |

## 2. Course Overview (Brief summary of scientific content)

Introduction to ANN - Neuroanatomy – Perceptron – Backpropagation - Hidden Units - Convolutional Networks - Recurrent Networks (LSTM, GRU) - Hopfield Network & Boltzmann Machine – Autoencoders - Generative Adversarial Networks - Designing applications of neural networks – Introduction to deep learning - Recent developments in neural networks and deep learning.

## 3. Course Learning Outcomes CLOs

| Program Outcomes (NARS/ARS) (according to the matrix in the program specs) | | Course Learning Outcomes Upon completion of the course, the student will be able to: | |
|---|---|---|---|
| Code | Text | Code | Text |
| A1 | Identify, formulate, and solve complex engineering problems by applying engineering fundamentals, basic science and mathematics | CLO1 | Apply mathematical matrices and calculus-based gradient descent rules to resolve weights optimization during multi-layer perceptron backpropagation. |
| B3 | Design and implement: elements, modules, sub-systems or systems in electrical/electronic/digital engineering using technological and professional tools | CLO2 | Identify and manage validation loss uncertainties, overfitting parameters, and local minima anomalies by selecting appropriate optimization algorithms and hidden unit regularization techniques. |
| C1 | Design/ analyze/ measure the performance of a computer systems, Database systems, software systems, computer networks, and Microprocessors with identifying the software tools and mathematical methods required to optimize their performance | CLO3 | Configure deep learning execution frameworks within standard computer hardware processing constraints, addressing memory-bound GPU caching profiles during network training. |
| C2 | Develop innovative solutions for practical industrial problems in Computer Engineering | CLO4 | Design and analyze customized computer software pipelines utilizing Convolutional and Recurrent (LSTM/GRU) network topologies to solve advanced predictive computer-based problems. |
| C3 | Synthesize different computer systems, measure their performance and analyze the | CLO5 | Maintain high standards of technical performance and professional programming practices when |

| | | | |
|---|---|---|---|
| | obtained results using mathematical models | | structuring datasets and compiling clean, scalable deep learning production code. |
| C4 | Design and compare between the different specifications for computer-based systems, multimedia and computer graphics | CLO6 | Integrate generative deep learning model libraries (Autoencoders/GANs) with peripheral server-side hardware components to implement fully functioning intelligent computer-based systems. |

## 4. Teaching and Learning Methods

1. Face to face lectures\tutorials.
2. Blended Learning (Synchronous\Asynchronous sessions)
3. Active Learning (Interactive Discussions - Case studies -Brainstorming – Presentations)
4. Self-learning.

### Course Schedule

| Number of the Week | Scientific content of the course (Course Topics) | Total Weekly Hours | Expected number of the Learning Hours | | | |
|---|---|---|---|---|---|---|
| | | | Theoretical teaching (lectures/discussion groups/ .....) | | Training (Practical) | Self-learning (Tasks/ Assignments/ Projects) |
| | | | Lectures | Tutorial | | |
| 1 | Introduction to Artificial Neural Networks (ANN). | 4 | 2 | 0 | 2 | 5 |
| 2 | Neuroanatomy: Biological inspiration for artificial neurons. | 4 | 2 | 0 | 2 | 5 |
| 3 | The Perceptron Model and Linear Classifiers. | 4 | 2 | 0 | 2 | 5 |
| 4 | The Backpropagation Algorithm and Gradient Descent. | 4 | 2 | 0 | 2 | 5 |
| 5 | Role and Architecture of Hidden Units. | 4 | 2 | 0 | 2 | 5 |
| 6-7 | Convolutional Neural Networks (CNN) for Image Processing. | 8 | 4 | 0 | 4 | 10 |
| 8 | Midterm + Revision | 4 | 2 | 0 | 2 | 5 |
| 9 | Recurrent Neural Networks (RNN) and Sequential Data. | 4 | 2 | 0 | 2 | 5 |

| | | | | | | |
|---|---|---|---|---|---|---|
| **10** | Long Short-Term Memory (LSTM) and Gated Recurrent Units (GRU). | **4** | **2** | **0** | **2** | **5** |
| **11** | Associative Memory: Hopfield Networks and Boltzmann Machines. | **4** | **2** | **0** | **2** | **5** |
| **12** | Unsupervised Learning with Autoencoders. | **4** | **2** | **0** | **2** | **5** |
| **13** | Principles of Generative Adversarial Networks (GANs). | **4** | **2** | **0** | **2** | **5** |
| **14** | Frameworks for Designing Neural Network Applications. | **4** | **2** | **0** | **2** | **5** |
| **15** | Deep Learning Fundamentals and Emerging Trends. | **4** | **2** | **0** | **2** | **5** |
| **16** | **Final Exam** | | | | | |

## 5. Methods of students' assessment

| No. | Assessment Methods | Assessment Timing (Week Number) | Marks/ Scores | Percentage of total course Marks |
|---|---|---|---|---|
| **1** | Assignments | Every 3 weeks | 5 | 5% |
| **2** | Quizzes | Every 2 weeks | 5 | 5% |
| **3** | Proctored exams: Midterm Exam | 8 | 20 | 20% |
| **4** | Practical/Oral Exam | 15 | 20 | 20% |
| **5** | Proctored exams: Final Exam | 16 | 50 | 50% |
| **6** | Formative assessment | 5 | 0 | 0% |

## 6. Learning Resources and Supportive Facilities *

| | | |
|---|---|---|
| **Learning resources (books, scientific references, etc.) *** | **The main (essential) reference for the course** (must be written in full according to the scientific documentation method) | • **Aggarwal, C. C. Neural Networks and Deep Learning: A Textbook. Springer, 2018.** |
| | **Other References** | • |
| | **Electronic Sources** (Links must be added) | Egyptian Knowledge Bank \| بنك المعرفة المصري https://www.ekb.eg/ar/home |
| | **Learning Platforms** (Links must be added) | • **www.els.engmet.edu.eg** Google Classroom(https://classroom.google.com) |
| | **Other** (to be mentioned) | • Instructor PowerPoint presentations |
| | | |
| **Supportive facilities & equipment for teaching and learning *** | **Devices/Instruments** | • - |
| | **Supplies** | • Whiteboard<br>• Presenter<br>• Data show system<br>• Sound System |
| | **Electronic Programs** | - |
| | **Skill Labs/ Simulators** | - |
| | **Virtual Labs** | - |
| | **Other** (to be mentioned) | - |

**Course Coordinator**

**Program Coordinator**

**Dr. Yasser El-Awady**

Yasser Alawady

# Course Specifications

# Elective Course (8) - Computer Vision

# 2025\2026

## 1. Basic Information

| | | | | | |
|---|---|---|---|---|---|
| **Course Title** | **Elective Course (8) - Computer Vision** | | | | |
| **Course Code** | **ELC474** | | | | |
| **Department participating in delivery of the course** | **Communications and Electronics Engineering Department** | | | | |
| **Number of credit hours of the course** | **Credit Hours** | **Theoretical** | | **Self-Learning** | **SWL** |
| | | **Lectures** | **Practical** | | |
| | **3** | **2** | **2** | **5** | **9** |
| **Course Type** | **Elective Requirements (Compulsory)** | | | | |
| **Academic level at which the course is taught** | **Level 400** | | | | |
| **Academic Program** | **– Communications & Computer Engineering** | | | | |
| **Institute** | **Misr Higher Institute of Engineering and Technology** | | | | |
| **University/Academy** | **Ministry of Higher Education and Scientific Research** | | | | |
| **Semester** | **Spring Semester** | | | | |
| **Prerequisite** | **BAS212 (Statistics and Probability Theory)**<br>**ELC221 (Object-Oriented Programming)** | | | | |
| **Name of Course Coordinator** | | | | | |
| **Course Specification Approval Date** | **18/8/2025**<br>**8/9/2025** | | | | |
| **Course Specification Approval** | **Communications and Electronics Engineering Department Council, Institute Council** | | | | |

## 2. Course Overview (Brief summary of scientific content)

Basics of image processing techniques and algorithms: image pre-processing – filtering and smoothing – image enhancement – edge detection – image segmentation – colors and Hough transform. Basics of computer vision techniques: lighting – optics – Camera model – Camera calibration and surface reconstruction – stereo camera system – Video processing – correlation

and stereo vision. Applications: interior surveillance – bar code scanning – object recognition – Appearance based matching – 3D scanning – 3D tracking of moving objects.

## 3. Course Learning Outcomes CLOs

| Program Outcomes (NARS/ARS) (according to the matrix in the program specs) | | Course Learning Outcomes Upon completion of the course, the student will be able to: | |
|---|---|---|---|
| Code | Text | Code | Text |
| A1 | Identify, formulate, and solve complex engineering problems by applying engineering fundamentals, basic science and mathematics | CLO1 | Apply mathematical projection matrices and coordinate transformation geometry to compute camera calibration and 3D surface reconstruction parameters. |
| B3 | Design and implement: elements, modules, sub-systems or systems in electrical/electronic/digital engineering using technological and professional tools | CLO2 | Identify and manage visual tracking uncertainties, noise distortions, and varying illumination hazards by selecting appropriate optical filters and stereo correlation techniques. |
| C1 | Design/ analyze/ measure the performance of a computer systems, Database systems, software systems, computer networks, and Microprocessors with identifying the software tools and mathematical methods required to optimize their performance | CLO3 | Configure stereo-camera vision rigs and maintain real-time physical video acquisition hardware within strict operational bandwidth limitations. |
| C2 | Develop innovative solutions for practical industrial problems in Computer Engineering | CLO4 | Design and analyze specialized software algorithms for appearance-based matching, segmentation, and 3D object tracking to solve autonomous computer-based vision problems. |
| C3 | Synthesize different computer systems, measure their performance and analyze the | CLO5 | Maintain high standards of engineering professionalism and code optimization metrics while deploying real-time surveillance and |

| | | | |
|---|---|---|---|
| | obtained results using mathematical models | | bar code scanning production applications. |
| C4 | Design and compare between the different specifications for computer-based systems, multimedia and computer graphics | CLO6 | Integrate computer vision software models with specialized sensory optics and spatial tracking hardware layers to implement fully operational automated systems. |

## 4. Teaching and Learning Methods

1. Face to face lectures\tutorials.
2. Blended Learning (Synchronous\Asynchronous sessions)
3. Active Learning (Interactive Discussions - Case studies -Brainstorming – Presentations)
4. Self-learning.

### Course Schedule

| Number of the Week | Scientific content of the course (Course Topics) | Total Weekly Hours | Expected number of the Learning Hours | | | |
|---|---|---|---|---|---|---|
| | | | Theoretical teaching (lectures/discussion groups/ .....) | | Training (Practical) | Self-learning (Tasks/ Assignments/ Projects) |
| | | | Lectures | Tutorial | | |
| 1 | Foundations of Image Pre-processing and Algorithms. | 4 | 2 | 0 | 2 | 5 |
| 2-3 | Spatial Domain Filtering and Smoothing Techniques. | 8 | 4 | 0 | 4 | 10 |
| 4 | Image Enhancement and Intensity Transformations. | 4 | 2 | 0 | 2 | 5 |
| 5 | Advanced Edge Detection and Boundary Analysis. | 4 | 2 | 0 | 2 | 5 |
| 6 | Image Segmentation Methods and the Hough Transform. | 4 | 2 | 0 | 2 | 5 |
| 7 | Fundamentals of Lighting and Optics in Computer Vision. | 4 | 2 | 0 | 2 | 5 |
| 8 | Midterm + Revision | 4 | 2 | 0 | 2 | 5 |
| 9 | Pinhole Camera Models and Projective Geometry. | 4 | 2 | 0 | 2 | 5 |
| 10 | Procedures for Camera Calibration and Surface Reconstruction. | 4 | 2 | 0 | 2 | 5 |

| | | | | | | |
|---|---|---|---|---|---|---|
| **11** | Architecture and Geometry of Stereo Camera Systems. | **4** | **2** | **0** | **2** | **5** |
| **12** | Real-time Video Processing and Motion Analysis. | **4** | **2** | **0** | **2** | **5** |
| **13** | Principles of Correlation and Stereo Vision Matching. | **4** | **2** | **0** | **2** | **5** |
| **14** | Object Recognition and Appearance-based Matching. | **4** | **2** | **0** | **2** | **5** |
| **15** | 3D Scanning and Tracking of Moving Objects. | **4** | **2** | **0** | **2** | **5** |
| **16** | **Final Exam** | | | | | |

## 5. Methods of students' assessment

| No. | Assessment Methods | Assessment Timing (Week Number) | Marks/ Scores | Percentage of total course Marks |
|---|---|---|---|---|
| **1** | Assignments | Every 3 weeks | 5 | 5% |
| **2** | Quizzes | Every 2 weeks | 5 | 5% |
| **3** | Proctored exams: Midterm Exam | 8 | 20 | 20% |
| **4** | Practical/Oral Exam | 15 | 20 | 20% |
| **5** | Proctored exams: Final Exam | 16 | 50 | 50% |
| **6** | Formative assessment | 5 | 0 | 0% |

## 6. Learning Resources and Supportive Facilities *

| | | |
|---|---|---|
| **Learning resources (books, scientific references, etc.) *** | **The main (essential) reference for the course** **(must be written in full according to the scientific documentation method)** | • **Szeliski, R. Computer Vision: Algorithms and Applications. 2nd ed., Springer, 2022.** |
| | **Other References** | • |
| | **Electronic Sources** (Links must be added) | Egyptian Knowledge Bank \| بنك المعرفة المصري https://www.ekb.eg/ar/home |

| | | |
|---|---|---|
| | **Learning Platforms** (Links must be added) | • www.els.engmet.edu.eg<br>Google Classroom(https://classroom.google.com) |
| | **Other** (to be mentioned) | • Instructor PowerPoint presentations |
| | | |
| **Supportive facilities & equipment for teaching and learning** * | **Devices/Instruments** | • - |
| | **Supplies** | • Whiteboard<br>• Presenter<br>• Data show system<br>• Sound System |
| | **Electronic Programs** | - |
| | **Skill Labs/ Simulators** | - |
| | **Virtual Labs** | - |
| | **Other** (to be mentioned) | - |

**Course Coordinator**

**Program Coordinator**

**Dr. Yasser El-Awady**

# Course Specifications

# Elective Course (8) - Machine Learning

# 2025\2026

## 1. Basic Information

| | | | | | |
|---|---|---|---|---|---|
| **Course Title** | **Elective Course (8) - Machine Learning** | | | | |
| **Course Code** | **ELC475** | | | | |
| **Department participating in delivery of the course** | **Communications and Electronics Engineering Department** | | | | |
| **Number of credit hours of the course** | **Credit Hours** | **Theoretical** | | **Self-Learning** | **SWL** |
| | | **Lectures** | **Practical** | | |
| | **3** | **2** | **2** | **5** | **9** |
| **Course Type** | **Elective Requirements (Compulsory)** | | | | |
| **Academic level at which the course is taught** | **Level 400** | | | | |
| **Academic Program** | **– Communications & Computer Engineering** | | | | |
| **Institute** | **Misr Higher Institute of Engineering and Technology** | | | | |
| **University/Academy** | **Ministry of Higher Education and Scientific Research** | | | | |
| **Semester** | **Spring Semester** | | | | |
| **Prerequisite** | **BAS212 (Statistics and Probability Theory)**<br>**ELC221 (Object-Oriented Programming)** | | | | |
| **Name of Course Coordinator** | | | | | |
| **Course Specification Approval Date** | **18/8/2025**<br>**8/9/2025** | | | | |
| **Course Specification Approval** | **Communications and Electronics Engineering Department Council, Institute Council** | | | | |

## 2. Course Overview (Brief summary of scientific content)

Introduction to Machine Learning - Supervised Learning and Linear Regression - Classification and Logistic Regression - Decision Tree and Random Forest - Naïve Bayes and Support Vector Machine - Unsupervised Learning – Machine learning project.

## 3. Course Learning Outcomes CLOs

| Program Outcomes (NARS/ARS) (according to the matrix in the program specs) | | Course Learning Outcomes Upon completion of the course, the student will be able to: | |
|---|---|---|---|
| Code | Text | Code | Text |
| A1 | Identify, formulate, and solve complex engineering problems by applying engineering fundamentals, basic science and mathematics | CLO1 | Apply multivariable calculus and matrix operations to optimize objective loss functions in linear and logistic regression variants. |
| B3 | Design and implement: elements, modules, sub-systems or systems in electrical/electronic/digital engineering using technological and professional tools | CLO2 | Identify and manage data uncertainties, bias-variance tradeoffs, and overfitting phenomena by applying cross-validation and hyperparameter regularizations. |
| C1 | Design/ analyze/ measure the performance of a computer systems, Database systems, software systems, computer networks, and Microprocessors with identifying the software tools and mathematical methods required to optimize their performance | CLO3 | Configure predictive learning execution layers within standard computer hardware processing profiles, addressing high-throughput memory caching. |
| C2 | Develop innovative solutions for practical industrial problems in Computer Engineering | CLO4 | Design and analyze customized computer software pipelines utilizing Decision Trees, Random Forests, and SVMs to solve multi-class classification problems. |
| C3 | Synthesize different computer systems, measure their performance and analyze the obtained results using mathematical models | CLO5 | Maintain high standards of engineering professionalism and reproducible coding principles while clean-structuring datasets for large-scale production projects. |

| | | | |
|---|---|---|---|
| C4 | Design and compare between the different specifications for computer-based systems, multimedia and computer graphics | CLO6 | Integrate unsupervised and supervised machine learning software models with targeted database and hardware interface components to deploy complete intelligent computer-based systems. |

## 4. Teaching and Learning Methods

1. Face to face lectures\tutorials.
2. Blended Learning (Synchronous\Asynchronous sessions)
3. Active Learning (Interactive Discussions - Case studies -Brainstorming – Presentations)
4. Self-learning.

### Course Schedule

| Number of the Week | Scientific content of the course (Course Topics) | Total Weekly Hours | Expected number of the Learning Hours | | | |
|---|---|---|---|---|---|---|
| | | | Theoretical teaching (lectures/discussion groups/ .....) | | Training (Practical) | Self-learning (Tasks/ Assignments/ Projects) |
| | | | Lectures | Tutorial | | |
| 1 | Introduction to Machine Learning Paradigms. | 4 | 2 | 0 | 2 | 5 |
| 2 | Fundamentals of Supervised Learning. | 4 | 2 | 0 | 2 | 5 |
| 3 | Mathematical Foundations of Linear Regression. | 4 | 2 | 0 | 2 | 5 |
| 4 | Classification Techniques and Logistic Regression. | 4 | 2 | 0 | 2 | 5 |
| 5 | Information Theory and Decision Tree Construction. | 4 | 2 | 0 | 2 | 5 |
| 6-7 | Ensemble Learning: Random Forest Principles. | 8 | 4 | 0 | 4 | 10 |
| 8 | Midterm + Revision | 4 | 2 | 0 | 2 | 5 |
| 9 | Probabilistic Classification with Naïve Bayes. | 4 | 2 | 0 | 2 | 5 |
| 10 | Support Vector Machines (SVM) and Kernel Methods. | 4 | 2 | 0 | 2 | 5 |
| 11 | Introduction to Unsupervised Learning. | 4 | 2 | 0 | 2 | 5 |

| | | | | | | |
|---|---|---|---|---|---|---|
| **12** | Clustering Algorithms and Pattern Discovery. | **4** | **2** | **0** | **2** | **5** |
| **13** | Dimensionality Reduction Techniques. | **4** | **2** | **0** | **2** | **5** |
| **14** | Machine Learning Project Life Cycle: From Data to Deployment. | **4** | **2** | **0** | **2** | **5** |
| **15** | Evaluation Metrics and Model Performance Tuning. | **4** | **2** | **0** | **2** | **5** |
| **16** | **Final Exam** | | | | | |

## 5. Methods of students' assessment

| No. | Assessment Methods | Assessment Timing (Week Number) | Marks/ Scores | Percentage of total course Marks |
|---|---|---|---|---|
| **1** | Assignments | Every 3 weeks | 5 | 5% |
| **2** | Quizzes | Every 2 weeks | 5 | 5% |
| **3** | Proctored exams: Midterm Exam | 8 | 20 | 20% |
| **4** | Practical/Oral Exam | 15 | 20 | 20% |
| **5** | Proctored exams: Final Exam | 16 | 50 | 50% |
| **6** | Formative assessment | 5 | 0 | 0% |

## 6. Learning Resources and Supportive Facilities *

| | | |
|---|---|---|
| **Learning resources (books, scientific references, etc.) *** | **The main (essential) reference for the course** (**must be written in full according to the scientific documentation method**) | • **Bishop, C. M., & Bishop, H. Deep Learning: Foundations and Concepts. Springer, 2023.** |
| | **Other References** | • |
| | **Electronic Sources** (Links must be added) | Egyptian Knowledge Bank \| بنك المعرفة المصري https://www.ekb.eg/ar/home |

| | | |
|---|---|---|
| | **Learning Platforms** (Links must be added) | • www.els.engmet.edu.eg<br>Google Classroom(https://classroom.google.com) |
| | **Other** (to be mentioned) | • Instructor PowerPoint presentations |
| | | |
| **Supportive facilities & equipment for teaching and learning** * | **Devices/Instruments** | • - |
| | **Supplies** | • Whiteboard<br>• Presenter<br>• Data show system<br>• Sound System |
| | **Electronic Programs** | - |
| | **Skill Labs/ Simulators** | - |
| | **Virtual Labs** | - |
| | **Other** (to be mentioned) | - |

**Course Coordinator**

**Program Coordinator**

**Dr. Yasser El-Awady**

# Course Specifications

# Elective Course (8) - AI Programming

# 2025\2026

## 1. Basic Information

| | | | | | |
|---|---|---|---|---|---|
| **Course Title** | **Elective Course (8) - AI Programming** | | | | |
| **Course Code** | **ELC476** | | | | |
| **Department participating in delivery of the course** | **Communications and Electronics Engineering Department** | | | | |
| **Number of credit hours of the course** | **Credit Hours** | **Theoretical** | | **Self-Learning** | **SWL** |
| | **3** | **Lectures** | **Practical** | **5** | **9** |
| | | **2** | **2** | | |
| **Course Type** | **Elective Requirements (Compulsory)** | | | | |
| **Academic level at which the course is taught** | **Level 400** | | | | |
| **Academic Program** | **– Communications & Computer Engineering** | | | | |
| **Institute** | **Misr Higher Institute of Engineering and Technology** | | | | |
| **University/Academy** | **Ministry of Higher Education and Scientific Research** | | | | |
| **Semester** | **Spring Semester** | | | | |
| **Prerequisite** | **BAS212 (Statistics and Probability Theory)**<br>**ELC221 (Object-Oriented Programming)** | | | | |
| **Name of Course Coordinator** | | | | | |
| **Course Specification Approval Date** | **18/8/2025**<br>**8/9/2025** | | | | |
| **Course Specification Approval** | **Communications and Electronics Engineering Department Council, Institute Council** | | | | |

## 2. Course Overview (Brief summary of scientific content)

Introduction to Python for AI - Jupyter Notebooks - NumPy - Anaconda - pandas - Matplotlib - Linear Algebra Essentials in programming shape - Calculus Essentials in programming - Neural Networks programming – AI project.

## 3. Course Learning Outcomes CLOs

| Program Outcomes (NARS/ARS) (according to the matrix in the program specs) | | Course Learning Outcomes Upon completion of the course, the student will be able to: | |
|---|---|---|---|
| Code | Text | Code | Text |
| A1 | Identify, formulate, and solve complex engineering problems by applying engineering fundamentals, basic science and mathematics | CLO1 | Apply mathematical linear algebra concepts and calculus derivative rules to code vectorized tensor operations and manual gradient updates within AI algorithms. |
| B3 | Design and implement: elements, modules, sub-systems or systems in electrical/electronic/digital engineering using technological and professional tools | CLO2 | Identify and manage data anomalies, missing values, and dimensional variance uncertainties by selecting appropriate pre-processing techniques using pandas. |
| C1 | Design/ analyze/ measure the performance of a computer systems, Database systems, software systems, computer networks, and Microprocessors with identifying the software tools and mathematical methods required to optimize their performance | CLO3 | Configure algorithmic execution scripts and maintain computational software paths within standard physical memory caching constraints. |
| C2 | Develop innovative solutions for practical industrial problems in Computer Engineering | CLO4 | Design and analyze specialized neural network software code blocks to solve predictive computer-based classification and regression problems. |
| C3 | Synthesize different computer systems, measure their performance and analyze the obtained results using mathematical models | CLO5 | Maintain high standards of engineering professionalism, documentation clean-code metrics, and reproducible data visualizations during repository code compilation. |

| | | | |
|---|---|---|---|
| C4 | Design and compare between the different specifications for computer-based systems, multimedia and computer graphics | CLO6 | Integrate compiled artificial intelligence software scripts with external data streams and server-side hardware environments to deploy complete functional systems. |

## 4. Teaching and Learning Methods

1. Face to face lectures\tutorials.
2. Blended Learning (Synchronous\Asynchronous sessions)
3. Active Learning (Interactive Discussions - Case studies -Brainstorming – Presentations)
4. Self-learning.

### Course Schedule

| Number of the Week | Scientific content of the course (Course Topics) | Total Weekly Hours | Expected number of the Learning Hours | | | |
|---|---|---|---|---|---|---|
| | | | Theoretical teaching (lectures/discussion groups/ .....) | | Training (Practical) | Self-learning (Tasks/ Assignments/ Projects) |
| | | | Lectures | Tutorial | | |
| 1 | Introduction to Python Programming specifically for AI applications. | 4 | 2 | 0 | 2 | 5 |
| 2 | Setting up the Environment: Anaconda Distribution and Jupyter Notebooks. | 4 | 2 | 0 | 2 | 5 |
| 3 | Numerical Computing and Array Manipulation with NumPy. | 4 | 2 | 0 | 2 | 5 |
| 4 | Data Manipulation, Cleaning, and Analysis using pandas. | 4 | 2 | 0 | 2 | 5 |
| 5-6 | Data Visualization and Plotting with Matplotlib. | 8 | 4 | 0 | 4 | 10 |
| 7 | Programming essentials of Linear Algebra: Tensors and Matrices. | 4 | 2 | 0 | 2 | 5 |
| 8 | Midterm + Revision | 4 | 2 | 0 | 2 | 5 |
| 9 | Programming essentials of Calculus: Derivatives and Partial Derivatives. | 4 | 2 | 0 | 2 | 5 |
| 10 | Algorithmic implementation of the Gradient Descent optimizer. | 4 | 2 | 0 | 2 | 5 |
| 11 | Architecting Neural Networks: Input, Hidden, and Output layers in code. | 4 | 2 | 0 | 2 | 5 |

| | | | | | | |
|---|---|---|---|---|---|---|
| **12** | Implementing Forward Propagation and Backpropagation from scratch. | **4** | **2** | **0** | **2** | **5** |
| **13** | Utilizing Deep Learning libraries and API integration. | **4** | **2** | **0** | **2** | **5** |
| **14** | Managing the AI Project Life Cycle: Data pipeline to model evaluation. | **4** | **2** | **0** | **2** | **5** |
| **15** | Final AI Project: Developing a functional end-to-end intelligent system. | **4** | **2** | **0** | **2** | **5** |
| **16** | **Final Exam** | | | | | |

## 5. Methods of students' assessment

| No. | Assessment Methods | Assessment Timing (Week Number) | Marks/ Scores | Percentage of total course Marks |
|---|---|---|---|---|
| **1** | Assignments | Every 3 weeks | 5 | 5% |
| **2** | Quizzes | Every 2 weeks | 5 | 5% |
| **3** | Proctored exams: Midterm Exam | 8 | 20 | 20% |
| **4** | Practical/Oral Exam | 15 | 20 | 20% |
| **5** | Proctored exams: Final Exam | 16 | 50 | 50% |
| **6** | Formative assessment | 5 | 0 | 0% |

## 6. Learning Resources and Supportive Facilities *

| | | |
|---|---|---|
| **Learning resources (books, scientific references, etc.) *** | **The main (essential) reference for the course** (**must be written in full according to the scientific documentation method**) | • **Russell, S., & Norvig, P. Artificial Intelligence: A Modern Approach. 4th ed., Pearson, 2021.** |
| | **Other References** | • |
| | **Electronic Sources** | Egyptian Knowledge Bank \| بنك المعرفة المصري |

| | | |
|---|---|---|
| | (Links must be added) | https://www.ekb.eg/ar/home |
| | **Learning Platforms** (Links must be added) | • www.els.engmet.edu.eg<br>Google Classroom(https://classroom.google.com) |
| | **Other** (to be mentioned) | • Instructor PowerPoint presentations |
| | | |
| **Supportive facilities & equipment for teaching and learning** * | **Devices/Instruments** | • - |
| | **Supplies** | • Whiteboard<br>• Presenter<br>• Data show system<br>• Sound System |
| | **Electronic Programs** | - |
| | **Skill Labs/ Simulators** | - |
| | **Virtual Labs** | - |
| | **Other** (to be mentioned) | - |

**Course Coordinator**

**Program Coordinator**

**Dr. Yasser El-Awady**

# Course Specifications

# Elective Course (8) -Expert Systems

# 2025\2026

## 1. Basic Information

| | | | | | |
|---|---|---|---|---|---|
| **Course Title** | **Elective Course (8) -Expert Systems** | | | | |
| **Course Code** | **ELC477** | | | | |
| **Department participating in delivery of the course** | **Communications and Electronics Engineering Department** | | | | |
| **Number of credit hours of the course** | **Credit Hours** | **Theoretical** | | **Self-Learning** | **SWL** |
| | | **Lectures** | **Tutorial** | | |
| | **3** | **2** | **2** | **5** | **9** |
| **Course Type** | **Elective Requirements (Institute Compulsory)** | | | | |
| **Academic level at which the course is taught** | **Level 400** | | | | |
| **Academic Program** | **– Communications & Computer Engineering** | | | | |
| **Institute** | **Misr Higher Institute of Engineering and Technology** | | | | |
| **University/Academy** | **Ministry of Higher Education and Scientific Research** | | | | |
| **Semester** | **Spring Semester** | | | | |
| **Prerequisite** | **BAS212 (Statistics and Probability Theory)<br>ELC221 (Object-Oriented Programming)** | | | | |
| **Name of Course Coordinator** | | | | | |
| **Course Specification Approval Date** | **18/8/2025<br>8/9/2025** | | | | |
| **Course Specification Approval** | **Communications and Electronics Engineering Department Council, Institute Council** | | | | |

## 2. Course Overview (Brief summary of scientific content)

Introduction to the experience and its relationship with the rules of information – Examples of expert systems – ways to show information – Methods of knowledge – Expert system architecture (knowledge bases – main working memory – dealing with the user – inference machine – explanation and detail) – rules – frames – inference systems – Expert Systems Project.

## 3. Course Learning Outcomes CLOs

| Program Outcomes (NARS/ARS) (according to the matrix in the program specs) | | Course Learning Outcomes Upon completion of the course, the student will be able to: | |
|---|---|---|---|
| Code | Text | Code | Text |
| A1 | Identify, formulate, and solve complex engineering problems by applying engineering fundamentals, basic science and mathematics | CLO1 | Apply discrete logic algorithms and production rule mathematics to transform human engineering experience into deterministic conditional statements. |
| B3 | Design and implement: elements, modules, sub-systems or systems in electrical/electronic/digital engineering using technological and professional tools | CLO2 | Identify and manage heuristics uncertainties, missing diagnostic facts, and conflicting rule boundaries by selecting appropriate certainty factors or fuzzy inference systems. |
| C1 | Design/ analyze/ measure the performance of a computer systems, Database systems, software systems, computer networks, and Microprocessors with identifying the software tools and mathematical methods required to optimize their performance | CLO3 | Configure internal working memory structures and maintain real-time user-interface interaction components within physical computer hardware caching boundaries. |
| C2 | Develop innovative solutions for practical industrial problems in Computer Engineering | CLO4 | Design and analyze specialized knowledge-based computer software layers utilizing frames and recursive inference mechanisms to solve automated troubleshooting problems. |
| C3 | Synthesize different computer systems, measure their performance and analyze the obtained results using mathematical models | CLO5 | Maintain high standards of engineering professionalism and logical code auditing parameters while organizing structural |

| | | | |
|---|---|---|---|
| | | | databases and rules within complex software engines. |
| C4 | Design and compare between the different specifications for computer-based systems, multimedia and computer graphics | CLO6 | Integrate developed rule-based software inference engines with targeted peripheral hardware components to deploy operational, production-ready expert systems. |

## 4. Teaching and Learning Methods

1. Face to face lectures\tutorials.
2. Blended Learning (Synchronous\Asynchronous sessions)
3. Active Learning (Interactive Discussions - Case studies -Brainstorming – Presentations)
4. Self-learning.

### Course Schedule

| Number of the Week | Scientific content of the course (Course Topics) | Total Weekly Hours | Expected number of the Learning Hours | | | |
|---|---|---|---|---|---|---|
| | | | Theoretical teaching (lectures/discussion groups/ .....) | | Training (Practical) | Self-learning (Tasks/ Assignments/ Projects) |
| | | | Lectures | Tutorial | | |
| 1 | Defining "Experience" and its relationship to information rules. | 4 | 2 | 0 | 2 | 5 |
| 2 | Historical Overview and Case Studies of Early Expert Systems. | 4 | 2 | 0 | 2 | 5 |
| 3 | Information Representation | 4 | 2 | 0 | 2 | 5 |
| 4 | Data vs. Knowledge. | 4 | 2 | 0 | 2 | 5 |
| 5 | Methods of Knowledge Acquisition and Elicitation. | 4 | 2 | 0 | 2 | 5 |
| 6 | Expert System Architecture: Overview of structural components. | 4 | 2 | 0 | 2 | 5 |
| 7 | The Knowledge Base: Storing domain-specific facts and heuristics. | 4 | 2 | 0 | 2 | 5 |
| 8 | Midterm + Revision | 4 | 2 | 0 | 2 | 5 |
| 9 | Main Working Memory and Session Context Management. | 4 | 2 | 0 | 2 | 5 |
| 10 | Designing the User Interface for Domain Experts and End-users. | 4 | 2 | 0 | 2 | 5 |

| | | | | | | |
|---|---|---|---|---|---|---|
| **11** | The Inference Engine: Forward and Backward Chaining. | **4** | **2** | **0** | **2** | **5** |
| **12** | Explanation Subsystems: Providing reasoning and detail to users. | **4** | **2** | **0** | **2** | **5** |
| **13** | Rule-Based Systems: IF-THEN logic and Conflict Resolution. | **4** | **2** | **0** | **2** | **5** |
| **14** | Structured Representation: Frames and Semantic Networks. | **4** | **2** | **0** | **2** | **5** |
| **15** | End-to-End Expert System Project: Implementation and Validation. | **4** | **2** | **0** | **2** | **5** |
| **16** | **Final Exam** | | | | | |

## 5. Methods of students' assessment

| No. | Assessment Methods | Assessment Timing (Week Number) | Marks/ Scores | Percentage of total course Marks |
|---|---|---|---|---|
| **1** | Assignments | Every 3 weeks | 5 | 5% |
| **2** | Quizzes | Every 2 weeks | 5 | 5% |
| **3** | Proctored exams: Midterm Exam | 8 | 20 | 20% |
| **4** | Practical/Oral Exam | 15 | 20 | 20% |
| **5** | Proctored exams: Final Exam | 16 | 50 | 50% |
| **6** | Formative assessment | 5 | 0 | 0% |

## 6. Learning Resources and Supportive Facilities *

| | | |
|---|---|---|
| **Learning resources (books, scientific references, etc.) *** | **The main (essential) reference for the course** (must be written in full according to the scientific documentation method) | • **Giarratano, J. C., & Riley, G. D. Expert Systems: Principles and Programming. 4th ed., Course Technology, 2005.** |
| | **Other References** | • Glasson, J., Therivel, R., & Chadwick, A. (2019). Introduction to environmental impact assessment (5th ed.). Routledge.<br>• |

| | | |
|---|---|---|
| | **Electronic Sources** (Links must be added) | Egyptian Knowledge Bank \| بنك المعرفة المصري https://www.ekb.eg/ar/home |
| | **Learning Platforms** (Links must be added) | • **www.els.engmet.edu.eg** Google Classroom(https://classroom.google.com) |
| | **Other** (to be mentioned) | • Instructor PowerPoint presentations |
| | | |
| **Supportive facilities & equipment for teaching and learning** * | **Devices/Instruments** | • - |
| | **Supplies** | • Whiteboard<br>• Presenter<br>• Data show system<br>• Sound System |
| | **Electronic Programs** | - |
| | **Skill Labs/ Simulators** | - |
| | **Virtual Labs** | - |
| | **Other** (to be mentioned) | - |

**Course Coordinator**

**Program Coordinator**

**Dr. Yasser El-Awady**

# Course Specifications

# Elective Course (9)- Advanced Programming II

# 2025\2026

## 1. Basic Information

| | | | | | |
|---|---|---|---|---|---|
| **Course Title** | **Elective Course (9)- Advanced Programming II** | | | | |
| **Course Code** | **ELC423** | | | | |
| **Department participating in delivery of the course** | **Communications and Electronics Engineering Department** | | | | |
| **Number of credit hours of the course** | **Credit Hours** | **Theoretical** | | **Self-Learning** | **SWL** |
| | | **Lectures** | **Practical** | | |
| | **3** | **2** | **2** | **4** | **8** |
| **Course Type** | **Elective Requirements (Institute Compulsory)** | | | | |
| **Academic level at which the course is taught** | **Level 400** | | | | |
| **Academic Program** | **– Communications & Computer Engineering** | | | | |
| **Institute** | **Misr Higher Institute of Engineering and Technology** | | | | |
| **University/Academy** | **Ministry of Higher Education and Scientific Research** | | | | |
| **Semester** | **Spring Semester** | | | | |
| **Prerequisite** | **ELC421 (Advanced Programming I)**<br><br>**ELC342 (Computer Networks)** | | | | |
| **Name of Course Coordinator** | | | | | |
| **Course Specification Approval Date** | **18/8/2025**<br><br>**8/9/2025** | | | | |
| **Course Specification Approval** | **Communications and Electronics Engineering Department Council, Institute Council** | | | | |

## 2. Course Overview (Brief summary of scientific content)

Programming techniques in networks - Network Programming (Protocols; IP, TCP, FTP) - Socket programming - Client/Server Programming. Securing network communications, multithreaded programming across networks - Mobile applications and networking. Languages for Internetworking programming and Data Transfer.

## 3. Course Learning Outcomes CLOs

| Program Outcomes (NARS/ARS) (according to the matrix in the program specs) | | Course Learning Outcomes Upon completion of the course, the student will be able to: | |
|---|---|---|---|
| Code | Text | Code | Text |
| A1 | Identify, formulate, and solve complex engineering problems by applying engineering fundamentals, basic science and mathematics | CLO1 | Apply mathematical models of network protocols and transport queues to calculate data throughput and latency parameters in distributed programs. |
| A3 | Application of engineering design to achieve cost-effective solutions that meet specific needs. Taking into account global, cultural, social, economic, environmental and ethical aspects. These applications are within the principles of sustainable design and development | CLO2 | Formulate secure network software solutions that adhere to standard computing ethics, user privacy acts, and modern network data encryption guidelines. |
| B3 | Design and implement: elements, modules, sub-systems or systems in electrical/electronic/digital engineering using technological and professional tools | CLO3 | Identify and manage network socket timeout uncertainties, packet drops, and race conditions by implementing thread synchronization mechanisms. |
| C1 | Design/ analyze/ measure the performance of a computer systems, Database systems, software systems, computer networks, and Microprocessors with identifying the software tools and mathematical methods required to optimize their performance | CLO4 | Configure low-level server sockets and maintain multi-tier computing architectures within physical system hardware memory and bandwidth allocations. |

| | | | |
|---|---|---|---|
| C2 | Develop innovative solutions for practical industrial problems in Computer Engineering | CLO5 | Design and analyze multithreaded client-server computer software implementations to solve complex high-concurrency data transfer problems. |
| C4 | Design and compare between the different specifications for computer-based systems, multimedia and computer graphics | CLO6 | Integrate mobile application software layers with external cloud API systems and physical network hardware components to implement stable mobile-based ecosystems. |

## 4. Teaching and Learning Methods

1. Face to face lectures\tutorials.
2. Blended Learning (Synchronous\Asynchronous sessions)
3. Active Learning (Interactive Discussions - Case studies -Brainstorming – Presentations)
4. Self-learning.

### Course Schedule

| Number of the Week | Scientific content of the course (Course Topics) | Total Weekly Hours | Expected number of the Learning Hours | | | |
|---|---|---|---|---|---|---|
| | | | Theoretical teaching (lectures/discussion groups/ .....) | | Training (Practical) | Self-learning (Tasks/ Assignments/ Projects) |
| | | | Lectures | Tutorial | | |
| 1 | Introduction to Advanced Network Programming Techniques. | 4 | 2 | 0 | 2 | 4 |
| 2 | Deep dive into Network Protocols: IP, TCP, and UDP. | 4 | 2 | 0 | 2 | 4 |
| 3-4 | Implementation of File Transfer Protocols (FTP) in code. | 8 | 4 | 0 | 4 | 8 |
| 5 | Fundamentals of Socket Programming (Berkeley Sockets). | 4 | 2 | 0 | 2 | 4 |
| 6 | Architecture and Design of Client/Server Applications. | 4 | 2 | 0 | 2 | 4 |
| 7 | Stateful vs. Stateless Connection Management. | 4 | 2 | 0 | 2 | 4 |
| 8 | Midterm + Revision | 4 | 2 | 0 | 2 | 4 |

| | | | | | | |
|---|---|---|---|---|---|---|
| 9 | Security Protocols for Protecting Network Communications (SSL/TLS). | 4 | 2 | 0 | 2 | 4 |
| 10 | Multithreaded Programming Models for Concurrent Network Tasks. | 4 | 2 | 0 | 2 | 4 |
| 11 | Synchronization and IPC in Distributed Systems. | 4 | 2 | 0 | 2 | 4 |
| 12 | Mobile Application Development and Networking Requirements. | 4 | 2 | 0 | 2 | 4 |
| 13 | Inter-process Communication across Heterogeneous Networks. | 4 | 2 | 0 | 2 | 4 |
| 14 | Modern Languages for Internetworking (e.g., Python, Java, Go). | 4 | 2 | 0 | 2 | 4 |
| 15 | Data Transfer Formats and Serialization (JSON, XML, Protobuf). | 4 | 2 | 0 | 2 | 4 |
| 16 | **Final Exam** | | | | | |

## 5. Methods of students' assessment

| No. | Assessment Methods | Assessment Timing (Week Number) | Marks/ Scores | Percentage of total course Marks |
|---|---|---|---|---|
| 1 | Assignments | Every 3 weeks | 5 | 5% |
| 2 | Quizzes | Every 2 weeks | 5 | 5% |
| 3 | Proctored exams: Midterm Exam | 8 | 20 | 20% |
| 4 | Practical/Oral Exam | 15 | 20 | 20% |
| 5 | Proctored exams: Final Exam | 16 | 50 | 50% |
| 6 | Formative assessment | 5 | 0 | 0% |

## 6. Learning Resources and Supportive Facilities *

| | | |
|---|---|---|
| Learning resources | The main (essential) reference for the course | • Stevens, W. R., Fenner, B., & Rudoff, A. M. UNIX Network Programming: The Sockets Networking API. 3rd ed., Addison-Wesley, 2003. |

| | | |
|---|---|---|
| **(books, scientific references, etc.) *** | **(must be written in full according to the scientific documentation method)** | |
| | **Other References** | • |
| | **Electronic Sources** (Links must be added) | Egyptian Knowledge Bank \| بنك المعرفة المصري https://www.ekb.eg/ar/home |
| | **Learning Platforms** (Links must be added) | • **www.els.engmet.edu.eg** Google Classroom(https://classroom.google.com) |
| | **Other** (to be mentioned) | • Instructor PowerPoint presentations |
| | | |
| **Supportive facilities & equipment for teaching and learning *** | **Devices/Instruments** | • - |
| | **Supplies** | • Whiteboard • Presenter • Data show system • Sound System |
| | **Electronic Programs** | - |
| | **Skill Labs/ Simulators** | - |
| | **Virtual Labs** | - |
| | **Other** (to be mentioned) | - |

**Course Coordinator**

**Program Coordinator**

**Dr. Yasser El-Awady**

Yasser Alawady

# Course Specifications

# Elective Course (9) - Information Security

# 2025\2026

## 1. Basic Information

| | | | | | |
|---|---|---|---|---|---|
| **Course Title** | **Elective Course (9) - Information Security** | | | | |
| **Course Code** | **ELC424** | | | | |
| **Department participating in delivery of the course** | **Communications and Electronics Engineering Department** | | | | |
| **Number of credit hours of the course** | **Credit Hours** | **Theoretical** | | **Self-Learning** | **SWL** |
| | | **Lectures** | **Practical** | | |
| | **3** | **2** | **2** | **4** | **8** |
| **Course Type** | **Elective Requirements (Institute Compulsory)** | | | | |
| **Academic level at which the course is taught** | **Level 400** | | | | |
| **Academic Program** | **– Communications & Computer Engineering** | | | | |
| **Institute** | **Misr Higher Institute of Engineering and Technology** | | | | |
| **University/Academy** | **Ministry of Higher Education and Scientific Research** | | | | |
| **Semester** | **Spring Semester** | | | | |
| **Prerequisite** | **ELC421 (Advanced Programming I)**<br><br>**ELC342 (Computer Networks)** | | | | |
| **Name of Course Coordinator** | | | | | |
| **Course Specification Approval Date** | **18/8/2025**<br><br>**8/9/2025** | | | | |
| **Course Specification Approval** | **Communications and Electronics Engineering Department Council, Institute Council** | | | | |

## 2. Course Overview (Brief summary of scientific content)

Introduction to Information Security - Principles of data security – hardware and software security techniques – Threats and Attack Modes - Cryptographic Models - software protection – computer viruses – worms – Trojans – Spy wares – networks security and firewalls – database administration security – Access control: Authentication (Password – Biometrics) – Authorization Protocols (simple authentication protocols – real world security protocols).

Methodologies and technologies for assurance and vulnerability analysis and intrusion detection.

## 3. Course Learning Outcomes CLOs

| Program Outcomes (NARS/ARS) (according to the matrix in the program specs) | | Course Learning Outcomes Upon completion of the course, the student will be able to: | |
|---|---|---|---|
| Code | Text | Code | Text |
| A1 | Identify, formulate, and solve complex engineering problems by applying engineering fundamentals, basic science and mathematics | CLO1 | Apply mathematical cryptographic formulas and discrete modular arithmetic to implement secure symmetric and asymmetric data encryption algorithms. |
| A3 | Application of engineering design to achieve cost-effective solutions that meet specific needs. Taking into account global, cultural, social, economic, environmental and ethical aspects. These applications are within the principles of sustainable design and development | CLO2 | Formulate system deployment guidelines that satisfy professional engineering ethics, global data privacy compliance acts, and digital security standards. |
| B3 | Design and implement: elements, modules, sub-systems or systems in electrical/electronic/digital engineering using technological and professional tools | CLO3 | Identify and manage system vulnerability uncertainties and software exploit hazards by selecting appropriate intrusion detection tools and patch deployment methodologies. |
| C1 | Design/ analyze/ measure the performance of a computer systems, Database systems, software systems, computer networks, and Microprocessors with identifying the software tools and mathematical methods required to optimize their performance | CLO4 | Configure hardware-based firewalls and maintain access control authentication servers within strict enterprise computing resource limitations. |

| | | | |
|---|---|---|---|
| C2 | Develop innovative solutions for practical industrial problems in Computer Engineering | CLO5 | Design and analyze specialized software code verification workflows to identify structural vulnerabilities and prevent malicious code injections within computer-based problems. |
| C4 | Design and compare between the different specifications for computer-based systems, multimedia and computer graphics | CLO6 | Integrate secure authorization protocol software layers with physical biometric readers and identity checking hardware modules to implement resilient defensive computer systems. |

## 4. Teaching and Learning Methods

1. Face to face lectures\tutorials.
2. Blended Learning (Synchronous\Asynchronous sessions)
3. Active Learning (Interactive Discussions - Case studies -Brainstorming – Presentations)
4. Self-learning.

### Course Schedule

| Number of the Week | Scientific content of the course (Course Topics) | Total Weekly Hours | Expected number of the Learning Hours | | | |
|---|---|---|---|---|---|---|
| | | | Theoretical teaching (lectures/discussion groups/ .....) | | Training (Practical) | Self-learning (Tasks/ Assignments/ Projects) |
| | | | Lectures | Tutorial | | |
| 1 | Introduction to Information Security and Core Principles of Data Security (Confidentiality, Integrity, Availability). | 4 | 2 | 0 | 2 | 4 |
| 2 | Comparison of Hardware and Software Security Engineering Techniques. | 4 | 2 | 0 | 2 | 4 |
| 3 | Classification of Security Threats, Vulnerabilities, and Attack Modes. | 4 | 2 | 0 | 2 | 4 |
| 4 | Cryptographic Models: Symmetric and Asymmetric Encryption Standards. | 4 | 2 | 0 | 2 | 4 |
| 5 | Software Protection Mechanisms and Reverse Engineering Prevention. | 4 | 2 | 0 | 2 | 4 |

| | | | | | | |
|---|---|---|---|---|---|---|
| 6-7 | Malware Analysis and Characteristics: Viruses, Worms, Trojans, and Spyware. | 8 | 4 | 0 | 4 | 8 |
| 8 | Midterm + Revision | 4 | 2 | 0 | 2 | 4 |
| 9 | Network Perimeter Defense: Architecture and Implementation of Firewalls. | 4 | 2 | 0 | 2 | 4 |
| 10 | Database Administration Security and Secure Storage Paradigms. | 4 | 2 | 0 | 2 | 4 |
| 11 | Access Control Frameworks: Multi-Factor Authentication (Passwords, Biometrics). | 4 | 2 | 0 | 2 | 4 |
| 12 | Authorization Mechanisms and Simple Authentication Protocols. | 4 | 2 | 0 | 2 | 4 |
| 13 | Implementation of Real-World Enterprise Security Protocols (e.g., Kerberos, SSL/TLS). | 4 | 2 | 0 | 2 | 4 |
| 14 | Methodologies for System Assurance, Code Auditing, and Vulnerability Analysis. | 4 | 2 | 0 | 2 | 4 |
| 15 | Deployment and Tuning of Intrusion Detection and Prevention Systems (IDS/IPS). | 4 | 2 | 0 | 2 | 4 |
| 16 | **Final Exam** | | | | | |

## 5. Methods of students' assessment

| No. | Assessment Methods | Assessment Timing (Week Number) | Marks/ Scores | Percentage of total course Marks |
|---|---|---|---|---|
| 1 | Assignments | Every 3 weeks | 5 | 5% |
| 2 | Quizzes | Every 2 weeks | 5 | 5% |
| 3 | Proctored exams: Midterm Exam | 8 | 20 | 20% |
| 4 | Practical/Oral Exam | 15 | 20 | 20% |
| 5 | Proctored exams: Final Exam | 16 | 50 | 50% |
| | Formative assessment | 5 | 0 | 0% |

## 6. Learning Resources and Supportive Facilities *

| | | |
|---|---|---|
| **Learning resources (books, scientific references, etc.) *** | **The main (essential) reference for the course** (must be written in full according to the scientific documentation method) | • **Stallings, W. Cryptography and Network Security: Principles and Practice. 8th ed., Pearson, 2023.** |
| | **Other References** | • |
| | **Electronic Sources** (Links must be added) | Egyptian Knowledge Bank \| بنك المعرفة المصري https://www.ekb.eg/ar/home |
| | **Learning Platforms** (Links must be added) | • **www.els.engmet.edu.eg** Google Classroom(https://classroom.google.com) |
| | **Other** (to be mentioned) | • Instructor PowerPoint presentations |
| | | |
| **Supportive facilities & equipment for teaching and learning *** | **Devices/Instruments** | • - |
| | **Supplies** | • Whiteboard<br>• Presenter<br>• Data show system<br>• Sound System |
| | **Electronic Programs** | - |
| | **Skill Labs/ Simulators** | - |
| | **Virtual Labs** | - |
| | **Other** (to be mentioned) | - |

**Course Coordinator**

**Program Coordinator**

**Dr. Yasser El-Awady**

Yasser Alawady

# Course Specifications

# Elective Course (9) - Distributed and Mobile Computing

# 2025\2026

## 1. Basic Information

| | | | | | |
|---|---|---|---|---|---|
| **Course Title** | **Elective Course (9) - Distributed and Mobile Computing** | | | | |
| **Course Code** | **ELC425** | | | | |
| **Department participating in delivery of the course** | **Communications and Electronics Engineering Department** | | | | |
| **Number of credit hours of the course** | **Credit Hours** | **Theoretical** | | **Self-Learning** | **SWL** |
| | | **Lectures** | **Practical** | | |
| | **3** | **2** | **2** | **4** | **8** |
| **Course Type** | **Elective Requirements (Institute Compulsory)** | | | | |
| **Academic level at which the course is taught** | **Level 400** | | | | |
| **Academic Program** | **– Communications & Computer Engineering** | | | | |
| **Institute** | **Misr Higher Institute of Engineering and Technology** | | | | |
| **University/Academy** | **Ministry of Higher Education and Scientific Research** | | | | |
| **Semester** | **Spring Semester** | | | | |
| **Prerequisite** | **ELC421 (Advanced Programming I)**<br>**ELC342 (Computer Networks)** | | | | |
| **Name of Course Coordinator** | | | | | |
| **Course Specification Approval Date** | **18/8/2025**<br>**8/9/2025** | | | | |
| **Course Specification Approval** | **Communications and Electronics Engineering Department Council, Institute Council** | | | | |

## 2. Course Overview (Brief summary of scientific content)

Mobile internet-mobile network layer-mobile IP-dynamic host configuration protocol mobile transport layer-implications of TCP on mobility-indirect TCP-snooping TCP mobile TCP transmission-selective retransmission, Transaction oriented TCP- Support for mobility-file systems WAP. Mobile Transport Layer, Other Transport Layer Protocols for Mobile

Networks. Protocols and Platforms for Mobile Computing - WAP, Bluetooth, XML, J2ME, JavaCard, PalmOS, Linux for Mobile Devices, Android. Basics of back-end programming through practical exercises via Spring framework - SpringBoot and the front development via Android. Mobile applications development - Native and hybrid technologies (iOs, Android, Titanium).

## 3. Course Learning Outcomes CLOs

| Program Outcomes (NARS/ARS) (according to the matrix in the program specs) | | Course Learning Outcomes Upon completion of the course, the student will be able to: | |
|---|---|---|---|
| Code | Text | Code | Text |
| A1 | Identify, formulate, and solve complex engineering problems by applying engineering fundamentals, basic science and mathematics | CLO1 | Apply mathematical queueing models and distributed network protocol parameters to calculate data synchronization latency across wireless channels. |
| A3 | Application of engineering design to achieve cost-effective solutions that meet specific needs. Taking into account global, cultural, social, economic, environmental and ethical aspects. These applications are within the principles of sustainable design and development | CLO2 | Formulate distributed mobile applications that comply with global user privacy standards, computing ethics, and environmental network sustainability frameworks. |
| B3 | Design and implement: elements, modules, sub-systems or systems in electrical/electronic/digital engineering using technological and professional tools | CLO3 | Identify and manage network packet-drop uncertainties, handoff latency drops, and high bit-error rates by selecting appropriate transport layer protocol variants (I-TCP/Snooping TCP). |
| C1 | Design/ analyze/ measure the performance of a computer systems, Database systems, software systems, computer networks, and Microprocessors with identifying the software tools | CLO4 | Configure local Android system environments and maintain back-end cloud server instances within physical hardware storage and bandwidth allocation limitations. |

| | | | |
|---|---|---|---|
| | and mathematical methods required to optimize their performance | | |
| C2 | Develop innovative solutions for practical industrial problems in Computer Engineering | CLO5 | Design and analyze specialized back-end software using Spring Boot alongside native/hybrid mobile application code to solve complex, real-time computer-based problems. |
| C4 | Design and compare between the different specifications for computer-based systems, multimedia and computer graphics | CLO6 | Integrate dynamic mobile client applications with Spring-based back-end server microservices and physical network routing hardware components to deploy stable, operational distributed computer systems. |

## 4. Teaching and Learning Methods

1. Face to face lectures\tutorials.
2. Blended Learning (Synchronous\Asynchronous sessions)
3. Active Learning (Interactive Discussions - Case studies -Brainstorming – Presentations)
4. Self-learning.

### Course Schedule

| Number of the Week | Scientific content of the course (Course Topics) | Total Weekly Hours | Expected number of the Learning Hours | | | |
|---|---|---|---|---|---|---|
| | | | Theoretical teaching (lectures/discussion groups/ .....) | | Training (Practical) | Self-learning (Tasks/ Assignments/ Projects) |
| | | | Lectures | Tutorial | | |
| 1 | Introduction to Mobile Internet and Mobile Network Layer Architectures. | 4 | 2 | 0 | 2 | 4 |
| 2 | Deep dive into Mobile IP and Dynamic Host Configuration Protocol (DHCP). | 4 | 2 | 0 | 2 | 4 |
| 3 | Mobile Transport Layer: Analysis of TCP implications on mobility. | 4 | 2 | 0 | 2 | 4 |
| 4 | Specialized TCP Variants: Indirect TCP, Snooping TCP, and Mobile TCP. | 4 | 2 | 0 | 2 | 4 |

| | | | | | | |
|---|---|---|---|---|---|---|
| **5-6** | Transmission Optimization: Selective Retransmission and Transaction-oriented TCP. | **8** | **4** | **0** | **4** | **8** |
| **7** | Support for Mobility in Distributed File Systems and WAP. | **4** | **2** | **0** | **2** | **4** |
| **8** | Midterm + Reivison | **4** | **2** | **0** | **2** | **4** |
| **9** | Emerging Transport Layer Protocols for Advanced Mobile Networks. | **4** | **2** | **0** | **2** | **4** |
| **10** | Protocols and Platforms: Bluetooth, XML, and J2ME Frameworks. | **4** | **2** | **0** | **2** | **4** |
| **11** | Mobile Operating Systems Analysis: PalmOS, Linux, and Android. | **4** | **2** | **0** | **2** | **4** |
| **12** | Backend Programming Fundamentals using the Spring Framework and SpringBoot. | **4** | **2** | **0** | **2** | **4** |
| **13** | Frontend Mobile Development: Android SDK and UI Design. | **4** | **2** | **0** | **2** | **4** |
| **14** | Native vs. Hybrid Mobile Technologies: iOS, Android, and Titanium. | **4** | **2** | **0** | **2** | **4** |
| **15** | End-to-End Distributed Application Development Project. | **4** | **2** | **0** | **2** | **4** |
| **16** | **Final Exam** | | | | | |

## 5. Methods of students' assessment

| No. | Assessment Methods | Assessment Timing (Week Number) | Marks/ Scores | Percentage of total course Marks |
|---|---|---|---|---|
| **1** | Assignments | Every 3 weeks | 5 | 5% |
| **2** | Quizzes | Every 2 weeks | 5 | 5% |
| **3** | Proctored exams: Midterm Exam | 8 | 20 | 20% |
| **4** | Practical/Oral Exam | 15 | 20 | 20% |
| **5** | Proctored exams: Final Exam | 16 | 50 | 50% |
| | Formative assessment | 5 | 0 | 0% |

## 6. Learning Resources and Supportive Facilities *

| | | |
|---|---|---|
| **Learning resources (books, scientific references, etc.) *** | **The main (essential) reference for the course** (must be written in full according to the scientific documentation method) | • Coulouris, G., Dollimore, J., Kindberg, T., & Blair, G. Distributed Systems: Concepts and Design. 5th ed., Pearson, 2012. |
| | **Other References** | • |
| | **Electronic Sources** (Links must be added) | Egyptian Knowledge Bank \| بنك المعرفة المصري https://www.ekb.eg/ar/home |
| | **Learning Platforms** (Links must be added) | • www.els.engmet.edu.eg Google Classroom(https://classroom.google.com) |
| | **Other** (to be mentioned) | • Instructor PowerPoint presentations |
| | | |
| **Supportive facilities & equipment for teaching and learning *** | **Devices/Instruments** | • - |
| | **Supplies** | • Whiteboard • Presenter • Data show system • Sound System |
| | **Electronic Programs** | - |
| | **Skill Labs/ Simulators** | - |
| | **Virtual Labs** | - |
| | **Other** (to be mentioned) | - |

**Course Coordinator**

**Program Coordinator**

**Dr. Yasser El-Awady**

Yasser Alawady

# Course Specifications

# Elective Course (9) - Databases II

# 2025\2026

## 1. Basic Information

| | | | | | |
|---|---|---|---|---|---|
| **Course Title** | **Elective Course (9) - Databases II** | | | | |
| **Course Code** | **ELC426** | | | | |
| **Department participating in delivery of the course** | **Communications and Electronics Engineering Department** | | | | |
| **Number of credit hours of the course** | **Credit Hours** | **Theoretical** | | **Self-Learning** | **SWL** |
| | | **Lectures** | **Practical** | | |
| | **3** | **2** | **2** | **4** | **8** |
| **Course Type** | **Elective Requirements (Institute Compulsory)** | | | | |
| **Academic level at which the course is taught** | **Level 400** | | | | |
| **Academic Program** | **– Communications & Computer Engineering** | | | | |
| **Institute** | **Misr Higher Institute of Engineering and Technology** | | | | |
| **University/Academy** | **Ministry of Higher Education and Scientific Research** | | | | |
| **Semester** | **Spring Semester** | | | | |
| **Prerequisite** | **ELC421 (Advanced Programming I)<br>ELC342 (Computer Networks)** | | | | |
| **Name of Course Coordinator** | | | | | |
| **Course Specification Approval Date** | **18/8/2025<br>8/9/2025** | | | | |
| **Course Specification Approval** | **Communications and Electronics Engineering Department Council, Institute Council** | | | | |

## 2. Course Overview (Brief summary of scientific content)

Review of Database Query and Data Manipulation Languages - examples of relational, hierarchical and network database designs - distributed databases - multicopy databases – Temporal Database - database administration: security, concurrence control and performance monitoring - data compression - sizing and timing.

## 3. Course Learning Outcomes CLOs

| Program Outcomes (NARS/ARS) (according to the matrix in the program specs) | | Course Learning Outcomes Upon completion of the course, the student will be able to: | |
|---|---|---|---|
| Code | Text | Code | Text |
| A1 | Identify, formulate, and solve complex engineering problems by applying engineering fundamentals, basic science and mathematics | CLO1 | Apply relational algebra and mathematical optimization calculus to compute query efficiency, database capacity sizing, and transaction processing times. |
| A3 | Application of engineering design to achieve cost-effective solutions that meet specific needs. Taking into account global, cultural, social, economic, environmental and ethical aspects. These applications are within the principles of sustainable design and development | CLO2 | Formulate administrative data storage layouts that explicitly comply with global user data privacy standards, professional computing ethics, and environmental server efficiency guidelines. |
| B3 | Design and implement: elements, modules, sub-systems or systems in electrical/electronic/digital engineering using technological and professional tools | CLO3 | Identify and manage replication lag uncertainties, concurrency write-conflicts, and synchronization delays by choosing appropriate multi-copy database consistency protocols. |
| C1 | Design/ analyze/ measure the performance of a computer systems, Database systems, software systems, computer networks, and Microprocessors with identifying the software tools and mathematical methods required to optimize their performance | CLO4 | Configure enterprise-level distributed database engines and maintain storage allocation paths within standard computer hardware and system memory boundaries. |

| | | | |
|---|---|---|---|
| C2 | Develop innovative solutions for practical industrial problems in Computer Engineering | CLO5 | Design and analyze specialized computer software schemas utilizing temporal data models and complex query optimization scripts to solve data manipulation problems. |
| C4 | Design and compare between the different specifications for computer-based systems, multimedia and computer graphics | CLO6 | Integrate distributed database software clusters with cloud networks and server hardware nodes to implement highly scalable, functional data infrastructure systems. |

## 4. Teaching and Learning Methods

1. Face to face lectures\tutorials.
2. Blended Learning (Synchronous\Asynchronous sessions)
3. Active Learning (Interactive Discussions - Case studies -Brainstorming – Presentations)
4. Self-learning.

### Course Schedule

| Number of the Week | Scientific content of the course (Course Topics) | Total Weekly Hours | Expected number of the Learning Hours | | | |
|---|---|---|---|---|---|---|
| | | | Theoretical teaching (lectures/discussion groups/ .....) | | Training (Practical) | Self-learning (Tasks/ Assignments/ Projects) |
| | | | Lectures | Tutorial | | |
| 1-2 | Advanced Review of SQL: Complex Queries and Data Manipulation Languages (DML). | 8 | 4 | 0 | 4 | 8 |
| 3 | Comparative Analysis of Relational, Hierarchical, and Network Database Models. | 4 | 2 | 0 | 2 | 4 |
| 4 | Architecture and Design of Distributed Database Systems. | 4 | 2 | 0 | 2 | 4 |
| 5 | Data Replication Strategies and Multicopy Database Management. | 4 | 2 | 0 | 2 | 4 |

| | | | | | | |
|---|---|---|---|---|---|---|
| **6** | Introduction to Temporal Databases: Managing Time-Variant Data. | **4** | **2** | **0** | **2** | **4** |
| **7** | Principles of Database Administration (DBA) and Governance. | **4** | **2** | **0** | **2** | **4** |
| **8** | Midterm + Revision | **4** | **2** | **0** | **2** | **4** |
| **9** | Database Security: Implementing Access Control and Encryption. | **4** | **2** | **0** | **2** | **4** |
| **10** | Concurrency Control Mechanisms: Locking and Timestamping. | **4** | **2** | **0** | **2** | **4** |
| **11** | Performance Monitoring and Query Optimization Techniques. | **4** | **2** | **0** | **2** | **4** |
| **12** | Data Compression Algorithms for Efficient Storage Management. | **4** | **2** | **0** | **2** | **4** |
| **13** | Database Sizing: Capacity Planning and Storage Estimation. | **4** | **2** | **0** | **2** | **4** |
| **14** | Timing Analysis: Response Time and Throughput Optimization. | **4** | **2** | **0** | **2** | **4** |
| **15** | Practical Implementation of a Distributed Database Project. | **4** | **2** | **0** | **2** | **4** |
| **16** | **Final Exam** | | | | | |

## 5. Methods of students' assessment

| No. | Assessment Methods | Assessment Timing (Week Number) | Marks/ Scores | Percentage of total course Marks |
|---|---|---|---|---|
| **1** | Assignments | Every 3 weeks | 5 | 5% |
| **2** | Quizzes | Every 2 weeks | 5 | 5% |
| **3** | Proctored exams: Midterm Exam | 8 | 20 | 20% |
| **4** | Practical/Oral Exam | 15 | 20 | 20% |
| **5** | Proctored exams: Final Exam | 16 | 50 | 50% |
| **6** | Formative assessment | 5 | 0 | 0% |

## 6. Learning Resources and Supportive Facilities *

| | | |
|---|---|---|
| **Learning resources (books, scientific references, etc.) *** | **The main (essential) reference for the course** (must be written in full according to the scientific documentation method) | • **Özsu, M. T., & Valduriez, P. Principles of Distributed Database Systems. 4th ed., Springer, 2020.** |
| | **Other References** | • |
| | **Electronic Sources** (Links must be added) | Egyptian Knowledge Bank \| بنك المعرفة المصري https://www.ekb.eg/ar/home |
| | **Learning Platforms** (Links must be added) | • **www.els.engmet.edu.eg** Google Classroom(https://classroom.google.com) |
| | **Other** (to be mentioned) | • Instructor PowerPoint presentations |
| | | |
| **Supportive facilities & equipment for teaching and learning *** | **Devices/Instruments** | • - |
| | **Supplies** | • Whiteboard<br>• Presenter<br>• Data show system<br>• Sound System |
| | **Electronic Programs** | - |
| | **Skill Labs/ Simulators** | - |
| | **Virtual Labs** | - |
| | **Other** (to be mentioned) | - |

**Course Coordinator**

**Program Coordinator**

**Dr. Yasser El-Awady**

Yasser Alawady

# Course Specifications

# Elective Course (9) - Bioinformatics

# 2025\2026

## 1. Basic Information

| | | | | | |
|---|---|---|---|---|---|
| **Course Title** | **Elective Course (9) - Bioinformatics** | | | | |
| **Course Code** | **ELC427** | | | | |
| **Department participating in delivery of the course** | **Communications and Electronics Engineering Department** | | | | |
| **Number of credit hours of the course** | **Credit Hours** | **Theoretical** | | **Self-Learning** | **SWL** |
| | | **Lectures** | **Practical** | | |
| | **3** | **2** | **2** | **4** | **8** |
| **Course Type** | **Elective Requirements (Institute Compulsory)** | | | | |
| **Academic level at which the course is taught** | **Level 400** | | | | |
| **Academic Program** | **– Communications & Computer Engineering** | | | | |
| **Institute** | **Misr Higher Institute of Engineering and Technology** | | | | |
| **University/Academy** | **Ministry of Higher Education and Scientific Research** | | | | |
| **Semester** | **Spring Semester** | | | | |
| **Prerequisite** | **ELC421 (Advanced Programming I)<br>ELC342 (Computer Networks)** | | | | |
| **Name of Course Coordinator** | | | | | |
| **Course Specification Approval Date** | **18/8/2025<br>8/9/2025** | | | | |
| **Course Specification Approval** | **Communications and Electronics Engineering Department Council, Institute Council** | | | | |

## 2. Course Overview (Brief summary of scientific content)

This course teaches the bioinformatics skills used in academic, biotech, and pharmaceutical laboratories for analyzing individual DNA and protein sequences. The focus is extensive hands-on experience using mainstream web-based bioinformatics tools. Students learn how to evaluate data sources and choose the correct paths to solutions. Throughout the semester, interesting biological questions are addressed by analyzing sequences, searching databases, using sophisticated software, and interpreting results. This is not a programming course.

## 3. Course Learning Outcomes CLOs

| Program Outcomes (NARS/ARS) (according to the matrix in the program specs) | | Course Learning Outcomes Upon completion of the course, the student will be able to: | |
|---|---|---|---|
| Code | Text | Code | Text |
| A1 | Identify, formulate, and solve complex engineering problems by applying engineering fundamentals, basic science and mathematics | CLO1 | Apply statistical score metrics and matrix scoring mechanics to analyze structural alignment results between unknown DNA and protein sequences. |
| A3 | Application of engineering design to achieve cost-effective solutions that meet specific needs. Taking into account global, cultural, social, economic, environmental and ethical aspects. These applications are within the principles of sustainable design and development | CLO2 | Formulate bioinformatic data-handling procedures that strictly conform to global bio-ethics laws, genomic data privacy standards, and medical compliance guidelines. |
| B3 | Design and implement: elements, modules, sub-systems or systems in electrical/electronic/digital engineering using technological and professional tools | CLO3 | Identify and manage data source impurities, sequencing error noises, and heuristic search tool uncertainties by cross-validating results across multiple web-based databases. |
| C1 | Design/ analyze/ measure the performance of a computer systems, Database systems, software systems, computer networks, and Microprocessors with identifying the software tools and mathematical methods required to optimize their performance | CLO4 | Configure local workspace data buffers and maintain web-based sequence fetching queries within standard computer hardware and network throughput limitations. |
| C2 | Develop innovative solutions for practical industrial problems in Computer Engineering | CLO5 | Design and analyze specialized diagnostic workflows utilizing sophisticated bioinformatics |

| | | | |
|---|---|---|---|
| | | | software packages to solve sequence mapping computer-based problems. |
| C4 | Design and compare between the different specifications for computer-based systems, multimedia and computer graphics | CLO6 | Integrate biological database software platforms with data visualization hardware layers to implement comprehensive, reliable analytical reporting systems. |

## 4. Teaching and Learning Methods

1. Face to face lectures\tutorials.
2. Blended Learning (Synchronous\Asynchronous sessions)
3. Active Learning (Interactive Discussions - Case studies -Brainstorming – Presentations)
4. Self-learning.

### Course Schedule

| Number of the Week | Scientific content of the course (Course Topics) | Total Weekly Hours | Expected number of the Learning Hours | | | |
|---|---|---|---|---|---|---|
| | | | Theoretical teaching (lectures/discussion groups/ .....) | | Training (Practical) | Self-learning (Tasks/ Assignments/ Projects) |
| | | | Lectures | Tutorial | | |
| 1 | Introduction to Bioinformatics in Biotech and Pharmaceutical Industries. | 4 | 2 | 0 | 2 | 4 |
| 2 | Fundamentals of DNA and Protein Sequence Structures. | 4 | 2 | 0 | 2 | 4 |
| 3 | Navigation and Evaluation of Global Biological Data Sources. | 4 | 2 | 0 | 2 | 4 |
| 4 | Principles of Sequence Alignment and Similarity Searching. | 4 | 2 | 0 | 2 | 4 |
| 5 | Database Searching Techniques | 4 | 2 | 0 | 2 | 4 |
| 6 | Using tools like BLAST in database searching techniques | 4 | 2 | 0 | 2 | 4 |
| 7 | Mainstream Web-based Bioinformatics Tool Suites. | 4 | 2 | 0 | 2 | 4 |
| 8 | Midterm + Revision | 4 | 2 | 0 | 2 | 4 |
| 9 | Analysis of Individual Genetic Sequences for Biological Patterns. | 4 | 2 | 0 | 2 | 4 |

| | | | | | | |
|---|---|---|---|---|---|---|
| **10** | Protein Structure Prediction and Functional Annotation. | **4** | **2** | **0** | **2** | **4** |
| **11** | Comparative Genomics and Evolutionary Analysis. | **4** | **2** | **0** | **2** | **4** |
| **12** | Sophisticated Software for Biological Data Interpretation. | **4** | **2** | **0** | **2** | **4** |
| **13** | Evaluating Quantitative Path Solutions for Biological Questions. | **4** | **2** | **0** | **2** | **4** |
| **14** | Computational Analysis of Pharmaceutical Sequence Data. | **4** | **2** | **0** | **2** | **4** |
| **15** | Interpretation of Results and Scientific Reporting in Bioinformatics. | **4** | **2** | **0** | **2** | **4** |
| **16** | **Final Exam** | | | | | |

## 5. Methods of students' assessment

| No. | Assessment Methods | Assessment Timing (Week Number) | Marks/ Scores | Percentage of total course Marks |
|---|---|---|---|---|
| **1** | Assignments | Every 3 weeks | 5 | 5% |
| **2** | Quizzes | Every 2 weeks | 5 | 5% |
| **3** | Proctored exams: Midterm Exam | 8 | 20 | 20% |
| **4** | Practical/Oral Exam | 15 | 20 | 20% |
| **5** | Proctored exams: Final Exam | 16 | 50 | 50% |
| **6** | Formative assessment | 5 | 0 | 0% |

## 6. Learning Resources and Supportive Facilities *

| | | |
|---|---|---|
| **Learning resources (books, scientific references, etc.) *** | **The main (essential) reference for the course** (must be written in full according to the scientific documentation method) | • ioinformatics: Sequence and Genome Analysis. 2nd ed., Cold Spring Harbor Laboratory Press, 2004. |
| | **Other References** | • **Baxevanis, A. D., Bader, G. D., & Wishart, D. S. (Eds.). (2020). *Bioinformatics: A practical guide to the analysis of genes and proteins* (4th ed.). Wiley.** |

| | | |
|---|---|---|
| | **Electronic Sources** (Links must be added) | Egyptian Knowledge Bank \| بنك المعرفة المصري https://www.ekb.eg/ar/home |
| | **Learning Platforms** (Links must be added) | • **www.els.engmet.edu.eg** Google Classroom(https://classroom.google.com) |
| | **Other** (to be mentioned) | • Instructor PowerPoint presentations |
| | | |
| **Supportive facilities & equipment for teaching and learning** * | **Devices/Instruments** | • - |
| | **Supplies** | • Whiteboard<br>• Presenter<br>• Data show system<br>• Sound System |
| | **Electronic Programs** | - |
| | **Skill Labs/ Simulators** | - |
| | **Virtual Labs** | - |
| | **Other** (to be mentioned) | - |

**Course Coordinator**

**Program Coordinator**

**Dr. Yasser El-Awady**

# Course Specifications

# Project (2)

# 2025\2026

## 1. Basic Information

| | | | | | |
|---|---|---|---|---|---|
| **Course Title** | **Project (2)** | | | | |
| **Course Code** | **ELC482** | | | | |
| **Department participating in delivery of the course** | **Communications and Electronics Engineering Department** | | | | |
| **Number of credit hours of the course** | **Credit Hours** | **Theoretical** | | **Self-Learning** | **SWL** |
| | **4** | **Lectures** | **Practical** | **10** | **17** |
| | | **1** | **6** | | |
| **Course Type** | **Minor Requirements (Compulsory)** | | | | |
| **Academic level at which the course is taught** | **Level 400** | | | | |
| **Academic Program** | **– Communications & Computer Engineering** | | | | |
| **Institute** | **Misr Higher Institute of Engineering and Technology** | | | | |
| **University/Academy** | **Ministry of Higher Education and Scientific Research** | | | | |
| **Semester** | **Spring Semester** | | | | |
| **Prerequisite** | **ELC481 - Project (1)** | | | | |
| **Name of Course Coordinator** | | | | | |
| **Course Specification Approval Date** | **18/8/2025**<br>**8/9/2025** | | | | |
| **Course Specification Approval** | **Communications and Electronics Engineering Department Council, Institute Council** | | | | |

## 2. Course Overview (Brief summary of scientific content)

The aim of Project 2 is to conduct detailed design and verification based on the preliminary system design specifications reached in Project 1. Once the design and verification is complete this should be followed by prototype implementation and testing. The outcome of Project 2 is a complete design – fully verified using standard verification tools and presented in the form of professional design documents and design drawings accompanied with bill of materials. At

the end of Project 2 – students are asked to submit a dissertation or project report and go through an oral examination after delivering a presentation of their work.

## 3. Course Learning Outcomes CLOs

| Program Outcomes (NARS/ARS) (according to the matrix in the program specs) | | Course Learning Outcomes Upon completion of the course, the student will be able to: | |
|---|---|---|---|
| Code | Text | Code | Text |
| A2 | Develop and conduct experiments and / or simulations, analyze and interpret data, evaluate and derive results and use statistical analyzes to arrive at conclusions | CLO1 | Execute systematic verification procedures, prototype testing, and data analysis to scientifically validate system-level performance. |
| A4 | Use of contemporary technologies, standards, specifications and codes of practice, principles of quality, health and safety requirements, environmental issues, principles of risk management | CLO2 | Utilize contemporary development technologies, standard codes of practice, and quality guidelines to execute safe and reliable prototype implementations. |
| A6 | Planning, supervision and monitoring of engineering projects | CLO3 | Apply systemic and critical engineering thinking to diagnose structural faults and solve high-complexity issues during the debugging phase. |
| A9 | Use creative, innovative, flexible ideas, and gain entrepreneurial and leadership skills to anticipate and react to new circumstances | CLO4 | Demonstrate a commitment to continuous lifelong learning by independently conducting background research to implement advanced software or hardware components. |
| B3 | Design and implement: elements, modules, sub-systems or systems in electrical/electronic/digital engineering using technological and professional tools | CLO5 | Identify and manage unexpected component behaviors, noise parameters, and operational uncertainties by adopting appropriate IT diagnostics tools. |

| | | | |
|---|---|---|---|
| C3 | Synthesize different computer systems, measure their performance and analyze the obtained results using mathematical models | CLO6 | Maintain high professional performance standards through the preparation of technical engineering drawings, an accurate Bill of Materials, and a formal dissertation document. |

## 4. Teaching and Learning Methods

1. Face to face lectures\tutorials.
2. Blended Learning (Synchronous\Asynchronous sessions)
3. Active Learning (Interactive Discussions - Case studies -Brainstorming – Presentations)
4. Self-learning.

### Course Schedule

| Number of the Week | Scientific content of the course (Course Topics) | Total Weekly Hours | Expected number of the Learning Hours | | | |
|---|---|---|---|---|---|---|
| | | | Theoretical teaching (lectures/discussion groups/ .....) | | Training (Practical) | Self-learning (Tasks/ Assignments/ Projects) |
| | | | Lectures | Tutorial | | |
| 1 | Transition from Preliminary to Detailed System Design. | 7 | 1 | 0 | 6 | 10 |
| 2 | Advanced Design Verification using Standard Engineering Tools. | 7 | 1 | 0 | 6 | 10 |
| 3 | Finalizing Hardware and Software Specifications. | 7 | 1 | 0 | 6 | 10 |
| 4 | Developing Professional Engineering Design Drawings. | 7 | 1 | 0 | 6 | 10 |
| 5 | Preparation of the Bill of Materials (BOM) and Cost Estimation. | 7 | 1 | 0 | 6 | 10 |
| 6 | Prototype Assembly and Implementation Techniques. | 7 | 1 | 0 | 6 | 10 |
| 7 | System Integration and Interface Verification. | 7 | 1 | 0 | 6 | 10 |
| 8 | Testing Methodologies: Functional, Performance, and Stress Testing. | 7 | 1 | 0 | 6 | 10 |
| 9 | Debugging and Troubleshooting Complex Digital Systems. | 7 | 1 | 0 | 6 | 10 |

| | | | | | | |
|---|---|---|---|---|---|---|
| **10** | Documenting Design Revisions and Technical Decisions. | **7** | **1** | **0** | **6** | **10** |
| **11** | Dissertation Writing: Structuring the Final Project Report. | **7** | **1** | **0** | **6** | **10** |
| **12** | Communication Skills: Preparing Professional Project Presentations. | **7** | **1** | **0** | **6** | **10** |
| **13** | Preparation for Oral Examination and Technical Defense. | **7** | **1** | **0** | **6** | **10** |

## 5. Methods of students' assessment

| No. | Assessment Methods | Assessment Timing (Week Number) | Marks/ Scores | Percentage of total course Marks |
|---|---|---|---|---|
| **1** | Tasks/Reports | Monthly | 25 | 25% |
| **2** | Meetings | Monthly | 25 | 25% |
| **3** | Oral/practical/ Presentation | After first term final Exam | 50 | 50% |

## 6. Learning Resources and Supportive Facilities *

| | | |
|---|---|---|
| **Learning resources (books, scientific references, etc.) *** | **The main (essential) reference for the course** (must be written in full according to the scientific documentation method) | • |
| | **Other References** | • |
| | **Electronic Sources** (Links must be added) | Egyptian Knowledge Bank \| بنك المعرفة المصري https://www.ekb.eg/ar/home |
| | **Learning Platforms** (Links must be added) | • www.els.engmet.edu.eg |

| | | |
|---|---|---|
| | | Google Classroom(https://classroom.google.com) |
| | **Other** (to be mentioned) | • Instructor PowerPoint presentations |
| | | |
| **Supportive facilities & equipment for teaching and learning** * | **Devices/Instruments** | • - |
| | **Supplies** | • Whiteboard<br>• Presenter<br>• Data show system<br>• Sound System |
| | **Electronic Programs** | - |
| | **Skill Labs/ Simulators** | - |
| | **Virtual Labs** | - |
| | **Other** (to be mentioned) | - |

**Course Coordinator**

**Program Coordinator**

**Dr. Yasser El-Awady**

# Course Specifications

# Energy, Water and Climate Change Issues

# 2025\2026

## 1. Basic Information

| | | | | | |
|---|---|---|---|---|---|
| **Course Title** | **Energy, Water and Climate Change Issues** | | | | |
| **Course Code** | **GEN431** | | | | |
| **Department participating in delivery of the course** | **Communications and Electronics Engineering Department** | | | | |
| **Number of credit hours of the course** | **Credit Hours** | **Theoretical** | | **Self-Learning** | **SWL** |
| | | **Lectures** | **Tutorial** | | |
| | **2** | **2** | **0** | **2** | **4** |
| **Course Type** | **Major Requirements (Institute Compulsory)** | | | | |
| **Academic level at which the course is taught** | **Level 400** | | | | |
| **Academic Program** | **– Communications & Computer Engineering** | | | | |
| **Institute** | **Misr Higher Institute of Engineering and Technology** | | | | |
| **University/Academy** | **Ministry of Higher Education and Scientific Research** | | | | |
| **Semester** | **Spring Semester** | | | | |
| **Prerequisite** | **Completing 90 Credit Hours** | | | | |
| **Name of Course Coordinator** | | | | | |
| **Course Specification Approval Date** | **18/8/2025**<br>**8/9/2025** | | | | |
| **Course Specification Approval** | **Communications and Electronics Engineering Department Council, Institute Council** | | | | |

## 2. Course Overview (Brief summary of scientific content)

التنوع البيولوجي في العالم في ظل المناخ البيئي الحالي - قضايا قلة الموارد وارتباطها بقضايا حقوق الإنسان - الفقر في مناطق معينة من العالم - الأهمية الإقليمية للمياه وارتباطها بالسياسات الدولية - ندرة المياه ومشاكل النمو السكاني السريع - العلاقة بين ندرة المياه والإمدادات النفطية - تأمين الاحتياجات النفطية للدول الصناعية - تطوير التقنيات والحلول المتعلقة بالغاز الطبيعي - أهمية قضية التغير المناخي وأثرها على العلاقات الدولية - قضايا التخفيف من آثار تغير المناخ والآثار السلبية لتغير المناخ (الجوانب الفيزيائية والاجتماعية والاقتصادية) - فرص استثمار تغير المناخ.

## 3. Course Learning Outcomes CLOs

| Program Outcomes (NARS/ARS) (according to the matrix in the program specs) | | Course Learning Outcomes Upon completion of the course, the student will be able to: | |
|---|---|---|---|
| Code | Text | Code | Text |
| A1 | Identify, formulate, and solve complex engineering problems by applying engineering fundamentals, basic science and mathematics | CLO1 | إتقان طيف واسع من المعرفة الهندسية والبيئية لتطبيق التفكير المجرد في تحليل أزمات المناخ العالمية. |
| A3 | Application of engineering design to achieve cost-effective solutions that meet specific needs. Taking into account global, cultural, social, economic, environmental and ethical aspects. These applications are within the principles of sustainable design and development | CLO2 | استخدام التقنيات والمهارات والأدوات الهندسية الحديثة لتقييم ندرة الموارد ونمذجة الآثار البيئية. |
| A4 | Use of contemporary technologies, standards, specifications and codes of practice, principles of quality, health and safety requirements, environmental issues, principles of risk management | CLO3 | العمل بفعالية ضمن فريق عمل غير متجانس لاقتراح حلول دولية متكاملة لقضايا أمن المياه والطاقة. |
| A6 | Planning, supervision and monitoring of engineering projects | CLO4 | إظهار القدرة على تخطيط والإشراف على ومراقبة المشاريع الهندسية المستدامة التي تعالج قضايا التخفيف من آثار المناخ. |

## 4. Teaching and Learning Methods

1. Face to face lectures\tutorials.
2. Blended Learning (Synchronous\Asynchronous sessions)
3. Active Learning (Interactive Discussions - Case studies -Brainstorming – Presentations)
4. Self-learning.

### Course Schedule

| Number of the Week | Scientific content of the course (Course Topics) | Total Weekly Hours | Expected number of the Learning Hours | | | |
|---|---|---|---|---|---|---|
| | | | Theoretical teaching (lectures/discussion groups/ .....) | | Training (Practical) | Self-learning (Tasks/ Assignments/ Projects) |
| | | | Lectures | Tutorial | | |
| 1 | التنوع البيولوجي العالمي: الحالة الراهنة للمحيط الحيوي والتهديدات المناخية. | 2 | 2 | 0 | 0 | 2 |
| 2 | ندرة الموارد وحقوق الإنسان: الآثار الاجتماعية والاقتصادية لنقص الموارد الأساسية. | 2 | 2 | 0 | 0 | 2 |
| 3 | جغرافيا الفقر: العوامل البيئية المسببة للفقر وتوزيعها العالمي. | 2 | 2 | 0 | 0 | 2 |
| 4 | سياسات المياه (Hydro-Politics) | 2 | 2 | 0 | 0 | 2 |
| 5 | الأهمية الإقليمية للمياه ودورها في الدبلوماسية الدولية. | 2 | 2 | 0 | 0 | 2 |
| 6 | الديموغرافيا والمياه: تحليل أثر النمو السكاني السريع على الأمن المائي. | 2 | 2 | 0 | 0 | 2 |
| 7 | ترابط المياه والطاقة: العلاقة الجدلية بين توفر المياه وإنتاج النفط. | 2 | 2 | 0 | 0 | 2 |
| 8 | Midterm + Revision | 2 | 2 | 0 | 0 | 2 |
| 9 | أمن الطاقة: استراتيجيات تأمين الاحتياجات النفطية للدول الصناعية. | 2 | 2 | 0 | 0 | 2 |
| 10 | ابتكارات الغاز الطبيعي: تطوير تقنيات وحلول الطاقة الأنظف. | 2 | 2 | 0 | 0 | 2 |
| 11 | التغير المناخي والدبلوماسية: كيف تعيد التحولات البيئية تشكيل العلاقات الدولية. | 2 | 2 | 0 | 0 | 2 |
| 12 | الجهود والسياسات (Mitigation): استراتيجيات التخفيف العالمية لتقليل انبعاثات الغازات. | 2 | 2 | 0 | 0 | 2 |
| 13 | الآثار المتعددة الأبعاد: التبعات الفيزيائية والاجتماعية والاقتصادية للاحتباس الحراري. | 2 | 2 | 0 | 0 | 2 |
| 14 | الاستثمار البيئي: استكشاف الفرص الاقتصادية في التكنولوجيا الخضراء والتكيف المناخي. | 2 | 2 | 0 | 0 | 2 |
| 15 | دمج قضايا الطاقة والمياه: أهداف التنمية المستدامة (SDGs) في الأطر العالمية. | 2 | 2 | 0 | 0 | 2 |

| | |
|---|---|
| 16 | **Final Exam** |

## 5. Methods of students' assessment

| No. | Assessment Methods | Assessment Timing (Week Number) | Marks/ Scores | Percentage of total course Marks |
|---|---|---|---|---|
| **1** | Assignments | Every 3 weeks | 13 | 13% |
| **2** | Quizzes | Every 2 weeks | 12 | 12% |
| **3** | Proctored exams: Midterm Exam | 8 | 25 | 25% |
| **4** | Proctored exams: Final Exam | 15 | 50 | 50% |
| **5** | Formative assessment | 5 | 0 | 0% |

## 6. Learning Resources and Supportive Facilities *

| | | |
|---|---|---|
| **Learning resources (books, scientific references, etc.) *** | **The main (essential) reference for the course** (must be written in full according to the scientific documentation method) | • **Tester, J. W., Drake, E. M., Driscoll, M. J., Golay, M. W., & Peters, W. A. Sustainable Energy: Choosing Among Options. 2nd ed., MIT Press, 2012.** |
| | **Other References** | • Twidell, J. (2021). Renewable energy resources (4th ed.). Routledge. |
| | **Electronic Sources** (Links must be added) | Egyptian Knowledge Bank \| بنك المعرفة المصري https://www.ekb.eg/ar/home |
| | **Learning Platforms** (Links must be added) | • **www.els.engmet.edu.eg** Google Classroom(https://classroom.google.com) |
| | **Other** (to be mentioned) | • Instructor PowerPoint presentations |
| | | |
| **Supportive facilities & equipment for teaching** | **Devices/Instruments** | • - |
| | **Supplies** | • Whiteboard<br>• Presenter<br>• Data show system |

| | | |
|---|---|---|
| and learning * | | • Sound System |
| | **Electronic Programs** | - |
| | **Skill Labs/ Simulators** | - |
| | **Virtual Labs** | - |
| | **Other** (to be mentioned) | - |

**Course Coordinator**

**Program Coordinator**

**Dr. Yasser El-Awady**

# Course Specifications
# نظم المراقبة و ضبط الجودة
# 2025\2026

## 1. Basic Information

| | | | | | |
|---|---|---|---|---|---|
| **Course Title** | **Quality Monitoring and Control**<br>**نظم المراقبة و ضبط الجودة** | | | | |
| **Course Code** | **ENG431** | | | | |
| **Department participating in delivery of the course** | **Communications and Electronics Engineering Department** | | | | |
| **Number of credit hours of the course** | **Credit Hours** | **Theoretical** | | **Self-Learning** | **SWL** |
| | | **Lectures** | **Tutorial** | | |
| | **1** | **1** | **0** | **2** | **3** |
| **Course Type** | **Major Requirements (Institute Compulsory)** | | | | |
| **Academic level at which the course is taught** | **Level 400** | | | | |
| **Academic Program** | **– Communications & Computer Engineering** | | | | |
| **Institute** | **Misr Higher Institute of Engineering and Technology** | | | | |
| **University/Academy** | **Ministry of Higher Education and Scientific Research** | | | | |
| **Semester** | **Spring Semester** | | | | |
| **Prerequisite** | | | | | |
| **Name of Course Coordinator** | | | | | |
| **Course Specification Approval Date** | **18/8/2025**<br>**8/9/2025** | | | | |
| **Course Specification Approval** | **Communications and Electronics Engineering Department Council, Institute Council** | | | | |

## 2. Course Overview (Brief summary of scientific content)

مقدمة في نظم المراقبة الإحصائية للعمليات – مفاهيم الجودة الشاملة وأدوات ضبط الجودة السبع – تصميم وتحليل مخططات المراقبة للمتغيرات والخصائص – استراتيجيات فحص العينات وقبولها – النمذجة الرياضية لتقييم جودة النظم والعمليات – مبادئ إدارة المخاطر والسلامة المهنية في خطوط الإنتاج – تطبيقات المعايرة وضمان الامتثال للمعايير واللوائح القياسية الدولية والمحلية – استخدام الأنظمة الرقمية والبرمجيات الحديثة في التقييم والمراقبة اللحظية للبيانات.

## 3. Course Learning Outcomes CLOs

| Program Outcomes (NARS/ARS) (according to the matrix in the program specs) | | Course Learning Outcomes Upon completion of the course, the student will be able to: | |
|---|---|---|---|
| Code | Text | Code | Text |
| A4 | Use of contemporary technologies, standards, specifications and codes of practice, principles of quality, health and safety requirements, environmental issues, principles of risk management | CLO1 | يقيم جودة العمليات الهندسية ومستويات أمان النظم من خلال تطبيق الأدوات التكنولوجية الحديثة والمعايير القياسية وإرشادات السلامة المهنية ومبادئ إدارة المخاطر. |
| A6 | Planning, supervision and monitoring of engineering projects | CLO2 | يطبق أدوات التحليل الإحصائي والمنهجيات العلمية لإجراء فحص دقيق للبيانات المستخرجة من نظم المراقبة واستنباط الحلول المناسبة للمشكلات التصنيعية والتشغيلية. |

## 4. Teaching and Learning Methods

1. Face to face lectures\tutorials.
2. Blended Learning (Synchronous\Asynchronous sessions)
3. Active Learning (Interactive Discussions - Case studies -Brainstorming – Presentations)
4. Self-learning.

## Course Schedule

| Number of the Week | Scientific content of the course (Course Topics) | Total Weekly Hours | Expected number of the Learning Hours | | | |
|---|---|---|---|---|---|---|
| | | | Theoretical teaching (lectures/discussion groups/ .....) | | Training (Practical) | Self-learning (Tasks/ Assignments/ Projects) |
| | | | Lectures | Tutorial | | |
| 1 | مقدمة إلى فلسفة الجودة الشاملة وتطور نظم المراقبة وضبط الجودة في الهندسة. | 1 | 1 | 0 | 0 | 2 |
| 2 | أدوات الجودة السبع الأساسية (أدوات التحليل الإحصائي وجمع البيانات). | 1 | 1 | 0 | 0 | 2 |
| 3 | مبادئ وأساسيات المراقبة الإحصائية للعمليات (Statistical Process Control - SPC). | 1 | 1 | 0 | 0 | 2 |
| 4 | تصميم وتحليل مخططات المراقبة للمتغيرات | 1 | 1 | 0 | 0 | 2 |
| 5 | خطط فحص العينات وقبولها (Acceptance Sampling) | 1 | 1 | 0 | 0 | 2 |
| 6-7 | المعايير الإحصائية المرتبطة بفحص العينات وقبولها (Acceptance Sampling) | 2 | 2 | 0 | 0 | 4 |
| 8 | النمذجة الرياضية وحساب مؤشرات قدرة العملية الإنتاجية | 1 | 1 | 0 | 0 | 2 |
| 9 | Midterm + Revision | 1 | 1 | 0 | 0 | 2 |
| 10 | معايير إدارة المخاطر والتحكم في جودة العمليات الهندسية وتقليل نسبة الفاقد. | 1 | 1 | 0 | 0 | 2 |
| 11 | إرشادات السلامة والصحة المهنية، والمتطلبات البيئية في بيئات التشغيل والمراقبة. | 1 | 1 | 0 | 0 | 2 |
| 12 | اللوائح، والأكواد القياسية، والمواصفات الدولية لإدارة الجودة (مثل عائلة مواصفات ISO 9001). | 1 | 1 | 0 | 0 | 2 |
| 13 | منهجيات وتقنيات التدقيق الداخلي (Quality Auditing) وأنظمة التقييم والتحليل الميكانيكي والرقمي. | 1 | 1 | 0 | 0 | 2 |
| 14 | استخدام الأدوات التكنولوجية والبرمجيات المعاصرة في المراقبة اللحظية لخطوط الإنتاج واستخلاص البيانات. | 1 | 1 | 0 | 0 | 2 |
| 15 | Revision | 1 | 1 | 0 | 0 | 2 |
| 16 | **Final Exam** | | | | | |

## 5. Methods of students' assessment

| No. | Assessment Methods | Assessment Timing (Week Number) | Marks/ Scores | Percentage of total course Marks |
|---|---|---|---|---|
| 1 | Assignments | Every 3 weeks | 13 | 13% |
| 2 | Quizzes | Every 2 weeks | 12 | 12% |
| 3 | Proctored exams: Midterm Exam | 8 | 25 | 25% |
| 4 | Proctored exams: Final Exam | 15 | 50 | 50% |
| 5 | Formative assessment | 5 | 0 | 0% |

## 6. Learning Resources and Supportive Facilities *

| | | |
|---|---|---|
| Learning resources (books, scientific references, etc.) * | **The main (essential) reference for the course** (must be written in full according to the scientific documentation method) | • **Oakland, J. S. Total Quality Management and Operational Excellence: Text with Cases. 4th ed., Routledge, 2014.** |
| | **Other References** | • **Oakland, J. S. (2020). *Total quality management and operational excellence: Text with cases* (5th ed.). Routledge.** |
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| | **Electronic Programs** | - |
| | **Skill Labs/ Simulators** | - |
| | **Virtual Labs** | - |
| | **Other** (to be mentioned) | - |

**Course Coordinator** **Program Coordinator**

**Dr. Yasser El-Awady**