FINAL INTERNATIONAL UNIVERSITY

FACULTY OF ENGINEERING

ARTIFICIAL INTELLIGENCE ENGINEERING Program of Courses

Course categories: UC = University Core; FC = Faculty Core; AC = Area Core; AE = Area Elective; FE = Faculty Elective; UE = University Elective

Semester	Course Code	Course Title	Course Category	Hours			Total Credit	Pre-requisite	ECTS Credit
				Lecture	Tutorial	Lab/Prac.			
1	MATH121	CALCULUS-I	FC	3	2	0	4	-	6
1	MATH123	DISCRETE MATHEMATICS	FC	3	1	0	3	-	5
1	PHYS121	PHYSICS-I	FC	3	1	1	4	-	5
1	ENGR101	INFORMATION TECHNOLOGY AND APPLICATIONS	FC	2	0	1	2	-	2
1	ENGR103	COMPUTER PROGRAMMING-I	FC	2	0	2	3	-	5
1	ENGL121	ENGLISH-I	UC	3	0	0	3	-	4
1	TUOG101/TURK131	TURKISH LANGUAGE-I/TURKISH AS A FOREIGN LANGUAGE-I	UC	2	0	0	2	-	3
		Total 7 courses	**TOTAL:**	**18**	**4**	**4**	**21**		**30**
2	MATH122	CALCULUS-II	FC	3	2	0	4	MATH121	6
2	MATH124	LINEAR ALGEBRA	FC	3	1	0	3	-	5
2	PHYS122	PHYSICS-II	FC	3	1	1	4	PHYS121	5
2	ENGR104	COMPUTER PROGRAMMING-II	FC	2	0	2	3	ENGR103	4
2	ENGL122	ENGLISH-II	UC	3	0	0	3	ENGL121	4
2	TARH101/HIST111	ATATURK'S PRINCIPLES AND HISTORY OF TURKISH REFORMS-I	UC	2	0	0	2	-	3
2	TUOG102/TURK132	TURKISH LANGUAGE-II/TURKISH AS A FOREIGN LANGUAGE-II	UC	2	0	0	2	- /TURK131	3
		Total 7 courses	**TOTAL:**	**18**	**4**	**3**	**21**		**30**
3	ELEE211	DIGITAL LOGIC DESIGN	AC	3	0	2	4	-	6
3	AINE201	FUNDAMENTALS OF ARTIFICIAL INTELLIGENCE	AC	3	0	0	3	-	6
3	CMPE215	ALGORITHMS AND DATA STRUCTURES	AC	3	0	1	3	ENGR104	6
3	MATH225	DIFFERENTIAL EQUATIONS	FC	4	0	0	4	MATH121, MATH124	5
3	TARH102/HIST112	ATATURK'S PRINCIPLES AND HISTORY OF TURKISH REFORMS-II	UC	2	0	0	2	-	3
3	UNIEXX1	UNIVERSITY ELECTIVE	UE	X	X	X	3	-	4
		Total 6 courses	**TOTAL:**	**15**	**0**	**3**	**19**		**30**
4	STAT226	PROBABILITY AND STATISTICS	FC	3	1	0	3	MATH121	6
4	CMPE216	OBJECT ORIENTED PROGRAMMING	AC	2	0	2	3	ENGR104	6
4	AINE204	ARTIFICIAL INTELLIGENCE TOOLS	AC	3	0	2	4	AINE201	6
4	CMPE252	ANALYSIS OF ALGORITHMS	AC	3	0	2	4	CMPE215	6
4	ENGR215	RESEARCH METHODS FOR ENGINEERING AND ARCHITECTURE	FC	2	0	0	2	-	3
4	OHSA206	OCCUPATIONAL HEALTH AND SAFETY	FC	3	0	0	3	-	3
		Total 6 courses	**TOTAL:**	**16**	**1**	**6**	**19**		**30**
5	CMPE321	MICROPROCESSORS	AC	3	0	2	4	ELEE211	6
5	CMPE341	DATABASE SYSTEMS	AC	3	0	2	4	CMPE215	5
5	AINE301	BASIC SEARCH METHODS	AC	3	0	0	3	MATH124, AINE201	5
5	SFWE343	SOFTWARE ANALYSIS AND DESIGN	AC	2	0	2	3	CMPE216	5
5	ENGRXX1	FACULTY ELECTIVE	FE	X	X	X	3	-	5
5	UNIEXX2	UNIVERSITY ELECTIVE	UE	X	X	X	3	-	4
		Total 6 courses	**TOTAL:**	**11**	**0**	**6**	**20**		**30**
6	AINE312	DATA SCIENCE	AC	3	0	0	3	ENGR104	5
6	AINE332	DEEP NEURAL NETWORKS	AC	3	0	0	3	ENGR104, STAT226	6
6	AINE334	KNOWLEDGE REPRESENTATION AND REASONING	AC	3	0	0	3	-	5
6	ENGRXX2	FACULTY ELECTIVE	FE	X	X	X	3	-	5
6	ENGRXX3	FACULTY ELECTIVE	FE	X	X	X	3	-	5
6	UNIEXX3	UNIVERSITY ELECTIVE	UE	X	X	X	3	-	4
		Total 6 courses	**TOTAL:**	**9**	**0**	**0**	**18**		**30**
7	AINE403	SUMMER TRAINING	FC	0	0	0	0	-	2
7	ENGR401	ENGINEERING DESIGN-I	FC	1	2	0	2	-	6
7	AINE413	MACHINE LEARNING	AC	3	0	0	3	STAT226	6
7	AINEXX1	AREA ELECTIVE	AE	X	X	X	3	-	6
7	AINEXX2	AREA ELECTIVE	AE	X	X	X	3	-	6
7	UNIEXX4	UNIVERSITY ELECTIVE	UE	X	X	X	3	-	4
		Total 6 courses	**TOTAL:**	**4**	**2**	**0**	**14**		**30**

8	ENGR402	ENGINEERING DESIGN-II	FC	0	4	2	3	ENGR401	10
8	ENGR404	ENGINEERING ATTRIBUTES AND ETHICS	FC	2	0	0	2	-	3
8	ENGRXX4	FACULTY ELECTIVE	FE	X	X	X	3	-	5
8	AINEXX3	AREA ELECTIVE	AE	X	X	X	3	-	6
8	AINEXX4	AREA ELECTIVE	AE	X	X	X	3	-	6
		Total 5 courses	**TOTAL:**	**2**	**4**	**2**	**14**		**30**
			GRAND TOTAL:	**93**	**15**	**24**	**146**		**240**

Area and Faculty Elective Courses

No.	Course Code	Course Title	Course Category	Hours			Total Credit	Pre-requisite	ECTS Credit
				Lecture	Tutorial	Lab/Prac.			
1	ELEE426	EMBEDDED SYSTEMS	FE	3	0	0	3	-	6
2	ELEE434	DIGITAL CONTROL SYSTEMS	FE	3	0	0	3	-	6
3	ELEE442	POWER ELECTRONICS	FE	3	0	0	3	-	6
4	ELEE451	MICROWAVE THEORY	FE	3	0	0	3	-	6
5	ELEE461	COMMUNICATIONS SYSTEMS II	FE	3	0	0	3	-	6
6	ELEE464	WIRELESS SENSOR NETWORKS	FE	3	0	0	3	-	6
7	ELEE462	WIRELESS COMMUNICATIONS	FE	3	0	0	3	-	6
8	ELEE463	INFORMATION THEORY	FE	3	0	0	3	-	6
9	ELEE471	HIGH VOLTAGE TECHNIQUES	FE	3	0	0	3	-	6
10	CVLE102	ENGINEERING DRAWING	FE	2	0	2	3	-	5
11	MATH328	NUMERICAL ANALYSIS	FE	3	1	0	3	MATH124, MATH225	6
12	CMPE322	DATA COMMUNICATION AND COMPUTER NETWORKS	FE	3	0	2	4	CMPE215	6
13	SFWE315	VISUAL PROGRAMMING	FE	2	0	2	3	CMPE216	5
14	SFWE316	INTERNET AND WEB PROGRAMMING	AE	3	0	0	3	-	6
15	SFWE431	HUMAN COMPUTER INTERACTION	AE	3	0	0	3	-	6
16	SFWE412	SOFTWARE QUALITY ASSURANCE	AE	3	0	0	3	-	6
17	AINE471	INTRODUCTION TO DATA ANALYSIS	AE	2	0	2	3	-	6
18	AINE481	ETHICS OF ARTIFICIAL INTELLIGENCE	AE	2	0	2	3	-	6
19	AINE421	FUNDAMENTALS OF COMPUTER VISION	AE	3	0	0	3	-	6
20	AINE431	EXPERT SYSTEMS	AE	3	0	0	3	-	6
21	AINE441	NEURAL COMPUTATION	AE	3	0	0	3	-	6
22	AINE451	AI IN SECURITY	AE	3	0	0	3	-	6
23	AINE461	ROBOTICS AND AI	AE	3	0	0	3	-	6
24	CMPE463	CLOUD COMPUTING	AE	3	0	0	3	-	6
25	CMPE474	INTRODUCTION TO PARALLEL COMPUTING	AE	3	0	0	3	-	6
26	ELEE474	DIGITAL IMAGE PROCESSING	AE	3	0	0	3	-	6
27	ELEE435	INTRODUCTION TO ROBOTICS	AE	3	0	0	3	-	6

PROGRAM INFORMATION	
General Goal of the Program	The Artificial Intelligence Engineering program aims to produce adept professionals equipped with practical experience and profound knowledge, poised to excel as esteemed experts in the realm of artificial intelligence. This comprehensive curriculum is designed to foster a deep understanding of AI principles, algorithms, and their real-world applications across various industries, emphasizing hands-on projects and industry collaborations. Ultimately, our goal is to cultivate innovative thinkers who can ethically and responsibly drive the advancement of AI technologies, contributing to groundbreaking solutions that shape the future of society and industry.

Program Outputs	1. Engineering Knowledge and Mathematical Foundation: Apply comprehensive knowledge of mathematics, statistics, computing fundamentals, and AI-specific theories to analyse and solve complex artificial intelligence engineering problems, integrating principles from calculus, linear algebra, probability, discrete mathematics, and algorithm analysis.
	2. Data Science and Machine Learning Application: Demonstrate expertise in data science methodologies, machine learning techniques, and statistical analysis to extract meaningful insights from complex datasets, implement predictive models, and develop data-driven AI solutions for real-world engineering challenges across various domains.
	3. Modern Tools and Emerging Technologies: Select, apply, and critically evaluate modern AI frameworks, development environments, cloud computing platforms, and emerging technologies including deep learning libraries, data visualization tools, and distributed computing systems, with understanding of their capabilities, limitations, and appropriate application contexts.
	4. Problem Analysis and AI Solution Design: Identify, formulate, and systematically analyze complex engineering problems involving intelligent systems by applying interdisciplinary knowledge from computer science, software engineering, and AI methodologies to develop innovative and practical solutions that meet specified technical and performance requirements.
	5. AI System Architecture and Implementation: Design, develop, implement, and evaluate intelligent systems and AI-based solutions using modern programming languages, software engineering principles, and AI tools, demonstrating proficiency in machine learning algorithms, neural networks, data structures, and system integration while considering scalability, performance, and real-world constraints
	6. Software Engineering and Development Lifecycle: Apply software engineering methodologies, version control systems, testing frameworks, and development lifecycle practices to create robust, maintainable, and efficient AI applications, incorporating quality assurance methods, debugging techniques, and industry-standard development tools and practices.
	7. Research and Innovation in AI: Conduct methodical investigations into complex AI engineering problems using appropriate research methodologies, experimental design, and analytical techniques to evaluate system performance, validate AI models, and contribute to the advancement of artificial intelligence knowledge through innovation and critical thinking.
	8. Ethics, Professional Responsibility, and AI Impact: Demonstrate understanding of professional, ethical, legal, and social responsibilities in AI engineering practice, including critical evaluation of algorithmic bias, fairness, transparency, privacy, security, intellectual property, and the broader societal impacts of intelligent systems on individuals and communities.
	9. Communication and Interdisciplinary Collaboration: Communicate effectively with technical and non-technical stakeholders through written reports, oral presentations, and visual documentation, while functioning collaboratively in multidisciplinary teams and demonstrating leadership skills in AI project coordination and technical decision-making.
	10. Lifelong Learning and Professional Development: Demonstrate commitment to continuous learning and adaptation in the rapidly evolving field of artificial intelligence by staying current with emerging technologies, research developments, and industry practices, while engaging in professional growth activities and contributing to the AI engineering community through knowledge sharing and mentorship.

STATISTICS

	Total		
Courses	**Number**	**Credit**	**ECTS**
All Courses	49	146	240
University Core Courses	6	14	20
Faculty Core Courses	17	49	81
Area Core Courses	14	47	79
Area Elective Courses	4	12	24
Faculty Elective Courses	4	12	20
University Elective Courses	4	12	16
Free Elective Courses			
Courses Offered By The Administering Department			
Courses Offered By Other Departments			

PER SEMESTER STATISTICS

	Semester								
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**Average**
Number of Courses Per Semester	7	7	6	6	6	6	6	5	6,13
Number of Credits Per Semester	21	21	19	19	20	18	14	14	18,25
ECTS Credits Per Semester	30	30	30	30	30	30	30	30	30,00

COURSE DESCRIPTIONS

Course Descriptions – I: All Area Core and Faculty/School Core courses offered by the department of the program.

Course Code	Course Title	Credit	ECTS Credit	Course Catego.	Pre-requisite	Teaching Language
MATH121	CALCULUS-I	(3,1,1)4	6	FC	-	English
Course Content	Calculus-I covers differential and integral calculus, with applications in geometry, physics, and engineering. Students will learn to apply calculus concepts to various scientific and engineering applications. Topics include identifying function types, graphing functions, evaluating limits, handling elementary functions (polynomial, trigonometric, logarithmic, exponential, etc.), solving undefined limits, and evaluating derivatives. Derivatives of elementary functions, product, and quotient rules will be covered, along with applications of derivatives. Integration topics include evaluating integrals, defining integrals, and using methods like substitution, integration by parts, and integrating rational functions. The course will also explore the practical applications of integration.					
MATH123	DISCRETE MATHEMATICS	(3,1,0)3	5	FC	-	English
Course Content	Discrete mathematics is the first non-calculus course for mathematics, computer science, and engineering majors. This course introduces the mathematical tools and techniques used to study discrete processes as opposed to continuous processes. Topics covered include discrete concepts such as basic set theory, functions, relations, recurrences, counting principles, the fundamentals of propositional logic and Boolean algebra, graphs, and trees. The course also introduces proof techniques in mathematics, including proof by induction, proof by truth table, proof by Venn diagram, etc. This course is indeed a prerequisite for logic design, operational research, combinatorics, abstract algebra, mathematical modeling, geometry, and topology courses.					
PHYS121	PHYSICS-I	(3,1,1)4	5	FC	-	English
Course Content	The aim of the course is to provide the basic information in order to help the students to understand the possible complicated problems in engineering. In this regard, the basic principles and methods of solving the problems in physics are taught. The course provides a basic grounding in elementary physics including mechanics. The basic subjects of the course are: Units and dimensions uniformly accelerated motion in one dimension, Freefall, Vector mathematics, Two-dimensional motion, Newton's laws of motion, Applications of Newton's laws, Free body diagrams, Circular Motion, Work and energy, Conservation of energy, Momentum, impulse, and collisions, Rotational kinematics, Torque, Static equilibrium. For completeness, the students are supposed to do 6 experiments related to the subjects of the course.					
ENGR101	INFORMATION TECHNOLOGY AND APPLICATIONS	(2,0,1)2	2	FC	-	English
Course Content	This course aims to introduce all students to the basic concepts of information technology and to train them in the skills needed to use office productivity tools. Course subjects include; History of Computing, Fundamental Hardware descriptions and functions, Software types and functions, Numbering Systems and Binary, Input, Output and Storage devices, Internet and the World Wide Web, Understanding Networks, Privacy while using Computers, Computer Crimes and Security, Computer Ethics, Cloud Computing fundamentals. The course also covers the usage of Microsoft Word, PowerPoint, and Excel.					
ENGR103	COMPUTER PROGRAMMING-I	(2,0,2)3	5	FC	-	English
Course Content	The Computer Programming course introduces students to the concept of programming including designing algorithms and writing pseudo-code to solve engineering-related problems, creating flowcharts to represent the steps of a problem solution, and the basic elements of the Python programming language the implement their solution. The course covers common high-level programming concepts such as Data types, constants and variables, arithmetic and logical operators, decision-making expressions. Fundamental components of Python included in the course are; storing and manipulating input data, design and use of selection structures, repetition structures, various data structures such as lists, dictionaries and sets, functions, and modular design.					
MATH122	CALCULUS-II	(3,2,0)4	6	FC	MATH121	English
Course Content	This calculus course covers differential and integral calculus with applications in geometry, physics, and engineering. Topics include sequences and infinite series, convergence tests, absolute and conditional convergence, power series, Taylor and Maclaurin series, and radius of convergence. It also covers parametric equations and polar coordinates, graphing polar equations, area in polar coordinates, arc length, and derivative of polar equations. Vectors and vector-valued functions, dot and cross products, lines, and planes are explored. Additionally, the course covers functions of several variables, domain, limits, partial derivatives, and definite integrals over regions.					
MATH124	LINEAR ALGEBRA	(3,1,0)3	5	FC	-	English
Course Content	The aim of this course is to introduce the basic operations in linear algebra and applications in engineering problems; matrices, matrix properties, and matrix operations: Addition, scalar multiplication, multiplication, transpose, solution of system of linear equations: Elimination method, Gauss Jordan forms, inverse method to solve linear systems, row reduced echelon forms, Gaussian elimination method, inverse, and determinants: solving linear equations with determinant (Cramer's rule), use one row to evaluate determinant, minor, cofactor, adjoin matrix, identity matrix, square matrix of the matrices. Real vector spaces, vectors and their properties and applications in engineering: Addition, subtractions, dot product, scalar multiplication, cross product, basis, dimensions, and subspaces.					
PHYS122	PHYSICS-II	(3,1,1)4	5	FC	PHYS121	English
Course Content	This course provides the basic information to help the students to understand the possible complicated problems in engineering. The subjects of the course are mostly Electricity and Magnetism. The basic subjects of the course are Properties of electric charges, Coulomb's law, and Electric field of continuous charge distribution, Gauss's law, and electric flux. Application of Gauss's law to charged insulators, Obtaining the value of the electric field from the electric potential, Electric potential and the potential energy due to point charges, Electric potential due to continuous charge distributions, Electric current, Resistance and Ohm's law, Electromotive force, Resistors in series and in parallel. Kirchhoff's rules.					
ENGR104	COMPUTER PROGRAMMING-II	(2,0,2)3	4	FC	ENGR102	English
Course Content	Review of the C programming language. Structured and modular programming using C. Local and global variables. Structured programming constructs. Arrays and array handling. Multi-dimensional arrays. Structures and Unions. Arrays of structures. Defining new data types in C. Functions in C. Call-by-value and call-by-reference. Character and string functions. Scope and extent. Recursion. Pointers and pointer arithmetic. Dynamic memory allocation and simple data structures in C. Arrays of pointers. Bit manipulation. Files; data and file processing. Conditional compilation and exception handling in C.					

ELEE211	**DIGITAL LOGIC DESIGN**	(3,0,2)4	6	AC	-	English
Course Content	This course presents the basic tools for the design and analysis of digital circuits and provides methods and procedures suitable for a variety of digital design applications in computers, control systems, data communications, etc. The course introduces data representation in binary systems, complements, Boolean algebra, logic gates, truth tables, logic circuits, timing diagrams, De Morgan's law, algebraic manipulation, minterms and maxterms, Sum of Products (SOP) and Product of Sums (POS) forms, Boolean function simplification tools and Karnough Map method, NAND and NOR implementations, don't care conditions, combinational circuit design and analysis procedures, and design of Adders, Subtracters and Code Converters.					
AINE201	**FUNDAMENTALS OF ARTIFICIAL INTELLIGENCE**	(3,0,0)3	6	AC	-	English
Course Content	Fundamentals of Artificial Intelligence provides a comprehensive introduction to AI concepts and techniques with a focus on engineering applications. Students will explore core areas including machine learning, deep learning, and advanced AI topics. The course covers supervised and unsupervised learning techniques, neural network architectures, and their applications in solving real-world engineering problems. Through hands-on programming assignments and a term project, students will gain practical experience in developing AI solutions using popular frameworks like TensorFlow and PyTorch. The course also addresses ethical considerations and future trends in AI, preparing students for advanced study and careers in AI engineering.					
CMPE215	**ALGORITHMS AND DATA STRUCTURES**	(3,0,1)3	6	AC	ENGR104	English
Course Content	The objective of this course is to provide the basics of data structures and data organization. The course will introduce C/C++ and algorithms for the implementation of data structures which are stack, queue, linked list, and tree. Also, the applications of data structures cover stack applications which are parenthesis checker, infix to postfix and prefix conversions, recursion, dynamic stack and queue, and tree traversals. Theoretical aspects of the most widely used data structures will be covered during the lectures. Programming assignments and lab works cover the C/C++ implementations of applications of data structures that are discussed in the lectures.					
MATH225	**DIFFERNTIAL EQUATIONS**	(4,0,0)4	5	FC	MATH121 MATH124	English
Course Content	In this course, the ordinary differential equations and their applications will be considered. The course will demonstrate the usefulness of ordinary differential equations for modeling physical and engineering problems. Complementary mathematical approaches for their solution will be presented, including analytical methods. The basic content of the course includes first-order ordinary differential equations and their types of exact, separable, Bernoulli, first order, homogeneous ordinary differential equations, linear independence of the solutions, higher-order ordinary differential equations, and their solutions. The undetermined coefficient methods, the variation of the parameter method, Cauchy-Euler equations. The definition of the Laplace transform and some important applications of the Laplace transform will be included in this lecture.					
ISTA226	**PROBABILITY AND STATISTICS**	(3,1,0)3	6	FC	MATH121	English
Course Content	The objective of this course is to introduce basic probability and statistics concepts. The focus of this course is on both applications and theory. Topics include: introduction to random variables, simple data analysis and descriptive statistics, frequency distribution, cumulative distribution, sample space, events, counting sample points (basic combinatorics), probability of an event, probability axioms, laws of probability, conditional probability, Bayes' rule, discrete and continuous random variables, probability distributions, cumulative probability distributions, discrete and continuous probability distributions, discrete uniform, Binomial, Geometric, Hypergeometric, Poisson, Continuous uniform, Normal Disributions, Gamma and Exponential distribution, jointly distributed random variables, expectation and covariance of discrete and continuous random variables, random sampling, sampling distributions, distribution of Sample Mean, Central Limit Theorem(CLT).					
CMPE216	**OBJECT ORIENTED PROGRAMMING**	(2,0,2)3	6	AC	ENGR104	English
Course Content	This course introduces the concepts of object-oriented programming to students with a background in the procedural paradigm. The course begins with a brief review of control structures and data types with emphasis on structured data types and array processing. It then moves on to introduce the object-oriented programming paradigm, focusing on the definition and use of classes along with the fundamentals of object-oriented design. Other topics include an overview of programming language principles, simple analysis of algorithms, basic searching and sorting techniques, memory management, an introduction to software engineering issues, and ethics in software development.					
AINE204	**ARTIFICIAL INTELLIGENCE TOOLS**	(3,0,2)4	6	AC	AINE201	English
Course Content	Artificial Intelligence Tools explores fundamental programming languages essential for AI, machine learning, data analytics, and visualization. Students will delve into crucial data structures including arrays, indexing, numerical operations, data frames, series, merging, and joining techniques. The course emphasizes functional programming, vector computation, and object-oriented programming tailored specifically for AI applications. Furthermore, it covers logic programming within the context of artificial intelligence, providing students with a comprehensive understanding of the tools necessary to develop and implement AI solutions in various domains.					
CMPE252	**ANALYSIS OF ALGORITHMS**	(3,0,2)4	6	AC	CMPE215	English
Course Content	The primary goal of this course is to introduce students to algorithm analysis and design in order to improve their analytical thinking skills. The emphasis of the course is on algorithms and problem-solving techniques. Runtime analysis, complexity analysis of sorting and searching algorithms, divide and conquer algorithms, dynamic programming, greedy algorithms, graph algorithms, and string matching algorithms are all important concepts. A variety of problem-solving paradigms will be applied to demonstrate creative and effective approaches to a particular challenge. In each scenario, emphasis will be given to categorically demonstrating the algorithm's soundness. Upon completion, the students will be able to demonstrate how effective the algorithm is in comparison to simple procedures.					
ENGR215	**RESEARCH METHODS FOR ENGINEERING AND ARCHITECTURE**	(2,0,0)2	3	FC	-	English
Course Content	The aim of this course is to develop students' knowledge and understanding of the role and conduct of quantitative and qualitative research methods in engineering. The imperative for ethical research practice will be presented. The course equips students with the skills to review and conduct methodologically sound research as a part of their professional work. Students develop the skills to recognize and reflect on the strengths and limitations of different research methodologies, understand the links between theory and practice, critically assess research, and address ethical and practical issues. The course takes a step-by-step approach to the design and implementation of quantitative and qualitative techniques including case study and precedent studies, surveys, interviews, focus groups, participant observation, textual and media analysis.					

OHSA206	**OCCUPATIONAL HEALTH AND SAFETY**	(3,0,0)3	3	FC	-	English
Course Content	This course provides engineering students with a comprehensive understanding of occupational safety and health management principles in various industries. Topics covered include the development of safety and health functions, hazard avoidance concepts, the impact of regulations, handling toxic substances, environmental control, noise, explosive materials, fire protection, personal protection, and first aid. By the end of the course, students will be equipped with the knowledge and skills to create safe working environments, implement safety measures, and effectively manage occupational safety and health concerns in professional settings.					
CMPE321	**MICROPROCESSORS**	(3,0,2)4	6	AC	ELEE211	English
Course Content	The Microprocessors course covers the main components and working principles of microprocessors, focusing on the Intel 80x86 family architecture. Topics include memory organization, assembly programming, and debugging. Students will develop programs for arithmetic, BCD, ASCII operations, and perform input/output device programming. They will learn to handle keyboard input, display characters or strings on the screen, and convert data to ASCII, packed BCD, and unpacked BCD formats. The course also explores properties and interfacing of parallel and serial ports, and designing microprocessor-based systems, using the real-world example of the 80x86 IBM PC. By the end of the course, students will have essential skills to work with microprocessors and develop practical applications.					
CMPE341	**DATABASE SYSTEMS**	(3,0,2)4	5	AC	CMPE215	English
Course Content	This is a database management system introduction course. The lectures' primary goal is to show students how to conceptually model data and then implement that model in SQL. The focus of the lectures is on practical aspects of data modeling, including normalization and the creation of entity connection diagrams. Oracle is used in the labs to teach SQL. The purpose of lab work is to thoroughly introduce SQL and, in particular, the SQL data manipulation language statement. The learner will be able to create databases for use in industry after completing this course.					
AINE301	**BASIC SEARCH METHODS**	(3,0,0)3	5	AC	MATH124 AINE201	English
Course Content	Basic Search Methods equips students with essential algorithms pivotal for artificial intelligence proficiency. The course covers a range of fundamental search strategies: Informed Search algorithms like A* use heuristic functions to guide search efficiently towards the goal. Heuristics provide approximate solutions and Admissible Heuristics ensure these are never overestimated. Local Search methods like Hill Climbing iteratively improve solutions by making small changes. Metaheuristics such as Genetic Algorithms optimize complex problems inspired by biological evolution processes. Evolutionary Algorithms use principles from genetics and selection to iteratively improve solutions.					
SFWE343	**SOFWARE ANALYSIS AND DESIGN**	(2,0,2)3	5	AC	CMPE216	English
Course Content	The aim of this course is to introduce some fundamental principles of the software engineering discipline and illustrate the application of those principles in the context of a real-life project. Main topics covered are software process models, rapid software development and prototyping, agile software development, Initial design, modularity, structure charts, partitioning using UML, database design, software metrics, risk analysis and management, testing and quality assurance, software estimation techniques, software quality, and configuration management. Upon completion of this course, the students analytical skills will be enhanced. Meanwhile, they will learn how to understand the customer's language and how to explore the customer's goals in context.					
AINE312	**DATA SCIENCE**	(3,0,0)3	5	AC	-	English
Course Content	Data Science introduces the fundamental processes and lifecycle of data science. It covers the reading, representation, manipulation, and storage of complex datasets. Emphasis is placed on Data Exploration and wrangling techniques, including cleaning and imputing missing data. The course addresses Data Visualization methods for effective communication of insights. It distinguishes between Supervised and Unsupervised Learning approaches, exploring classification and regression techniques. Students learn to evaluate model performance and assess the degree of fit. Dimensionality reduction methods such as Principal Component Analysis are introduced, along with attribute selection using forward and backward selection methods.					
ANIE332	**DEEP NEURAL NETWORKS**	(3,0,0)3	6	AC	-	English
Course Content	Deep Neural Networks covers foundational topics such as the Perceptron learning algorithm and its convergence theorem. It delves into advanced concepts like the Multilayer Perceptron, learning mechanisms employing gradient descent and the backpropagation algorithm. Students explore nuances such as the impact of learning rate and momentum terms, addressing overfitting and techniques for generalization like regularization and weight elimination. The course also discusses challenges like the vanishing gradient problem and introduces Convolutional Networks, pivotal for tasks involving image and signal processing.					
AINE334	**KNOWLEDGE RPRESENTATION AND REASONING**	(3,0,0)3	5	AC	-	English
Course Content	Knowledge Representation & Reasoning provides both theoretical foundations and practical skills in representing and reasoning with knowledge. It covers essential topics such as propositional and first-order predicate logic for structured knowledge representation. The course explores Resolution and Description Logics as formal languages for expressing knowledge. Students learn various reasoning techniques including forward and backward chaining in rule-based systems. Additionally, the curriculum includes studying Frames, Ontologies, and Semantic Nets as organizational structures for knowledge. The course concludes with an exploration of Uncertainty and Probabilistic Reasoning in decision-making contexts.					
AINE403	**SUMMER TRAINING**	(0,0,0)0	2	FC	-	English
Course Content	Engineering summer training is a 40-day internship for engineering students to apply theoretical knowledge from their Bachelor's studies in a professional setting. The training can take place in any institution related to Artficial Intelligence Engineering. Students work on real-life tasks, interact with professionals, and explore their interests within the industry. After the third year of their studies, they write summer training reports summarizing their experiences. A committee evaluates these reports to assess the students' internship performance. The training aims to bridge the gap between academia and industry, enabling students to better prepare for future career opportunities and make informed decisions about their professional path.					
ENGR401	**ENGINEERING DESIGN-I**	(1,0,2)2	6	FC	-	English
Course Content	Engineering Design is a crucial activity for engineering students, involving various phases of the design process. Students work in teams under supervision to complete interdisciplinary capstone projects over one academic year, spanning ENGR401 and ENGR402 courses. ENGR401 covers problem formulation, technical surveys, detailed problem study, analysis, and methodical initial solution formulation. The course requires comprehensive preliminary design documentation for solving a realistic and complex computer engineering problem, applying skills gained throughout the undergraduate program. Students present progress through reports and presentations during the semester and at its conclusion. This extended exercise aims to cultivate professional application and experience in engineering design.					

AINE413	MACHINE LEARNING	(3,0,0)3	6	AC	-	English
Course Content	Machine Learning covers fundamental objectives and techniques essential for understanding and implementing predictive models. Topics include linear prediction and regression methods, along with advanced inference techniques like maximum likelihood, maximum a posteriori, and Bayesian inference. The course explores strategies for handling overfitting and enhancing model generalization through regularization and cross-validation. In supervised learning, students delve into generative and discriminative approaches, parametric and nonparametric methods, and algorithms such as logistic regression, Naïve-Bayes classifiers, neural networks, and support vector machines. Unsupervised learning topics include clustering, k-means, decision trees, dimensionality reduction techniques, and kernel methods.					
ENGR402	ENGINEERING DESIGN-II	(0,4,2)3	6	FC	ENGR104	English
Course Content	This course is the sequel to ENGR401. It consists of the implementation of a realistic, preferably interdisciplinary, engineering capstone design project emphasizing engineering design principles on an electrical and electronic engineering topic. It is carried out by a team of students under the supervision of an instructor. The team must complete the detailed design and implementation of the preliminary design they started in the ENGR401 course. It is an extended exercise in the professional application of the knowledge, experience and skills gained in the undergraduate program. The team has to complete analysis, design, implementation, testing and documentation of a proto-type or actual engineered product, present it and submit a final report in the technical project report format.					
ENGR404	ENGINEERING ATRIBUTES AND ATHICS	(2,0,0)2	3	FC	-	English
Course Content	Engineering Attributes and Ethics is a final year course which aims to provide knowledge and awareness of a number of important engineering issues. The knowledge areas include but are not limited to: professionalism, ethics, project management, sustainable development, risk management, change management, standards, health, environment, hazards, workplace health and security, societal issues as well as contemporary issues reflecting on the applications of the engineering profession. Awareness areas include but are not limited to entrepreneurship, innovation and the legal ramifications of the engineering solutions.					

Course Descriptions – II: Area Elective courses offered by the department of the program.

Course Code	Course Title	Credit	ECTS Credit	Course Catego.	Pre-requisite	Teaching Language
SFWE316	INTERNET AND WEB PROGRAMMING	(3,0,0)3	6	AE	-	English
Course Content	This course is an introduction to programming for the World Wide Web. Students will learn about the relationship between clients and servers, how the internet works, and how web pages are constructed using several technologies. The following topics will be covered: HyperText Markup Language (HTML) for authoring web pages; Cascading Style Sheets (CSS) for applying stylistic information to web pages; JavaScript (JS) for creating interactive web pages; Asynchronous JavaScript and XML (Ajax) for enhanced web interaction and applications; PHP web services for handling and responding to web service requests; and Structured Query Language (SQL) for interacting with databases. After successfully completing this course, a student should be able to Support the development of web pages.					
SFWE431	HUMAN COMPUTER INTERACTION	(3,0,0)3	6	AE		English
Course Content	The course introduces students to analysis, design, and evaluation of the interaction between people and information and communication technologies. The aim is to give students an adequate understanding of the concepts of usability, user experience, and user-centered design. Special attention is given to understanding the lifecycle of interaction design with special emphasis on using qualitative and quantitative methods in establishing requirements and evaluating interactive technologies. Students will learn about current developments in the fields of interaction design and human-computer interaction.					
SFWE412	SOFTWARE QUALITY ASSURANCE	(3,0,1)3	6	AE	-	English
Course Content	This comprehensive course delves into the critical aspects of software verification and validation, emphasizing both static and dynamic quality assurance activities throughout the software lifecycle. Students will explore various testing methodologies, including unit, integration, system, and usability testing, while learning to apply metrics that quantify testing strength and program complexity. The course covers advanced techniques for engineering robust software systems, encompassing requirements gathering, specification development, validation, and verification processes. Participants will gain proficiency in diverse modeling paradigms, such as information, behavior, domain, function, and constraint models, and become familiar with specification languages. This knowledge equips students to develop high-quality, reliable software solutions in real-world scenarios.					
AINE431	EXPERT SYSTEMS	(3,0,1)3	6	AE	-	English
Course Content	This course introduces intelligent agent principles, searching, knowledge and reasoning, planning, learning, and expert systems. Students will discover how theory and application complement each other in this course. Theory and application are both presented. Students will be introduced to problem-oriented languages, which they can use to create their own expert systems. Students will obtain an understanding of the role of expert systems in today's society by merging theory with a fully functional way of applying that theory to real-world problems.					
AINE471	INTRODUCTION TO DATA ANALYSIS	(2,0,2)3	6	AE	-	English
Course Content	Data analytics is the art and science of turning large quantities of usually incomprehensive data into meaningful and commercially valuable information. It includes several IT areas, such as statistical methods for identifying patterns in data and making inferences; database technologies for managing the data sets to be mined; a range of intelligent technologies that derive automatically patterns from data; and visualisation and other multimedia techniques that support human pattern discovery capabilities. This subject offers the foundations of data analytics, data mining and knowledge discovery methods and their application to practical problems.					
AINE481	ETHICS OF ARTIFICIAL INTELLIGENCE	(2,0,2)3	6	AE	-	English
Course Content	Ethics of Artificial Intelligence" examines the moral implications and societal impacts of AI technologies. Students will explore key ethical principles in AI development, including fairness, transparency, and accountability. The course covers techniques for detecting and mitigating algorithmic biases, enhancing AI explainability, and ensuring privacy. Through case studies and projects, students will develop skills to navigate ethical dilemmas in AI applications. The course also investigates limitations of current ethical AI approaches and discusses trade-offs between ethical considerations and technical performance. Students will gain knowledge to develop AI systems that are both technologically advanced and ethically sound.					

AINE421	**FUNDAMENTALS OF COMPUTER VISION**	(3,0,0)3	6	AE	-	English
Course Content	Computer vision is the interdisciplinary field that enables machines to gain high-level understanding from digital images and videos. It seeks to automate tasks that the human visual system can do, combining theories from artificial intelligence, machine learning, and computer graphics. This course introduces the fundamental concepts and techniques of computer vision, including image formation, feature detection, object recognition, and scene understanding. Students will explore both classical algorithms and modern deep learning approaches that power today's visual perception systems. Through hands-on projects, students will implement vision algorithms to solve real-world problems such as facial recognition, object tracking, and image classification. The course also examines current limitations and challenges in computer vision systems, preparing students to contribute to this rapidly evolving field in both research and industry applications.					
AINE441	**NEURAL COMPUTATION**	(3,0,0)3	6	AE	-	English
Course Content	Neural computation explores the theory and implementation of algorithms inspired by the structure and function of biological neural systems. This course introduces fundamental concepts of neural networks, covering key architectures from perceptrons to modern deep learning models. Students will learn essential training algorithms, optimization techniques, and regularization methods for improving model performance. Through practical assignments, students will implement neural networks to solve problems in pattern recognition, classification, and prediction. The course also examines the challenges and limitations of current neural computation approaches, providing students with both theoretical understanding and practical skills needed for applying neural networks to complex real-world problems.					
AINE451	**AI IN SECURITY**	(3,0,0)3	6	AE	-	English
Course Content	Artificial Intelligence in Security explores the application of AI technologies to cybersecurity challenges and threats. This course examines how machine learning and AI systems can enhance security measures through anomaly detection, threat intelligence, and automated response mechanisms. Students will learn about AI-powered security tools for malware detection, network traffic analysis, and vulnerability assessment. The course covers both offensive and defensive applications, including the use of AI in penetration testing and the vulnerabilities of AI systems themselves to adversarial attacks. Through case studies and hands-on exercises, students will develop skills to implement and evaluate AI security solutions while understanding the ethical implications and limitations of automated security systems. Students will gain practical knowledge for leveraging AI to strengthen defense strategies in an increasingly complex threat landscape.					
AINE461	**ROBOTICS AND AI**	(3,0,0)3	6	AE	-	English
Course Content	Robotics and AI integrates artificial intelligence principles with robotic systems to create intelligent machines capable of autonomous operation in complex environments. This course explores the fundamental concepts of robotic perception, planning, and control alongside AI techniques that enable adaptive behavior. Students will learn about sensor integration, computer vision for robotics, motion planning algorithms, and machine learning approaches for robot decision-making. The curriculum covers both theoretical foundations and practical implementation through hands-on projects using robotic platforms. Students will design and program robots to solve real-world tasks, gaining experience with current robotics software frameworks and hardware interfaces. The course also examines ethical considerations and societal impacts of autonomous robotic systems, preparing students for careers in this rapidly evolving interdisciplinary field that bridges physical engineering with artificial intelligence.					
CMPE463	**CLOUD COMPUTING**	(3,0,0)3	6	AE	-	English
Course Content	This course focuses on the use of the most popular cloud computing applications and services that run on a distributed network using virtualized resources and are accessed by common Internet protocols and networking standards. Its architecture, abstraction, virtualization, infrastructure, scaling deployments, machine learning in the cloud, data management, security, and privacy in the cloud will be discussed in detail. On successful completion of this course, students should be able to: Explain Cloud Computing abstraction and virtualization; Describe cloud storage services, pros and cons; Use different cloud storage services; Work with cloud APIs and SDKs; Describe machine learning in the cloud; Secure data in the cloud; and Build their own cloud with open stack.					
CMPE474	**INTRODUCTION TO PARALLEL COMPUTING**	(3,0,0)3	6	AE	-	English
Course Content	This course focuses on designing effective programs that take advantage of the extraordinary power afforded by modern parallel computers and allow the programs to achieve the highest levels of performance. Parallel computing is widely used. Parallel computing is commonly used to meet speed and efficiency goals in everything from embedded devices and laptops to high-end supercomputers and large-scale data centers. Multi-core processors, as well as clusters and supercomputers built from them, are examples of parallel computers. The course focuses more on how to use these programming systems to achieve and increase high performance than on the mechanics of these systems. In addition, the course presents an appropriate analytical framework for understanding performance, such as performance models, scalability analysis, and iso-efficiency.					
ELEE471	**DIGITAL IMAGE PROCESSING**	(3,0,3)3	6	FE	-	English
Course Content	The signal and Image Processing course is organized to introduce the fundamentals of digital signal and image processing techniques. The emphasis will be on analysis tools, the design of digital filters, and the computation of the Discrete Fourier Transform (DFT). The course is designed to give all the fundamental concepts in digital image processing with an emphasis on spatial filtering, frequency domain filtering, image enhancement, image restoration, compression, and segmentation. Morphological image processing and the introduction to object recognition are the last topics of the course. Included these topics, the interpolation techniques, frequency domain filtering, and image-averaging methods for noise removal are important topics covered. The studied methods are experimented with using a simulator program.					
ELEE435	**INTRODUCTION TO ROBOTICS**	(3,0,3)3	6	FE	-	English
Course Content	This course introduces fundamentals of robot control. Brief review about robots, hardware and robot problems will be explained to give a general idea about the use of robotics. Various types of basic sensors are also be discussed under the issue of robot hardware. Agent function design will be taught to gain robot control algorithm development and design. Robot control programming with mostly used controllers and related programming language concepts will also be covered to improve hardware programming skills of participants of this course. Lectures give the background to the extensive hands-on practical work using the laboratories A practical project will be performed to have an experience about to control a real robot with microcontroller.					