



## College of Engineering

### Master of Science in Artificial Intelligence Systems

Year I - Semester 1		
Course Code	Course Title	CH
EEM 600	Principles of Artificial Intelligence	4
EEM 601	Statistical Data Analysis and Research Methods	4
EEM 602	Internet of Things (IoT)	4

Year I - Semester 2		
AIE 603	Machine Learning	4
AIE 604	Deep Learning Applications	4
AIE 605	Special Topics in Artificial Intelligence	4

Year II - Semester 3-4		
EEM 699	Thesis	12

**Total Credit Hours 36**

#### COURSES DESCRIPTION:

Course Code:	EEM 600	Course Title:	Principles of Artificial Intelligence
Course Description:	Historical background and foundations of artificial intelligence. Major Development of AI; the Philosophical Background. Introduction to concepts of		

	Intelligent agents and their use for Engineering applications. The search algorithms and concepts (A* search and iterative deepening methods). Classes of AI and Concepts of computational AI. Artificial Intelligence versus Machine learning and Deep Learning. AI as Logical formalisms, propositional and first order predicate calculus Planning, from STRIPS to other Partial Order Planning Probability and uncertainty, the Bayesian inference and Bayes computational networks. Machine learning. AI based decision trees. Classes of ANN Neural Nets. The hill climbing, and genetic programming (algorithms). Other classes of Engineering AI, Vision systems, IoT, Bigdata, Robotics, and Computational Systems. AI and Ethics: The Ethical Principles of AI. AI Management, principles and fundamentals.
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<b>Course Code:</b>	<b>EEM 601</b>	<b>Course Title:</b>	<b>Statistical Data Analysis and Research Methods</b>
Course Description:	This applied course is designed for graduate students. The goals of the course are to develop the skills necessary to identify an appropriate statistical technique, estimate models, analyze data, and interpret results for independent research and to critically evaluate contemporary research using advanced quantitative methods. The course will include descriptive and inference statistics, hypothesis testing, confidence intervals, processing and analysis of research data using different parametric and nonparametric statistical methods, regression analysis for linear and nonlinear models, and introduction to the design of experiments. Research methods, research ideas through literature survey, planning and designing specific methods for conducting research, analyzing data using scientific methodology and presenting research results in a systematic and objective way.		

<b>Course Code:</b>	<b>EEM 602</b>	<b>Course Title:</b>	<b>Internet of Things (IoT)</b>
Course Description:	This advanced course delivers an understanding of engineering aspects of Embedded Systems and Internet of Things and their enabling smart everywhere applications, like in power systems smart grid, smart cities, smart home, industrial automation, telemetry, etc. Typical architectures of IoT systems are introduced, including microcontrollers and sensors. It is industrially focused, tailored to the demands of companies that design and manufacture mobile electronic equipment which interfaces with wireless networks and applications. Students will also learn how to use typical IoT enabling communications technologies.		

<b>Course Code:</b>	<b>AIE 603</b>	<b>Course Title:</b>	<b>Machine Learning</b>
<b>Course Description:</b>	<p>The purpose of the Machine Learning is to present to learners with more details about creating algorithms using different ML techniques, Regression, Classification, and Time Series Modelling for engineering domain applications. The Machine Learning content also covers the most popular and widely used Deep Learning technologies and their applications, as well as Natural Language Processing, thus, paving the way for a solid foundation of Machine Learning Further, in this Machine Learning online course, learners will learn how to extract predictions from data using MATLAB as coding environment. All the below computational algorithms will be used for engineering aspects of applications. More details, about machine learning.</p> <p>Introduction to Machine Learning  Supervised Learning and Linear Regression  Classification and Logistic Regression  Decision Tree and Random Forest  Design of ANN- Hardware Neural Networks  Naïve Bayes and Support Vector Machine  Unsupervised Learning  Fuzzy Clustering  Natural Language Processing and Text Mining  Time Series Analysis  Predication  Advanced Predication  Examples and Applications with Coding</p>		

<b>Course Code:</b>	<b>AIE 604</b>	<b>Course Title:</b>	<b>Deep Learning Applications</b>
<b>Course Description:</b>	<p>The purpose of the Deep Learning is to present to learners with more details about one of the latest engineering applications of AI and machine learning in daily basis. This includes: smartphone apps, power grids, helping to find solutions to climate change, and other more issues. This course will rather lead to profitable roles in IT, engineering healthcare, FinTech, e-commerce, and other industries. Deep Learning is one of the most highly sought-after skills in AI. In this course, learners will also learn the foundations of Deep Learning, understand how to build advanced ANN, successful machine learning projects for engineers. Learners will learn Convolutional networks, RNNs, LSTM, Adam, Dropout, BatchNorm, Xavier/He initialization.</p> <p>Syllabus: More details, about DEEP LEARNING:</p>		

	<p>CNN-Convolutional Neural Networks          Invariance, stability          Variability models, deformation model, stochastic model.          Scattering networks          Supervised Learning: classification.          Properties of CNN representations: invertibility, stability, invariance.          covariance/invariance: capsules and related models.          Connections with other models: dictionary learning, LISTA.          Localization, Regression, and Embeddings, DrLim, and inverse problems          Extensions to noneuclidean domains          Dynamical systems: RNNs          Deep Unsupervised Learning          Autoencoders, standard, denoising, contractive          Variational Autoencoders, Adversarial Generative Networks          Maximum Entropy Distributions          Non-convex optimization for deep networks, Stochastic Optimization          Attention and Memory Models          Examples and Applications with Coding.</p>
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Course Code:	AIE 605	Course Title:	Special Topics in Artificial Intelligence
Course Description:	<p>AI has several demanding engineering applications. For this course, depending on the request of the requirements of majority of the M.Sc. Candidates, special topics in AI in engineering will be offered. This course will focus on one (or multiple) of the following topics that is used in Artificial Intelligence.</p> <p><u>(i) AI ENGINEERING FOR HEALTHCARE:</u> AI has been tremendously introduced in the area of healthcare and the engineering aspects of tools and devices. Given this fact, this special topic within this course will rather focus on how engineers will use AI tools and how can be applied into verities of healthcare engineering aspects. Related topics are; AI-powered predictive care, engineering tools for connected Network Hospitals, connected care, better patient and staff experiences, in addition to Bigdata Mining and Analysis while relying on engineering uses.</p> <p><u>(ii) MECHATRONICS AND AI FOR INDUSTRY 4.0 ENGINEERING:</u> AI has also been fully utilized within several sectors related to engineering industry and the Industry 4.0. Given this fact, for the industrial use of artificial intelligence in Industry 4.0 engineering, it is therefore necessary to consider concepts that include distributed, high-performance engineering hardware together with adapted algorithms and coding algorithms. Local analysis of data, enables independent operation and establishes inherent</p>		

data security. Processing as close as possible to the data sources process-integrated sensors, low latency and improved quality of results in analysis. This special topic will help to establish standards related to the use of AI in engineering the work for Industry 4.0.

(iii) EDUCATIONAL AI SYSTEMS: An important special topic of AI is in daily life and related use of AI in education. AI can affect large number of sectors related to education and related engineering of devices used for that purpose. This includes the engineering of systems related to classrooms monitoring, home use of distance education, student support, which is a growing use in higher education institutions. Schools utilize machine learning in student guidance. AI applications can indeed help students automatically schedule their course load. Others recommend courses, majors, and career paths—as is traditionally done by guidance counselors or career services offices. Students performance with similar data profiles performed in the past. Within this special topic of AI in education, we are coloring the educational profile and enhancing its discrepancies according to students profiles.

(iv) CIVIL ENGINEERING AND TRANSPORTATION AI SYSTEMS: AI has found itself within the civil engineering and transportation arena. For example, safety of passengers, walking pedestrians, and for drivers has always been the number one concern for the transportation. There are several models that have been validated for the use of AI for civil engineering sectors and applications. With benefits of AI models so far, and rather than decrease the number of human errors; transportation analytics assists in minimizing effects of driving hazards in crowded areas, while also monitoring safety regulation compliance and vehicle maintenance reports, AI can provide better management for the transportation sector. This also includes, Plan and schedule efficiently, Predict and monitor of traffic for engineering works, and safety for road users.

(v) ROBOTICS ENGINEERING APPLICATIONS: Artificial Intelligence has been extensively applied and used within the robotics industry. Within this specialization, candidates will be more focused towards design of engineering-based systems for robotics applications. This includes drones, vision systems, motion and navigation systems, and building interactions with human behavior.

(VI) NATURAL LANGUAGE PROCESSING SYSTEMS: Deep studying of principles behind human language and the related building of systems. This topic also includes the use of Machine Learning tools for building of AI hardware for related applications. Mapping to given input in natural language into useful representations (written and speaking).

Course Code:	<b>EEM 699</b>	Course Title:	<b>Thesis</b>
Course Description:	The last semester of the Master program provides the student with an opportunity to undertake extensive investigation of an advanced or specialized topic relating to his/her MSc program; to provide the opportunity to plan and execute a significant project of research, investigation or development.		