ISLAMIC UNIVERSITY OF TECHNOLOGY

Course Outline and Course Plan

Course Teachers	**Mr. Asif Newaz, Lecturer** **Mr. Ahmad Shafiullah** **Mr. X7** **Mr. X8**		
Department	Electrical and Electronic Engineering Department (EEE)	**Program**	B. Sc. in Electrical and Electronic Engineering
Course Code	EEE 4710	**Course Title**	Artificial Intelligence and Machine Learning
Academic Year	2022- 2023	**Semester**	7th
Contact Hours	1.5	**Credit Hours**	0.75
Textbooks and Reference books (if any)	1. Machine Learning 2. Pattern Recognition and Machine Learning 3. Artificial Intelligence: A Modern Approach	**Authors of the books**	1. Tom Mitchell 2. Christopher M. Bishop 3. Stuart Russell and Peter Norvig
Prerequisites (If any)	N/A	Curriculum Requirement	Compulsory
Course Homepage			
Teaching Methods/ Approaches	☑ **Lecture**	☐ **Group discussion**	☑ **Demonstration**	☑ **Problem-solving**
	☐ **Project**	☑ **Others: Presentation**		
Tools	**MATLAB, Python**			
Teaching aids	☑ **Multi-media**	☑ **OHP**	☑ **Board and Marker**	☐ **Others**

Assessment type:	**Attendance & Class Performance (15%)**	**Assignments (15%)**	**Open-ended Lab (15% + 15% = 30%)**	**Lab Quiz (40%)**
Week/Date	Every Alternate Week	Every Alternate Week	TBA	TBA

Course Content	Introduction to Python programming. Important libraries: Pandas, Scikit-Learn, Seaborn, NumPy, Matplotlib. Exploratory Data Analysis (EDA). Outlier detection, Missing data handling, Correlation analysis. ML pipeline: Data preparation, validation, modelling, performance evaluation; Handling imbalanced data, Various performance measures, Cross-validation; Hyperparameter tuning, Feature Selection; Convolutional Neural Network (CNN) .
Course Objectives	This course aims to provide the students with: 1. Develop an understanding of the concepts of AI and its applications in different domains using Python. 2. Develop an understanding of the fundamentals of ML algorithms and learn to apply the concept in solving real-world problems.

Course Outcomes (COs)	**CO1 – Understand** the basics of data analysis using python. **CO2** – **Learn** the basic concepts of AI algorithms and ML pipeline. **CO3** – **Apply** the AI tools in real-world applications.

Mapping of COs, POs, and Bloom's Taxonomy			
CO No.	**Course Outcomes (CO) Statement**	**Levels of Bloom's Taxonomy**	**Matching with Program Outcome (PO)**
CO1	**Understand** the basics of data analysis using python.	C4, P1, A3	PO2
CO2	**Learn** the basic concepts of AI algorithms and ML pipeline.	C2, P4, A1	PO1
CO3	**Apply** the AI tools in real-world applications.	C3, P3, A2	PO3, PO4, PO5

Weeks	**Topics**
1 & 2	Introduction to Python: Pandas, Scikit-Learn, Seaborn, Numpy.
3 & 4	Exploratory Data Analysis (EDA) – Data preprocessing, Outlier detection, correlation analysis.
5 & 6	Open Ended Lab – 01 ML pipeline: Data preparation, validation, modelling, performance evaluation.
7 & 8	Handling imbalanced data, Various performance measures, Cross-validation
9 & 10	Hyperparameter tuning, Feature Selection
11 & 12	Open Ended Lab – 02 Convolutional Neural Network (CNN)
13 & 14	Lab Final Examination, Viva

Mapping of Course Outcomes (COs) and Program Outcomes (POs) and Evaluation Methods				
Assessment Method	**Marks (as %)**	Mark distributions (as %) on COs and POs		
		CO1	CO2	CO3
		PO1	PO1	PO3, PO4, PO5
Attendance and Class Performance	15%			15%
Assignment	15%			15%
Open ended labs	30%	15%		15%
Lab Final	40%	10%	20%	10%
Total	100%	25%	20%	55%

Mapping between COs and POs												
Course Outcome (CO)	**Program Outcomes (POs)**											
	1	2	3	4	5	6	7	8	9	10	11	12
CO1- Understand the fundamental ideas behind AI and ML.		√										
CO2 - Learn the basic concepts of AI & ML algorithms.	√											
CO3 - Apply the AI & ML tools in real-world applications.			√	√	√							

Program Outcomes (POs: PO1 ~ PO12)	
PO No.	**Program Outcomes (POs)**
	Upon graduation, from the Bachelor of Science in Electrical and Electronic Engineering program, the students are expected to have the ability to:
PO1	**Engineering knowledge:** Apply knowledge of mathematics, natural science, engineering fundamentals and an engineering specialization to the solution of complex electrical and electronic engineering problems.
PO2	**Problem analysis:** Identify, formulate, research literature and analyse complex electrical and electronic engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences and engineering sciences.
PO3	**Design/development of solutions**: Design solutions for complex electrical and electronic engineering problems and design systems, components or processes that meet specified needs with appropriate consideration for public health and safety, cultural, societal, and environmental considerations.
PO4	**Investigation:** Conduct investigations of complex electrical and electronic engineering problems using research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of information to provide valid conclusions.
PO5	**Modern tool usage:** Create, select and apply appropriate techniques, resources, and modern engineering and IT tools, including prediction and modelling, to complex electrical and electronic engineering problems, with an understanding of the limitations.
PO6	**The engineer and society:** Apply reasoning informed by contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to professional engineering practice and solutions to complex electrical and electronic engineering problems.
PO7	**Environment and sustainability:** Understand and evaluate the sustainability and impact of professional engineering work in the solution of complex electrical and electronic engineering problems in societal and environmental contexts.
PO8	**Ethics:** Apply ethical principles embedded with religious values, professional ethics and responsibilities, and norms of electrical and electronic engineering practice.
PO9	**Individual work and teamwork:** Function effectively as an individual, and as a member or leader in diverse teams and in multi-disciplinary settings.
PO10	**Communication:** Communicate effectively on complex engineering activities with the engineering community and with society at large, such as being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.
PO11	**Project management and finance:** Demonstrate knowledge and understanding of engineering management principles and economic decision-making and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.
PO12	**Life-long learning:** Recognize the need for and have the preparation and ability to engage in independent and life-long learning in the context of electrical and electronic engineering related technological change.

K

Table 4.1: Knowledge Profile

	Attribute
K1	A systematic, theory-based understanding of the natural sciences applicable to the discipline
K2	Conceptually based mathematics, numerical analysis, statistics and the formal aspects of computer and information science to support analysis and modeling applicable to the discipline
K3	A systematic, theory-based formulation of engineering fundamentals required in the engineering discipline
K4	Engineering specialist knowledge that provides theoretical frameworks and bodies of knowledge for the accepted practice areas in the engineering discipline; much is at the forefront of the discipline
K5	Knowledge that supports engineering design in a practice area
K6	Knowledge of engineering practice (technology) in the practice areas in the engineering discipline
K7	Comprehension of the role of engineering in society and identified issues in engineering practice in the discipline: ethics and the engineer's professional responsibility to public safety; the impacts of engineering activity; economic, social, cultural, environmental and sustainability
K8	Engagement with selected knowledge in the research literature of the discipline

P

Table 4.2: Range of Complex Engineering Problem Solving

Attribute	**Complex Engineering Problems** have characteristic P1 and some or all of P2 to P7:
Depth of knowledge required	P1: Cannot be resolved without in-depth engineering knowledge at the level of one or more of K3, K4, K5, K6 or K8 which allows a fundamentals-based, first principles analytical approach
Range of conflicting requirements	P2: Involve wide-ranging or conflicting technical, engineering and other issues
Depth of analysis required	P3: Have no obvious solution and require abstract thinking, originality in analysis to formulate suitable models
Familiarity of issues	P4: Involve infrequently encountered issues
Extent of applicable codes	P5: Are outside problems encompassed by standards and codes of practice for professional engineering
Extent of stakeholder involvement and conflicting requirements	P6: Involve diverse groups of stakeholders with widely varying needs
Interdependence	P7: Are high-level problems including many component parts or sub-problems

A

Table 4.3: Range of Complex Engineering Activities

Attribute	**Complex activities** means (engineering) activities or projects that have some or all of the following characteristics:
Range of resources	A1: Involve the use of diverse resources (and for this purpose resources include people, money, equipment, materials, information and technologies)
Level of interaction	A2: Require resolution of significant problems arising from interactions between wide-ranging or conflicting technical, engineering or other issues
Innovation	A3: Involve creative use of engineering principles and research-based knowledge in novel ways
Consequences for society and the environment	A4: Have significant consequences in a range of contexts, characterized by difficulty of prediction and mitigation
Familiarity	A5: Can extend beyond previous experiences by applying principles-based approaches

Grading Policy

Numeric Grade	Letter Grade	Grade Point
80% and above	A+	4.00
75% to less than 80%	A	3.75
70% to less than 75%	A-	3.50
65% to less than 70%	B+	3.25
60% to less than 65%	B	3.00
55% to less than 60%	B-	2.75
50% to less than 55%	C+	2.50
45% to less than 50%	C	2.25
40% to less than 45%	D	2.00
Less than 40%	F	0.00

Class Schedule

Section	Day	Time
A1/A2	Monday	08.00 – 10.30
B1/B2	Tuesday	10.30 – 01.00
C1/C2	Friday	08.00 – 10.30

Consulting hours for the students:
Monday: 10:30 AM - 01:00 PM
Thursday: 09:15 AM - 10:30 PM

Instructor Contact Details

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