Course Specification

(Bachelor)

Course Title:	Machine Learning
Course Code:	ITEC314
Program: :	Bachelor In Information Technology (BIT)
Department:	Information Technology & Security
College:	College Of Engineering & Computer Science
Institution:	Jazan University
Version:	1.2
Last Revision Date:	01/02/2025

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A. General information about the course:

Course Identification					
1. Credit hours:	**3**				
2. Course type					
a.	University ☐	College ☐	Department☒	Track☒	Others☐
b.	Required ☐	Elective☒			
3. Level/year at which this course is offered:	**6**				
4. Course general Description					
With the increased availability of data from varied sources there has been increasing attention paid to the various data driven disciplines such as analytics and machine learning. This course is intended to introduce some of the basic concepts of machine learning in algorithmic perspective. This course will familiarize students with a broad cross-section of models and algorithms for machine learning, and prepare students for the application of machine learning techniques. Topics covered in this course include, Machine learning types, linear and non-linear regression, nonparametric methods, Bayesian methods, support vector machines, kernel methods, Artificial Neural Networks, model selection, learning theory, VC dimension, clustering, EM, dimensionality reduction, PCA, SVD, and reinforcement learning. The course will also facilitate the students to solve real world problems using machine learning techniques.					
5. Pre-requirements for this course (if any): NIL					
6. Co- requirements for this course (if any): NIL					
7. Course Main Objective(s)					
On completion of this course, students will be able to:					
• Understand the concept of machine learning • Select appropriate machine learning models for different data problems. • Apply algorithms to solve real-world problems. • Design and analysis of ML experiments					

1. Teaching mode (mark all that apply)

No	Mode of Instruction	Contact Hours	Percentage
1.	Traditional classroom	64	100
2.	E-learning	No credit- Blackboard LMS is used as a e-learning tool for assignments, projects and video tutorials.	
3.	Hybrid • Traditional classroom • E-learning		
4.	Distance learning		

2. Contact Hours (based on the academic semester)

No	Activity	Contact Hours
1.	Lectures	28
2.	Laboratory/Studio	28
3.	Field	-
4.	Tutorial	-
5.	Others (specify) Revision & Exam	10
	Total	64

B. Course Learning Outcomes (CLOs), Teaching Strategies and Assessment Methods

Code	Course Learning Outcomes	CLOs aligned with program	Teaching Strategies	Assessment Methods	ABET Student Outcomes (SOs)
1.0	Knowledge and understanding				
1.1	**Gain** a solid understanding of core machine learning principles.	K1	Visual & Verbal [Lectures / Presentations]	Mid Term, Quiz, Final Exam	SO1
1.2	**Understand** and **relate** the principles of Bayes decision theory, parametric methods, and multivariate methods, with machine learning based decision scenarios.	K2	Visual & Verbal [Lectures / Presentations]	Mid Term, Final Exam	SO1
2.0	Skills				
2.1	**Examine** the process of learning a class, critically evaluating the factors that contribute to effective class learning in supervised machine learning.	S1	Visual & Verbal [Lectures / Presentations]	Final Lab Exam, Final Exam	SO2
2.2	**Select and use** dimensionality reduction, clustering, deep learning, and reinforcement learning techniques in various data problems, demonstrating a hands-on understanding of these algorithms and methodologies.	S2	Visual & Verbal [Lectures / Lab Practical]	Final Lab Exam, Final Exam	SO2

Code	Course Learning Outcomes	CLOs aligned with program	Teaching Strategies	Assessment Methods	ABET Student Outcomes (SOs)
2.3	**Evaluate** various performance measures used in machine learning, comparing their suitability for different tasks and understanding the implications of selecting specific metrics.	S2	Visual & Verbal [Lectures / Lab Practical]	Final Lab Exam, Final Exam	SO2
3.0	Values, autonomy, and responsibility				
3.1	**Implement** real world machine learning problems and **interpret** their results.	V3	[Brainstorming] [Student teacher discussion]	Mini Project, Final Exam	SO3

C. Course Content

No	List of Topics	Contact Hours
	Chapter 1: Machine Learning Basics ○ What is Machine Learning? ○ Types of Learning ○ Supervised Learning ○ Unsupervised Learning ○ Reinforcement Learning ○ Examples of Machine Learning ○ Machine Learning Opportunities ○ Machine Learning Challenges **Bayesian Decision Theory**	4T + 4P
	Chapter 2: Supervised Learning ○ **Classification** ○ Learning a Class ○ Probably Approximately Correct Learning ○ Noise ○ Learning multiple classes ○ **Regression** ○ Popular Supervised learning algorithms	6T + 6P

	Chapter 3: Unsupervised Learning ○ Dimensionality Reduction ○ PCA/Factor Analysis ○ Clustering/K-means Clustering	6T + 6P
	Chapter 4: Deep Learning and Reinforcement Learning ○ **Deep Learning** ○ Deep Neural Networks ○ Back Propagation ○ Regularization ○ **Reinforcement Learning** ○ Model based learning ○ Temporal difference learning ○ Q learning/Deep Q Learning	4T + 4P
	Chapter 5: Design and Analysis of ML Experiments ○ Guidelines for ML Experiments ○ Cross Validation ○ Bootstrapping ○ Performance Measures	4T + 4P
	Revision/Lab/Exam Discussion	2T + 2P
Total		26T + 26P

D. Students Assessment Activities

No	Assessment Activities *	Assessment timing (in week no)	Percentage of Total Assessment Score
1.	Assignment -1	2nd Week	10%
2.	Mini-project/Assignment-2	5th Week	15%
3.	Midterm Exam (in the scheduled class)	7th /8h Week	15%
4.	Final Lab Exam	13th Week	20%
5.	Final Theory Exam	14th Week	40%

*Assessment Activities (i.e., Written test, oral test, oral presentation, group project, essay, etc.)

E. Learning Resources and Facilities

1. References and Learning Resources

Essential References	• Ethem Alpaydin, Introduction to Machine Learning, Third Edition, MIT Press, 2014

	• Stephen Marsland, Machine Learning – An Algorithmic Perspective‖, Second Edition, Chapman and Hall/CRC Machine Learning and Pattern Recognition Series, 2014.
Supportive References	• Peter Flach, Machine Learning: The Art and Science of Algorithms that Make Sense of Data‖, First Edition, Cambridge University Press, 2012. • Chris Bishop, Pattern Recognition and Machine Learning, 2006. • Tom M Mitchell, Machine Learning, First Edition, McGraw Hill Education, 2013 • Jason Bell, —Machine learning – Hands on for Developers and Technical Professionals‖, First Edition, Wiley, 2014
Electronic Materials	
Other Learning Materials	**Text books:** • Mathematics for Machine Learning: https://mml-book.github.io/ **Data Resources:** • UC Irvine Machine Learning Repository https://archive.ics.uci.edu/ml/index.php • Variety of consumer datasets https://www.kaggle.com/datasets • World Bank https://data.worldbank.org/data-catalog/ • US Government Data https://www.data.gov/

2. Required Facilities and equipment

Items	Resources
facilities (Classrooms, laboratories, exhibition rooms, simulation rooms, etc.)	PC with internet connection Projector, Smart Board
Technology equipment (projector, smart board, software)	IDEs: Pycharm/Jupiter notebook/Google Colab Programing: Python/R Libraries: Panda, Scipy, Numpy Framework: Keras EDA tools: Matplotlib, Seaborn
Other equipment (depending on the nature of the specialty)	-

F. Assessment of Course Quality

Assessment Areas/Issues	Assessor	Assessment Methods
Effectiveness of teaching	HOD	Direct

Assessment Areas/Issues	Assessor	Assessment Methods
Effectiveness of students assessment	HOD	Direct
Quality of learning resources	CTs & TL	Direct
The extent to which CLOs have been achieved	CTs & CC	Direct
Course Materials, Teaching Methods	Students	Indirect

Assessor (Students, Faculty, Program Leaders, Peer Reviewer, Others (specify)
Assessment Methods (Direct, Indirect)

G. Specification Approval Data

COUNCIL /COMMITTEE	DEPARTMENT COUNCIL
REFERENCE NO.	
DATE	