جامعة البحرين
University of Bahrain
مركز ضمان الجودة والاعتماد الأكاديمي
Quality Assurance and Accreditation Center

Academic Course Specification Form

استمارة توصيف المقرر الأكاديمي

القسم الخاص بالطالب
Section Concerning the Student

1. Course Code:	**ITCE 381**	.1 رمز المقرر:
2. Course Title	**Applied Machine Learning**	.2 اسم المقرر:
3. College:	College of Science	.3 الكلية:
4. Department:	Department of Mathematics	.4 القسم:
5. Academic Program:	**Bachelor of Science in Mathematics**	.5 البرنامج الأكاديمي:
6. Course Credits:	3-0-3	.6 عدد الساعات المعتمدة:
7. Course NQF Level	7	.7 مستوى المقرر وفقا للإطار الوطني للمؤهلات:
8. Notional Hours:	119	.8 عدد الساعات الافتراضية:
9. NQF Credits	12	.9 عدد الساعات المعتمدة للمقرر وفقا للإطار الوطني للمؤهلات:
10. Prerequisite:	ITCS 214 & STAT 371	.10 المتطلب المسبق للمقرر:
11. Lectures Timing & Location:	TBA	.11 وقت المحاضرة ومكانها:
12. General Mode of Teaching and Learning	Tranditional تقليدي	.12 النمط العام للتعليم والتعلّم:
13. Course Coordinator:	TBA	.13 منسق المقرر:
14. Course Instructor:	TBA	.14 مدرس المقرر:
15. Office Hours and Location:	TBA	.15 الساعات المكتبية ومكانها:
16. Instructor's Email:	TBA	.16 البريد الإلكتروني لمدرس المقرر:
17. Academic Year:	Click or tap here to enter text.	.17 السنة الأكاديمية:
18. Semester:	First Semester الفصل الأول	.18 الفصل الدراسي:

19. Textbook(s):	19. الكتب الدراسية للمقرر:
Raschka, Sebastian, et al. Machine Learning with PyTorch and Scikit-Learn: Develop machine learning and deep learning models with Python. Packt Publishing Ltd, 2022.	
20. References:	**20. المراجع:**
21. Other learning resources used (e.g. e-Learning, field visits, periodicals, software, etc.):	**21. مصادر أخرى (مثال : التعلم الالكتروني، زيارات ميدانية، دورات، برامج كمبيوتر، الخ....)**
E-Learning: Backboard, Microsoft Teams Software: VS Code, Jupiter Notebook	
22. Course Description (as published in the College Catalogue):	**22. توصيف المقرر(حسبما ورد في دليل الكلية):**
This course covers the basics of machine learning with a focus on applications and programming. Topics include: linear regression, logistic regression, multiclass classification, Neural Networks, Support Vector Machines (SVMs), K-Nearest Neighbor (KNN), k-means clustering.	

23. Course Intended Learning Outcomes (3 to 5 CILOs):	**23. مخرجات التعلّم للمقرر (CILOs) (3 إلى 5 مخرجات تعلّمية):**
1. Define the main concepts and applications of machine learning	
2. Evaluate and program supervised machine learning algorithms	
3. Evaluate and program unsupervised machine learning algorithms	
4. Use mainstream frameworks to implement and test machine learning algorithms	
5. Apply deep learning techniques to solve real-world problems in a course project	

24. Course Assessment Percentages (As per Regulations of Study and Examination at the University of Bahrain):	**24. أساليب التقويم ونسبها المئوية (بحسب نظام الدراسة والامتحانات في جامعة البحرين):**
Examinations / Midterm	20%
Practical Home Assignments	20%
Term Project / Case studies	20%
Final Exam	40%
Total	**100%**

25. Description of Topics Covered:	**25. وصف الموضوعات التي ينبغي تناولها:**
Topic Title **(e.g. chapter/experiment title)** **الموضوع**	***Description*** **التفصيل**
Supervised Learning	The topic includes algorithms for supervised learning such as linear regression, logistic regression, neural networks, etc.
Unsupervised Learning	The topic includes algorithms for unsupervised learning such as K-means, isolation trees, etc.
Machine Learning Programming	The topic reviews the Python programming language and important libraries and packages for machine learning (examples: NumPy, matplotlib, pandas, etc.)
Machine Learning Frameworks	The topic introduces a mainstream machine learning/deep learning framework (Examples: scikit-learn + TensorFlow or Pytorch). The objective of the topic is to enable students to train, test and deploy models using the framework.

26. Weekly Schedule				26. الجدول الأسبوعي:
Week **الإسبوع**	**Date** **التاريخ**	**Topics Covered** **المواضيع المعروضة**	**CILOs** **المخرجات التعلُمية للمقرر (CILOs)**	**Teaching/Assessment Mode and Method** **منهجية ونمط التدريس/التقييم**
01		**Introduction to Python**: NumPy, Matplotlib, pandas and scikit-learn datasets package	1, 4	Traditional Teaching تدريس تقليدي
02		**Linear regression**: intuition, model training process, cost function, gradient descent algorithm	1, 2, 4	
03		**Practical Considerations**: model evaluation, training with fixed epochs, early stoppage using a validation set	1, 2, 4	
04		**Practical Considerations**: handling non-linearity (Polynomial Regression), feature scaling, model underfitting, model overfitting, regularization, cross-validation (k-fold), pipelines and grid search hyperparameter tuning in scikit-learn.	1, 2, 4	
05		**Classification with logistic regression**: activation functions, binary classification, multiclass classification (One vs, All), SoftMax activation for multiclass classification, classification evaluation metrics	1, 2, 4	
06		**K-Nearest Neighbors (KNN)**: classification and regression, distance metrics. **Dimensionality Reduction with PCA**: the curse of dimensionality, intuition, best practices with PCA	1, 2, 4	
07		**Unsupervised learning with K-means**: clustering intuition, initialization of centroids, K-means^{++}, choosing optimal k (elbow method), evaluation metrics	1, 3, 4	
08		**Text feature extraction example**: bag of words model implementation with scikit-learn **Image feature extraction example**: Histogram of Oriented Gradients (HOG) with scikit-learn	1, 4	
09		**Support Vector Machine (SVM)**: intuition, outliers and soft margins, the kernel trick, SVM kernel functions, SVM hyperparameters	1, 2, 4	
10		**Decision Trees**: intuition, training with entropy and information gain, tree ensemble, bagging, boosting, random forest, XGboost	1, 2, 4	
11		**Anomaly detection with unsupervised and semi-supervised methods**: isolation forest, single-class- SVM	1, 3, 4	
12		**Neural Networks**: intuition and training with backpropagation, implementation of simple Multilayer Perceptron (MLP) with scikit-learn **Introduction to deep learning frameworks**: training a neural network with Keras + TensorFlow	1, 2, 4	
13		**Convolutional Neural Network**: intuition, convolution layers, pooling layers **Transfer learning example**: using pre-trained models for image classification	1, 2 , 4	
14		Project Demos	5	
15		REVISION	-	

10 Academic Integrity Statement:	27. بيان النزاهة الأكاديمية:
Students are to observe the highest level of honesty and academic ethics in pursuit of their academic goals as per UOB Regulations of Student Conduct and Academic Integrity, Anti-plagiarism Policies, and Students' Rights and Responsibilities Handbook. The consequences for cheating, plagiarism, unauthorized collaboration, and other forms of academic dishonesty can be very serious and will be dealt with as per the aforementioned policies and regulations.	يعتبر الصدق والنزاهة عنصران أساسيان في العملية الأكاديمية. حيث يُتوقع من الطلاب خلال سعيهم لتحقيق أهدافهم الأكاديمية التحلى بالأمانة والأخلاق في جميع الأوقات، وذلك وفقًا للوائح والأنظمة الخاصة بطلبة جامعة البحرين، بالإضافة إلى دليل حقوق الطلبة وواجباتهم، وكما جاء في سياسة الانتحال الخاصة بجامعة البحرين. حيث سيتم التعامل مع أي انتهاك للنزاهة الأكاديمية بحسب ما تنص عليه السياسات والأنظمة السابق ذكرها.
11 Attendance and Absence Regulations:	**28. نظام الحضور والغياب:**
Students are required to adhere to regular attendance for class lectures and practical sessions, as determined by the nature of the course, as per Article (33), of Regulations of Study and Examination at the University of Bahrain.	يُتوقع من الطلاب الالتزام بالحضور المنتظم للساعات الصفية والعملية بحسب طبيعة المقرر، وفقًا للمادة (33)، من نظام الدراسة والامتحانات في جامعة البحرين.