Academic Program Description Form

University Name: Al- Nahrain University

Faculty/Institute: College of Science

Scientific Department: Computer Science

Academic or Professional Program Name: Master Degree in Computer Science

Final Certificate Name: Master Degree in Computer Science

Academic System: Semesters – Bologna Process

Description Preparation Date: 2025-2026

File Completion Date: 17/11/2025

Signature: K H · A ·

Head of Department Name:

Assi. Prof. Dr. Khamael Al-Dulaimi

Date:

Signature:

Scientific Associate Name:

Assist. Prof Dr. Manaf Adnan Saleh

Date:

The file is checked by: Dr. Orooba Nadhim Harbi

Department of Quality Assurance and University Performance

Director of the Quality Assurance and University Performance Department:
Dr. Orooba Nadhim Harbi

Date: 17 / 11 / 2025

Signature:

Republic of Iraq
Ministry of Higher Education and Scientific Research
Al-Nahrain University / College of Science
Dean's office

Approval of the Dean

Prof. Dr. Asmaa Hadi Mohammed

Course Description Form

1. Course Name:
Big Data
2. Course Code:
3. Semester / Year:
First Semester/MSc
4. Description Preparation Date:
1-9-2025
5. Available Attendance Forms:
Traditional Attendance (in-person) Blended Attendance
6. Number of Credit Hours (Total) / Number of Units (Total)
30/2
7. Course administrator's name (mention all, if more than one name)
Dr. Suhad A. Yousif Email:suhad.a.yousif@nahrainuniv.edu.iq
8. Course Objectives

Course Objectives	• Fundamental Understanding of Big Data Concepts: Ensure students grasp key concepts such as data volume, velocity, variety, and veracity. Discuss the evolution and significance of big data in modern computing. • Proficiency in Big Data Technologies: Teach students about various big data technologies and platforms like Hadoop, Spark, NoSQL databases, and cloud-based big data solutions. • Data Analytics and Processing Skills: Develop students' ability to perform data analytics, including the use of statistical methods, machine learning algorithms, and data mining techniques suitable for large datasets. Data Management and Storage: Educate on effective methods for storing, retrieving, and managing big data, including distributed file systems, data warehousing, and data lakes. • Practical Application and Problem Solving: Provide hands-on experience through projects or case studies that involve real-world big data challenges, encouraging students to apply their knowledge to solve practical problems.

9. Teaching and Learning Strategies

Strategy	• Flipped Classroom: Assign foundational material (readings, tutorials, or recorded lectures) for students to review before class. • Use in-class time for practical activities like coding, problem-solving, or case study discussions. • b. Hands-On Lab: Provide datasets and tasks requiring students to use tools like Apache Spark, Hadoop, SQL, Python (Pandas, NumPy). • c. Project-Based Learning • Assign semester-long group projects where students design, implement, and present a Big Data solution. • Include datasets and scenarios from domains like healthcare, finance, or social media to diversify learning. • e. Peer Learning: Encourage group activities, discussions, and code reviews to enhance collaborative skills and knowledge sharing.

10. Course Structure

Week	**Hours**	**Required Learning Outcomes**	**Unit or subject name**	**Learning method**	**Evaluation method**
Week	Hours	ILOs	Unit/Module or Topic Title	Teaching Method	Assessment Method
1	2	What is Big data?	✓ Characteristics of Big Data (Volume, Velocity, Variety, Veracity, Value) ✓ Importance and Applications of Big Data	**Lectures Presentation**	**Lab for coding**

2	2	Big Data Technologies and Ecosystem	✓ Hadoop, Spark, NoSQL databases, and other key technologies ✓ Overview of Big Data processing frameworks ✓ Understanding data storage options	=	=
3	2	Distributed File Systems and Data Storage	✓ HDFS (Hadoop Distributed File System) ✓ Data replication and fault tolerance ✓ Storage strategies for big data	=	=
4	2	MapReduce and Hadoop	✓ Introduction to MapReduce ✓ Hadoop ecosystem components ✓ Writing MapReduce programs	=	=
5	2	Apache Spark	✓ Introduction to Spark ✓ RDDs (Resilient Distributed Datasets) ✓ Spark transformations and actions	=	=

6	2	Introduction to Data Analytics	✓ Types of analytics (Descriptive, Diagnostic, Predictive, Prescriptive) ✓ Data mining and machine learning ✓ Data visualization for insights	=	=
7	2	Advanced Analytics with Spark	✓ Machine learning libraries in Spark	=	=
8	2	Advanced Analytics with Spark	✓ Building and evaluating predictive models' performance.	=	=
9	2	NoSQL Database Concepts	✓ Introduction to NoSQL databases ✓ Types of NoSQL databases (Document, Key-Value, Column-Family, Graph)	=	=
10	2	Hands-on with NoSQL Databases	✓ A comparison between common NoSQL databases.	=	=

11	2	Cloud Computing and Big Data	✓ Introduction to cloud platforms (AWS, Azure, GCP) ✓ Deploying big data solutions in the cloud ✓ Cost considerations and scalability	=	=
12	2	Mid Exam		=	=
13	2	Project Kickoff	✓ Explanation of the course project ✓ Choosing a dataset and problem statement ✓ Forming project teams	=	=
14	2	Project Work Sessions	✓ Guided project work sessions ✓ Project presentations and feedback	=	=

11. Course Evaluation

20% for the formal final writing exam
10 % for the practical exam
70 % for the formal final writing exam

12. Learning and Teaching Resources

Required textbooks (curricular books any)	• **"Big Data: Principles and Best Practices of Scalable Real-Time Data Systems"** • Author: Nathan Marz and James Warren

	• Focus: Core concepts and architecture of Big Data systems, real-time data processing. • **"Big Data Processing with Apache Spark"** • Author: Srini Penchikala • Focus: Hands-on guidance on using Apache Spark for processing large datasets.
Main references (sources)	• **"Mining of Massive Datasets"** • Authors: Jure Leskovec, Anand Rajaraman, and Jeffrey D. Ullman • Focus: Algorithms and techniques for analyzing large-scale data.
Recommended books and references (scientific journals, reports…)	**Big Data and Business Analytics"** • Editors: Jay Liebowitz • Focus: Applications of Big Data in business contexts. **Journal of Big Data** • Topics: Advances in Big Data analytics, machine learning, and applications. • Publisher: Springer. **IEEE Transactions on Big Data** • Topics: Research papers on Big Data systems, tools, and applications.
Electronic References, Websites	• **Coursera** Courses on Big Data by top universities (e.g., University of California San Diego's "Big Data Specialization"). • **edX** Big Data programs, such as MIT's "Data Science and Big Data Analytics.

	• **Apache Spark Documentation** URL: https://spark.apache.org/documentation.html • **Hadoop Documentation** URL: https://hadoop.apache.org/docs/ •

Course Description Form

1. Course Name:
Internet of Things
2. Course Code:
3. Semester / Year:
First Semester/ M.Sc. Year
4. Description Preparation Date:
20/10/2025
5. Available Attendance Forms:
- Theory Lectures - Practical Lab
6. Number of Credit Hours (Total) / Number of Units (Total)
60/2
7. Course administrator's name (mention all, if more than one name)
Name: Prof. Dr. Abdulkareem Merhej Radhi Email: Abdulkareem.merhej@nahrainuniv.edu.iq
8. Practical Teaching
Projects using C++ & Python
9. Course Objectives

Course Objectives	This course aims to Design and implement an Internet of Things system from scratch. During this course, students will acquire multiple skills in building different types of Internet of Things systems according to the proposed applications. They will also have the ability and skill in how to invest in artificial intelligence systems in building systems capable of analyzing data and making smart decisions. In addition to learning about the different protocols that are used to send and receive data to and from the various units that make up those systems.

10.	Teaching and Learning Strategies
Strategy	The main strategy that will be adopted in delivering this module is by explaining lectures in an interactive way by letting the students to participate in the presenting through questions and answers while at the same time refining and expanding their critical thinking skills. This will be achieved through classes and labs. This material includes: Introduction to how to use microcontrollers, microprocessors, and specialized programming languages in designing and implementing various applications. Also understanding the artificial intelligence algorithms that can be used to analyze data to make smart decisions and understanding the methods and means used to employ the World Wide Web to send and receive data from its various sources.

11. Course Structure					
Week	**Hours**	**Required Learning Outcomes**	**Unit or subject name**	**Learning method**	**Evaluation method**
1	2	A Brief History of IOT	Introduction to IOT	Theoretical Lectures	Quiz
2	2	What is the main Characteristics of IOT	Characteristics of IOT	Theoretical Lectures	Quiz
3	2	Concept of Logical and Physical Design	Logical and Physical Design	Theoretical Lectures	Quiz
4	2	Communications protocols in IOT	Communications Protocols in IOT	Theoretical Lectures	Quiz
5	2	Introduction to sensors	Sensors in IOT Networks	Theoretical Lectures	Quiz
6	2	M2M & IOT concepts	Difference between IOT and M2M	Theoretical Lectures	Quiz
7	2	Practical Applications	Some application of IOT		
8	2	Microcontrollers	Introduction to Microcontroller	Theoretical Lectures	Quiz
9	2	C++ & Python	Introduction to |Microcontroller Languages	Theoretical Lectures	Quiz
10	2	Microprocessor Concepts	Introduction to Microprocessor	Theoretical Lectures	Quiz
11	2	Python	Introduction to |Microprocessor Languages	Theoretical Lectures	Quiz
12	2	Cleaning & Transforming	Data Processing and Analysis	Theoretical Lectures	Quiz
13	2	Big Data using Cloud	Cloud Computing	Theoretical Lectures	Quiz
14	2	Data Analysis	Fog Computing	Theoretical Lectures	Quiz

15	2		Case Studies	Theoretical Lectures	Quiz

12.Practical Course Structure

Week	Hours	Required Learning Outcomes	Unit or subject name	Learning method	Evaluation method
1	2	IOT Project	Decision Making	Programming C++	Program complete
2	2		Microcontrollers	Programming C++	Program complete
3	2		Microcontrollers	Programming C++	Program complete
4	2		Microcontrollers	Programming C++	Program complete
5	2		Microprocessors	Programming Python	Program complete
6	2		Microprocessors	Programming Python	Program complete
7	2		Microprocessors	Programming Python	Program complete
8	2		Microprocessors	Programming Python	Program complete
9	2		Microprocessors	Programming Python	Program complete
10	2		Microprocessors	Programming Python	Program complete
11	2		Microprocessors	Programming Python	Program complete
12	2		Microprocessors	Programming Python	Program complete
13	2		Microprocessors	Programming Python	Program complete
14	2		Microprocessors	Programming Python	Program complete
15	2		Microprocessors	Programming Python	

13. Course Evaluation

10 Quizzes
5 Assignments
15 Lab
10 Report
10 Midterm Exam
50 Final Exam

14. Learning and Teaching Resources

Required textbooks (curricular books, if any)	1.Internet of Things: A Hands-On Approach: Arsheep Bahga & Vijay Madisetti, 2015. 2. Jan Holler, "From Machine-to-Machine to the Internet of Things: Introduction to a New Age of Intelligence", 1st Edition, Academic Press, 2014.
Main references (sources)	
Recommended books and references (scientific journals, reports…)	
Electronic References, Websites	

Course Description Form

1. Course Name:

Large Scale Machine Learning

2. Course Code:

3. Semester / Year:

First / MSc

4. Description Preparation Date:

20/10/2024

5. Available Attendance Forms:

In the class

6. Number of Credit Hours (Total) / Number of Units (Total)

Name: Prof. Dr. Ban N. Dhannoon
Email: ban.n.dhannoon@nahrainuniv.edu.iq

7. Course administrator's name (mention all, if more than one name)

8. Course Objectives

Course Objectives	• This course provides a quick and indirect introduction to the basic concepts and algorithms related to learning. • It includes the limitations and tools needed for software that can learn from data. • We'll cover a few of the benefits, the most commonly used ones (such as linear regression

9. Teaching and Learning Strategies

Strategy	• Present lectures in a PowerPoint slide show • Implement some algorithms manually to increase understanding • Request a program to implement a specific algorithm

10. Course Structure

Week	Hours	Required Learning Outcomes	Unit or subject name	Learning method	Evaluation method
1	3	learning, ML life cycle, Main Challenges of ML (Data, Model, Ethical Challenges), Types of data, Bias and Variance in ML, overfitting and underfitting	General Introduction	PowerPoint	
2	3	Neural Networks, architecture, learning MLP	ML Techniques	PowerPoint	

		Dropout Activation Functions NN example with BP			
3	3	Model Validation, Linear Regression model with example	Learning Methods	PowerPoint	
4	3	Types of GD, • Statistics of Regression Analysis (r and r-squared), with example • Normal Equation with example	Gradient Descent in Linear Regression	PowerPoint and on–board	
5	3	• Data Sets, Objects, and Attribute Types; • Measuring the Central Tendency (mean, median, mode), • Symmetric vs Skewed data • Measuring the Dispersion of Data • Graphic Displays (Boxplot & Scatter plot)	Know your data	PowerPoint and on–board	
6	3	Mid1			
7	3	Assignment 1		PowerPoint	
8	3	• Data Visualization • Pixel-Oriented Techniques • Geometric -Oriented Techniques • Measuring similarity and dissimilarity • Proximity Measures for Nominal Attributes • Dissimilarity (Nominal) Example • Proximity Measures for Binary Attributes • Dissimilarity of Numeric Data	Data Visualization	PowerPoint and on–board	
		• Vector Objects • Cosine Similarity • Tanimoto coefficient (Tanimoto similarity) • Confusion matrix (binary vs multi classes) • statistical Measures			
9	3	Classification Algorithms • Logistic Regression • Decision Tree • Random Forest • Support Vector Machine	Supervised classification	PowerPoint and on–board	
10	3	• Naïve Bayes Classifier • K- Nearest Neighbors (classification and Regression)	Classification and regression	PowerPoint and onboard	
11	3	Mid2			
12	3	• Hard and soft clustering • Clustering Algorithms: • Centroid-based Clustering • Density-based Clustering	Clustering	PowerPoint	

		• Connectivity-based Clustering			
13	3	Hierarchical clustering	Unsupervised Learning	PowerPoint	
14	3	Feature Extraction and Selection	Dimensionality reduction	PowerPoint	
15	3	Association Rule mining	Frequent items		

1. Course Evaluation

Final Exam 70
Mid1 Exam 7.5
Mid2 Exam 7.5
Two monthly projects 10
Quizes 5

2. Learning and Teaching Resources

Required textbooks (curricular books, if any	Hands-On Machine Learning with Scikit-Learn and TensorFlow: Conce Tools, and Techniques to Build Intelligent Systems, Aurelien Geron, Ori 2023.
Main references (sources)	Machine Learning for Business Analytics, 2023
Recommended books and references (scientific journals, reports…)	Machine Learning Bookcamp, 2021
Electronic References, Websites	Stanford University Machine Learning CS229 Lecture notes by Andrew Ng. Youtube

Course Description Form

1. Course Name:
Computer Networks and Web Technology
2. Course Code:
3. Semester / Year:
1st / Master
4. Description Preparation Date:
06-02-2026
5. Available Attendance Forms:
Compulsory
6. Number of Credit Hours (Total) / Number of Units (Total)
45 Hours (Theory) / 3 Units
7. Course administrator's name (mention all, if more than one name)
Name: Dr. Jamal M. Kadhim Email: jamal.mohammed@nahrainuniv.edu.iq
8. Course Objectives

Course Objectives	• Understanding Computer networks. • Understanding 7-model layers. • Understanding protocols of each layer and packet journey from source to destination. • Understanding host addressing through IPv4.0 and IPv6.0.

9. Teaching and Learning Strategies	
Strategy	Lectures, problem classes

10. Course Structure

Week	Hours	Required Learning Outcomes	Unit or subject name	Learning method	Evaluation method
1	3		Introduction to computer Networking.	Formal Lectures	Class Activity
2	=		Application Layer.	=	Class Activity

3	=		Application Layer.	=	Class Activity
4	=		Transport Layer.	=	Class Activity
5	=		Transport Layer.	=	Class Activity
6	=		Client-server and wireshark program	=	Class Activity
7	=		First Mid-Exam	=	
8	=		Network Layer	=	Class Activity
9	=		Network Layer	=	Class Activity
10	=		Data Link Layer	=	Class Activity
11	=		Data Link Layer	=	Class Activity
12	=		Second mid-exam	=	Class Activity
13	=		Physical layer	=	Class Activity
14	=		Networking Tools	=	Class Activity

11. Course Evaluation

Distributing the score out of 100 according to the tasks assigned to the student such as daily preparation, daily oral, monthly, or written exams, reports .... etc

12. Learning and Teaching Resources

Required textbooks (curricular books, if any)	Computer networking : a top-down approach / James F. Kurose, Keith W. Ross.—7th ed.
Main references (sources)	
Recommended books and references (scientific journals, reports…)	
Electronic References, Websites	

Course Description Form

1. Course Name:
Computer Vision
2. Course Code:
3. Semester / Year:
Second Semester / Master year
4. Description Preparation Date:
1/2/2026
5. Available Attendance Forms:
Attendance Mandatory
6. Number of Credit Hours (Total) / Number of Units (Total)
30 Hours (theoretical) / 2 Units
7. Course administrator's name (mention all, if more than one name)
Name: Assist. Prof. Dr. Zainab Namh Abdula Email: zainab.namhabdula@nahrainuniv.edu.iq
8. Course Objectives

Course Objectives	This course explores the fundamental principles and practical applications of **Computer Vision**. It begins with an overview of the human visual system and the mathematical representation of images through color spaces, sampling, and quantization. Students will master essential image enhancement techniques, including spatial and frequency domain filtering (Fourier Transforms), and learn to segment images using methods like Otsu's and K-Means. The curriculum then shifts toward **Feature Extraction and Pattern Recognition**, covering edge detection (Sobel, Canny), corner detection (Harris), and advanced descriptors like HOG and Local Binary Patterns. Finally, the course dives into high-level tasks such as **Image Classification, Object Detection, and Face Detection**, while addressing real-world challenges like image augmentation and performance metrics (Precision/Recall).

9. Teaching and Learning Strategies	
Strategy	Lectures Project-Based Learning Seminars Frequent Quizzes

10. Course Structure

Week	Hours	Required Learning Outcomes	Unit or subject name	Learning method	Evaluation method
W1	2	Introduce the students to the concept of Computer Vision and gain an understanding of how the human visual system	Introduction to Computer Vision and applications Human Visual System overview and Color Spaces	Lecture Slides	Oral Questions
W2	2	students will gain a comprehensive understanding of how images are created and represented digitally then applying the concept of linear algebra and its applications in image manipulation	Image Formation Model Image sampling and quantization Affine Transformation	Lecture Slides	Oral Questions Homework
W3	2	Students will understand how pixels represent images digitally and how filters can modify image properties	Pixels and Filters Image Histograms Spatial Filters Correlation and Convolution	Lecture Slides	Oral Questions
W4	2	students will learn how to analyze and manipulate images based on their frequency components rather than just spatial details	Filtering in Frequency domain Discrete Fourier Transform	Lecture Slides	Oral Questions Quiz
W5	2	students will understand how to partition an image into meaningful regions, which is essential for object detection and recognition	Image Segmentation Otsu Method K -Means	Lecture Slides	Oral Questions
W6	2		Mid Exam 1		
W7	2	students will learn how to identify and highlight boundaries within images, which is fundamental for understanding shapes and objects	Edge Detection Sobel Filter Canny Edge Detection Image Filtering effect	Lecture Slides	Oral Questions and Homework
W8	2	students will gain skills in detecting essential geometric features in images	Hough Transform Harris Corner Detection	Lecture Slides	Oral Questions
W9+10	4	students will learn how to characterize images based on texture and structure at different scales.	Image Features Local vs Global Local Binary Pattern GLCM Histogram Oriented Gradients	Lecture Slides and Worked Examples	Quiz
W11	2		Mid exam 2		
W12	2	students will develop skills essential for building and	Image Classification Recall and Precision Problems	Lecture Slides and	Oral Questions

Week	Hours	Required Learning Outcomes	Unit or subject name	Learning method	Evaluation method
		evaluating effective image classification models.	Image Augmentation and Feature Engineering	Worked Examples	
W13	2	students will learn how to identify and locate multiple objects within an image or video frame,	Object Detection	Lecture Slides and Worked Examples	Oral Questions
W14	2	students will learn techniques to automatically identify and locate human faces in images or video streams	Face Detection	Lecture Slides and Worked Examples	Oral Questions
W15	2		Projects		

11.Course Evaluation

Assessment Type	Marks
Homework	5
Attendance	5
Mid Exam	20
Final Exam	70
Total	100

12.Learning and Teaching Resources

Required textbooks (curricular books, if any)	Computer Vision: Foundations and Applications © 2017 Compiled by Ranjay Krishna published by Stanford University Computer Vision: Algorithms and Applications by Richard Szeliski.
Main references (sources)	Digital Image Processing, 4th edition by Rafael C. Gonzalez • Richard E. Woods
Recommended books and references (scientific journals, reports...)	
Electronic References, Websites	https://www.ssla.co.uk/digital-image-processing https://www.sanfoundry.com/1000-digital-image-processing-questio answers/

Course Description Form

1. Course Name:
Cyber security
2. Course Code:
3. Semester / Year:
second semester/ MSc
4. Description Preparation Date:
1−2−2026
5. Available Attendance Forms:
6. Number of Credit Hours (Total) / Number of Units (Total)
30 h/2 units
7. Course administrator's name (mention all, if more than one name)
Name: Asst. Prof. Dr. Dalal N. Hamood Email: dalal.naeem@nahrainuniv.edu.iq
8. Course Objectives

Course Objectives	**This course is providing students with the knowledge and skills necess to protect systems and data from cyber threats.**

9. Teaching and Learning Strategies	
Strategy	Lectures Homework Problem-based learning Case studies

10. Course Structure

Week	Hours	Required Learning Outcomes	Unit or subject name	Learning method	Evaluation method
Week1	2		Networking an internet (infrastructure, software)	Lecture	Quiz
Week2	2		Understand the term cybercrime, hacking, Types of cybercrime	Lecture	Quiz

Week3	2		cyber security cyberspace	Lecture	Quiz
Week4	2		characteristics c cybersecurity layers of cybe security	Lecture	Quiz
Week5	2		File security Encrypt a file, folde drive. Set a passwor for files lik documents, spreadsheets, compressed files	Lecture	Quiz
Week6	2		Protection fro malware Understand how ant virus software work and its limitations. Understand that ant virus software shoul be installed o computers and devices	Lecture	Quiz
Week7	2		Network security Understand th function, limitations c a firewall in persona work environmen 3.1.5 Turn a person firewall on, off. Allov block an applicatio service/feature acces through a person firewall	Lecture	Quiz
Week8	2		Exam mid1		
Week9	2		Wireless security	Lecture	Quiz
Week10	2		Password Management Recognise goo password policies, lik adequate passwor length, adequate lette number and speci characters mix, n sharing password changing the regularly, differe passwords for differe services	Lecture	Quiz

Week11	2		Secure Browsing B aware that certai online activit (purchasing, banking should only b undertaken on secu web pages using secure networ connection.	Lecture	Quiz
Week12	2		. Secure websites	Lecture	Quiz
Week13	2		Email security (1) Understand the purpos of encryptin decrypting an e-mail	Lecture	Quiz
Week14	2		Email security (2 Understand the ter digital signature.	Lecture	Quiz
Week15	2		Exam mid2		

11. Course Evaluation

Distributing the score out of 100 according to the tasks assigned to the student such as daily preparation, daily oral, monthly, or written exams, seminar .... etc

12. Learning and Teaching Resources

Required textbooks (curricular books, if any)	
Main references (sources)	**Introduction to cyber security** 2017
Recommended books and references (scientific journals, reports…)	
Electronic References, Websites	Computer Lab + Java Language

Course Description Form

1. Course Name:
Deep Learning
2. Course Code:
M.Sc.
3. Semester / Year:
Second / MSc
4. Description Preparation Date:
20/12/2025
5. Available Attendance Forms:
In the class
6. Number of Credit Hours (Total) / Number of Units (Total)
45 hours / 3 units
7. Course administrator's name (mention all, if more than one name)
Name: Prof. Dr. Ban N. Dhannoon Email: ban.n.dhannoon@nahrainuniv.edu.iq
8. Course Objectives

Course Objectives	• **This course discusses the latest deep learning models that researchers are currently using. Different deep architectures and their components are discussed in detail.** • **It also discusses algorithms used to train deep architectures to improve deep models. These deep architectures are not only capable of learning complex tasks but can even outperform humans in some custom applications.**

9. Teaching and Learning Strategies

Strategy	**Provide lectures in PowerPoint slide show** **Execute selected methods for more understanding**

10. Course Structure

Week	Hours	Required Learning Outcomes	Unit or subject name	Learning method	Evaluation method
1	3	• Shallow Learning • Why to Use Deep Learning • How Deep Learning Works		Powerpoint	
2	3	• Convolutional Neural Network (ConvNet/CNN) Convolution Operation			

3	3	• Architecture of CNN.			
4	3	• Training Convolution Neural Networks Loss Functions and Softmax Classifier			
5	3	• Gradient Descent-Based Optimization Techniques Challenges in Training Deep Networks			
6	3	Mid 1			
7	3	• Weight Initialization Techniques			
8	3	• LeNet-5 • AlexNet			
9	3	• ZFNet • VGGNet			
10	3	• GoogleNet • ResNet			
11	3	• (DenseNet) • Capsule Network			
12		• Restricted Boltzmann Machine (RBM)			
13		Mid 2			
14	3	• Deep Belief Network Deep Autoencoders			
15	3	Generative Adversarial Networks			

11. Course Evaluation

Final Exam 70
Mid1 Exam 10
Mid2 Exam 10
Two monthly projects 10

12. Learning and Teaching Resources

Required textbooks (curricular books, if any	• Advances in Deep Learning, 2020
Main references (sources)	• Dive in Deep Learning 2019
Recommended books and references (scientific journals, reports…)	• The Little Book of Deep Learning, François Fleuret, 2023
Electronic References, Websites	• Youtube

Course Description Form

1. Course Name:
Information and Network Security
2. Course Code:
3. Semester / Year:
2nd / Master
4. Description Preparation Date:
06-02-2026
5. Available Attendance Forms:
Compulsory
6. Number of Credit Hours (Total) / Number of Units (Total)
45 Hours (Theory) / 3 Units
7. Course administrator's name (mention all, if more than one name)
Name: Dr. Jamal M. Kadhim Email: jamal.mohammedkadhim@nahrainuniv.edu.iq
8. Course Objectives

Course Objectives	*Understanding Computer Security.* *- Understanding Cryptography* *- Understanding Access Control.* *- Understanding Network Security Protocols*

9. Teaching and Learning Strategies	
Strategy	Lectures, problem classes

10. Course Structure

Week	Hours	Required Learning Outcomes	Unit or subject name	Learning method	Evaluation method
1	3		Introduction to ormation Security	Formal Lectures	Class Activity
2	=		Cryptography- Cry basics	=	Class Activity
3	=		Cryptography – Symme Key Crypto	=	Class Activity

4	=		Cryptography – Symme Key Crypto	=	Class Activity
5	=		Cryptography – Public Crypto	=	Class Activity
6	=		Cryptography – Public Crypto	=	Class Activity
7	=		Mid term Exam	=	
8	=		Access control Authentication	=	Class Activity
9	=		Access control Authentication	=	Class Activity
10	=		Access control Authorization	=	Class Activity
11	=		Access control Authorization	=	Class Activity
12	=		Second mid-exam	=	Class Activity
13	=		Simple Authenticat Protocols	=	Class Activity
14	=		Real World Secu Protocols	=	Class Activity

11. Course Evaluation

Distributing the score out of 100 according to the tasks assigned to the student such as daily preparation, daily oral, monthly, or written exams, reports .... etc

12. Learning and Teaching Resources

Required textbooks (curricular books, if any)	▪ Information Security: principles and practice, Mark Stamp 2012
Main references (sources)	
Recommended books and references (scientific journals, reports…)	
Electronic References, Websites	

Course Description Form

1. Course Name:

Data Coding and Data Compression

2. Course Code:

3. Semester / Year:

Second Semester/ 2025-2026

4. Description Preparation Date:

31march 2026

5. Available Attendance Forms:

Attendance Study

6. Number of Credit Hours (Total) / Number of Units (Total)

30

7. Course administrator's name (mention all, if more than one name)

Name: Assistant Prof. Abeer Khalid Al-Mashhadany

Email: abeer.khalidahmed@nahrainuniv.edu.iq

8. Course Objectives

Course Objectives	• Natural Language Processing (NLP) is a branch of Artificial Intelligence that studies how ma that can make sense of text and perform tasks like translation, summarization, gran mar ch Language Models, Naive Bayes and Sentiment Classification, Vector Semantics and Em Constituency Grammars, Logical Representations of Sentence Meaning, Machine Tra slator and Dialogue Systems and Chatbots.

9. Teaching and Learning Strategies

Strategy	• **Books, theoretical lectures and references to helpful websites** • **Providing the electronic presentation of the lecture…as an aid to clarifi ation** • **Explanation on the board and solving examples with integrated details** • **Design and implementation of practical programs for programming algo ithms** • **Solve multiple examples and engage the student by providing quick exer motivating students to follow up and correct each other.** • **Homework examples from the article** • **In addition to homework that focuses on strengthening the student's pr gram**

10. Course Structure

Week	Hours	Required Learning Outcomes	Unit or subject name	Learn

Week No.	Date	Title	Sub-Titles	Refere
1		**Introduction: purposes and tasks**		

2		N-gram Language Models	• The role of language models. • Simple N-gram models. • Estimating parameters and smoothing. • Evaluating language models.	
3		Naive Bayes and Sentiment Classification	• Naive Bayes Classifiers • Optimizing for Sentiment Analysis • Naive Bayes for other text classification tasks • Test sets and Cross-validation	
4				**Idle**
5		Vector Semantics and Embeddings	• Lexical Semantics • Vector Semantics • Words and Vectors • TF-IDF: Weighing terms in the vector • Optional: Pointwise Mutual Information (PMI) • Semantic properties of embeddings • Bias and Embeddings • Evaluating Vector Models	
6		**Mid 1**		
7		Part-of-Speech Tagging	• English Word Classes • The Penn Treebank Part-of-Speech Tagset • Part-of-Speech Tagging • HMM Part-of-Speech Tagging • Maximum Entropy Markov Models • Part-of-Speech Tagging for Morphological Rich Languages	
8		Constituency Grammars	• Context-Free Grammars • Grammar Rules for English • Treebanks • Grammar Equivalence and Normal Form • Lexicalized Grammars	

9		Training on Constituency Grammars	• Construct Grammar and train to solve NLP problems	
10		**idle**		
11		Logical Representations of Sentence Meaning	• Computational Desiderata for Representations • Model-Theoretic Semantics • First-Order Logic • Event and State Representations • Description Logics	
12		**Mid 2**		
13		Logical Representations of Sentence Meaning	Construct model from real information and train to solve NLP problems	
14		Real NLP problem	• Apply all given NLP tools to solve the problem	
15		**Seminar**		

11. Course Evaluation

Project	10
Seminar	05
Homeworks	05
Mid 1	05
Mid 2	05
Final Exam	70 marks

12. Learning and Teaching Resources

Required textbo (curricular books, if any	- "Speech and Language Processing", by Daniel Jurafsky, Jar es H 2024. - Natural Language Processing with Python, by Steven Bird, Ew 2024.
Main references (sourc	- "Speech and Language Processing", by Daniel Jurafsky, Ja Copyright c 2024.

	- Natural Language Processing with Python, by Steven Bird © 2024.
Recommended books and references (scientific journals, reports…)	- "Speech and Language Processing", by Daniel Jurafsky, Ja Copyright c 2024. - Natural Language Processing with Python, by Steven Bird © 2024.

Course Description Form

1. Course Name: Recommender Systems

2. Course Code:

3. Semester / Year: Second Semester/ Postgraduate Studies

4. Description Preparation Date:2025-2026

5. Available Attendance Forms: Full time

6. Number of Credit Hours (Total) / Number of Units (Total):30 hour\ 2 units

7. Course administrator's name (mention all, if more than one name)

Name: Ass. Prof.Dr.Nadia Fadhil AL-Bakri
Email: nadia.f.al-bakri@nahrainuniv.edu.iq

8. Course Objectives

Course Objectives	The fundamental and practical aspects of Recommender systems are are defined, focusing on theory as well as on the practical use and applications of Recommender systems. Recommendation systems are around us and are encountered on multiple domains such as e-commerce, content and media distribution, social media and so on. The course aims to explain both basics and advanced topics and concepts for recommended systems.

9. Teaching and Learning Strategies

Strategy	**Conceptual Introduction**: Start by introducing the fundamental concepts of recommen systems, such as collaborative filtering, content-based filtering, and hybrid methods. **Real-World Examples**: Use case studies and real-world examples to illustrate how recommender systems are used in various applications such as e-commerce, streaming services, social media, and online learning platforms. **Interactive Discussions**: Facilitate interactive discussions and debates on topics such as algorithmic bias, privacy concerns, ethical considerations, and the social implications of recommender systems. **Assessment**: Assess student learning through a variety of methods such as quizzes, exams, presentations, project reports, code reviews, and peer evaluations

10. Course Structure

Week	Hours	Required	Unit or subject name	Learning method	Evaluation method

1	2 theory		Introduction and basic taxonomy of recommender systems Recommender System Formal Definitions. Personalized verse Non-personalized RSs. Data and Knowledge Sources.	Formal Lectures	Class Activity
2	=		Recommender System challenges. Similarity measures and prediction formulas in RS.	Formal Lectures	Class Activity and Quiz
3	=		Collaborative Filtering (CF)-based Recommender System. Memory-BasedMethods (Neighborhood-Based). User-based Collaborative Filtering.	Formal Lectures	Class Activity
4	=		Item- Based Collaborative Filtering. Model-Based Collaborative Filtering Methods. Collaborative Filtering challenges.	Formal Lectures	Class Activity
5	=		Content-Based Recommender System. Content representation. Similarity-based retrieval. Content-Based challenges.	Formal Lectures	Class Activity
6	Mid1 exam				
7	=		Knowledge-based Recommendation. Knowledge representation and reasoning. Interacting with constraint-based recommenders.	Formal Lectures	Class Activity
8	=		Demographic Recommender System What is demographic features?	Formal Lectures	Class Activity

			Demographic based filtering. Demographic RS applications.		
9			Hybrid Recommendation Approaches Hybridization designs. Monolithic hybridization design.	Formal Lectures	Class Activity and Quiz
10,11	=		Recommender Systems and Linked Open Data. Semantics-aware Recommendation. Linked Open Data for Recommender Systems. Feeding Recommender Systems with LOD. Exploiting Semantic Distance in Linked Open Data for Recommendation	Formal Lectures	Class Activity and Quiz
12	Mid2				
13,14	=		Context-Aware Recommender Systems. Introduction and Motivation. What Is Context? Modeling Contextual Information in RS: Traditional Approach. Paradigms for Incorporating Context in RS.	Formal Lectures	Class Activity
15	=		Recommender Systems Evaluation. Recommender system metrics evaluation. Recommender system decision support.	Formal Lectures	Class Activity

11. Course Evaluation

Distributing the score out of 100 according to the tasks assigned to the student such as daily preparation, daily oral, monthly, or written exams, reports .... etc

12. Learning and Teaching Resources

Required textbooks (curricular books, if any)	1-Third Edition Springer 2022 Francesco Ricci • Lior Rokach • Bracha Shapir 2-Recommender Systems Algorithms and Applications Taylor & Francis Group,2021

	P. Pavan Kumar, S. Vairachilai, Sirisha Potluri,Sachi Nandan Mohanty 3-Recommender Systems An Introduction, Cambridge University Press,2011 DIETMARJANNACH,MARKUS ZANKER,ALEXANDER FELFERNIG GERHARDFRIEDRICH
Main references (sources)	Recommender Systems and Linked Open Data
Recommended books and references (scientific journals, reports…)	
Electronic References, Websites	

Course Description Form

1. Course Name:
Scientific Research Methodology
2. Course Code:
3. Semester / Year:
Semester-2/ 2026
4. Description Preparation Date:
5. Available Attendance Forms:
6. Number of Credit Hours (Total) / Number of Units (Total)
2 Hours / week
7. Course administrator's name (mention all, if more than one name)
Name: Zahraa A. Jaaz Email: zahraa.jaaz@nahrainuniv.edu.iq

8. Course Objectives	
Course Objectives	• **The course aims to provide students with the basic concepts of scientific research methodology, how to write a thesis and research paper, and how to link them with a practical research project.** • **In this course, we will focus on writing the thesis and research paper, as we focus on the structure of the thesis and research paper, the method of collecting data, and writing the results.** • **Examples, exercises and presentation reports that enhance their ability to write in an academic manner** • **Use the English language in writing using academic words and correct grammar**

9. Teaching and Learning Strategies	
Strategy	**Lecture—Showing** **Worked Examples** **Socratic Questioning** **Discussion-Based Learning** **Project-Based Learning**

10. Course Structure

Week	Hours	Required Learning Outcomes	Unit or subject name	Learning method	Evaluation method
W1	2		Introduction Structure of thesis Structure of manuscript	Lecture—Showing	
W2	2		How to write Introduction	Lecture—Showing	
W3	2		How to write Literature Review	Socratic Questioning And Discussion-Based Learning	Oral Questions
W4	2		Using terms in writing literature review	Worked Examples	Paper Quiz
W5	2		Poblem Identification & Formulation – Research Question – Investigation Question – Measurement Issues	Worked Examples	
W6	2		Research Design: Concept and Importance in Research – Features of a good research design –	Worked Examples	Online test
W7	2		Mid Exam		
W8	2		Collecting dataset Private dataset Public dataset	Socratic Questioning Discussion-Based Learning	Oral Questions
W9	2		Qualitative and Quantitative Research: Qualitative research – Quantitative research –	Worked Examples	Paper Quiz
W10	2		Data Analysis Data Preparation – Univariate analysis (frequency tables, bar charts, pie charts, percentages), Bivariate analysis – Cross tabulations and Chi-square test including testing hypothesis of association	Worked Examples	Online test
W11	2		Interpretation of Data and Paper Writing – Layout of a Research Paper, Journals in Computer Science, Impact factor of Journals, When and where to publish .		
W12	2		? Ethical issues related to publishing, Plagiarism and Self-Plagiarism	Worked Examples	Oral Questions
W13	2		Assignment-1 writing-research	Worked Examples	Paper Quiz

			paper		
W14	2		Assignment-2 Writing Literature review	Project-Based Learning	assignment
W15	2		Academic Databases for Computer Science Discipline.		

11. Course Evaluation

First Mid-Term Exam 10%
Report 10%
Quizzes 5%
Assignments 5%
Total: 30%
Final Exam 70%

12. Learning and Teaching Resources

Required textbo (curricular books, if any)	
Main references (sources)	Bailey S. Academic writing: A practical guide for students. Psychology Press; 2003.
Recommended books and references (scientific journals, reports...)	All published papers from springer, IEEE, ELSEIVER are related to computer science discipline
Electronic References, Websites	1- Oshima, A. and Hogue, A., 2007. *Introduction to academic writing* (p. 3). Pearson/Longman. 2- Irvin LL. What is academic writing. Writing spaces: Readings on writing. 2 Jun 18;1:3-17.