هيئة تقويم التعليم والتدريب
Education & Training Evaluation Commission

T-104
2022

Course Specification

Course Title:	**Artificial Neural Networks**
Course Code:	**442 COMP-3**
Program:	**Bachelor in Computer Science**
Department:	**Computer Science**
College:	**College of Computer Science and Information Technology**
Institution:	**Jazan University**
Version:	**V2**
Last Revision Date:	**12 September 2021**

Table of Contents:

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:		Level 14/5th Year			
4. Course general Description This course provides an introduction to artificial neural networks. It reviews biological neural networks, and presents a general framework to construct their mathematical models with a view to study their applications. It gives a historical view to the McCulloch-Pitts model, application of Rosenblatt's Perceptron learning model in both linear and non-linear classification problems and the Widrow-Hoff's model. It discusses important issues in the design, training, troubleshooting, and testing of neural network applications.					
5. Pre-requirements for this course (if any): COMP241- Artificial Intelligence					
6. Co- requirements for this course (if any): None					
7. Course Main Objective(s) • Familiarize students with the basic concepts and needs of neural networks in current area of computer science and engineering applications. • Describe and apply appropriate neural networks design techniques. • Designing a neural network using back propagation based on the nature of the problem. • Develop the skills required for designing, training, testing, and troubleshooting neural network applications on real world.					

1. Teaching mode (**mark all that apply)**

No	Mode of Instruction	Contact Hours	Percentage
1.	Traditional classroom	44	80%
2.	E-learning		
3.	Hybrid • Traditional classroom • E-learning		

No	Mode of Instruction	Contact Hours	Percentage
4.	Distance learning (Self Learning)	11	20%

2. Contact Hours (based on the academic semester)

No	Activity	Contact Hours
1.	Lectures	22
2.	Laboratory/Studio	22
3.	Field	
4.	Tutorial	
5.	Others (specify)	8
	Total	52

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

Code	Course Learning Outcomes	Code of CLOs aligned with program	Teaching Strategies	Assessment Methods
1.0	Knowledge and understanding			
1.1	Describe the basic concepts and fundamentals of Neural Network with learning Process	K1	Class lectures and lecture notes	Midterm/ Assignment / Final Exam/Final Lab
1.2	Compare the recent advances in neural network architectures and choose the appropriate architecture for a given problem.	K2	Research papers/ Class lectures/ lecture notes/ Case studies	Midterm/ Assignment 1/ Final Exam
2.0	Skills			
2.1	Analyze the working of single layer and multilayer perceptron	S1	Class lectures/ lecture notes/Case studies	Final Exam/ Mini Projects/ Assignment
2.2	Evaluate problem solving strategies to propose learning algorithm	S2	Class lectures/ lecture notes/ Case studies / Brainstorming	Final Exam/ Assignments
2.3	Implement the concept of artificial neural network in broad spectrum of data intensive applications in deep learning.	S4	Class lectures/ Presentations/ lab demonstrations	Final Exam/ Group Assignments / Final Lab

Code	Course Learning Outcomes	Code of CLOs aligned with program	Teaching Strategies	Assessment Methods
2.4	Create an end-to-end model to solve real world problems using artificial neural network techniques.	S3	Class lectures/ presentations/ lab demonstrations	Final Exam/ Group Assignments
3.0	Values, autonomy, and responsibility			
3.1	Recognize problems in various fields such as healthcare services, education, transport, food, security, etc. and propose a solution using neural networks.	V1	Small group discussion / Brainstorming/ Class discussion to train students to think independently	Group Assignments/ Final Exam
3.2	Demonstrate the ability to function effectively as a member of a team to analyse and solve a given task.	V2	Group discussion	Mini Project

C. Course Content

No	List of Topics	Contact Hours
1.	Chapter – 1 INTRODUCTION a) Introduction, Benefits of Neural Network, Human Brain, Models of Neuron b) Types of Activation Function, Network Architecture. Exercise Problems	2T + 2P
2.	Chapter – 2 LEARNING PROCESSES a) Introduction, Error Correction Learning, Memory Based Learning, b) Hebbian Learning, Competitive Learning c) Learning with a Teacher, Learning Without a Teacher, Pattern Association & Recognition Self-Study: Boltzmann Learning, Credit Assignment problem	3T + 3P
3.	Chapter – 3 SINGLE LAYER PERCEPTRONS a) Introduction, Adaptive Filtering Problem, Unconstrained Optimization Techniques, b) Newton Method, Gauss Newton Method, Perceptron, Relationship between the perception and Bayes classifier for a Gaussian Environment.	

	Self-Study: Methods of Steepest Descent	2T + 2P
4.	Chapter – 4 MULTILAYER PERCEPTRONS a) Introduction, Preliminaries, Backpropagation Algorithm, Activation function, Stopping Criteria b) Heuristics for making the back propagation algorithm, c) Feature Detection, Network Pruning Techniques d) Virtues and Limitations of Back propagation algorithm, Convolutional Networks Self-Study: Summary of Back Propagation Algorithm, XOR Problem	4T + 4P
5.	Chapter-5 INTRODUCTION TO DEEP LEARNING a) Introduction, Historical trends in Deep learning, Machine learning basics, Learning Algorithms, the performance measure, the experience b) A first look at neural network, Data representation for neural network c) Anatomy of neural network, Introduction to keras Self-Study: Preparing Labels, Models	3T + 3P
6.	Chapter – 6 NEURAL NETWORK APPLICATION a) NN Application Design, Data Representation, b) Internal Representation Issues, External Interpretation Issues, c) Creating Data Representations, Representing Time.	3T + 3P
7.	Chapter – 7 NEURAL NETWORK APPLICATION DESIGN & EXAMPLES a) Exemplar Analysis, Ensuring Coverage, Ensuring Coverage, Ensuring Consistency b) Training and Performance Evaluation, Example I: Predicting the Weather, c) A Note on Setting Desired Outputs, Example II: Face Recognition.	3T + 3P
8.	Lab Exam + Revision	2T + 2P
Total		22T+22P

D. Students Assessment Activities

No	Assessment Activities *	Assessment timing (in week no)	Percentage of Total Assessment Score
1.	Midterm Exam	6th-7th week	15%
2.	Assignment I	3rd week	10%
3.	Mini Project (Case Study/ Group assignment)	6th-7th week	15%
4.	Lab Exam + Lab Assignment	As per schedule	20%
5.	Final Theory Exam	As per schedule	40%
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*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	Neural Networks and Deep Learning By Charu C. Agarwal, 2018, ISBN:9783319944623.
Supportive References	Deep Learning with Python, Francois Chollet, 2018, ISBN: 9781617294433.
Electronic Materials	• Hinton, G. E., Plaut, D. C., and Shallice, T. (1993) Simulating brain damage.Scientifi American 269:76-82. • Optional enrichment: Kruschke, J. K. (1992) ALCOVE: An exmplar-based model of category learning.*Psychological Review* 99(1):22-44.
Other Learning Materials	Online tutorial

2. Required Facilities and equipment

Items	Resources
facilities (Classrooms, laboratories, exhibition rooms, simulation rooms, etc.)	• Classroom equipped with projector, whiteboard, and sufficient seating arrangements. • Lab with software installed and individual computer terminal for each student.
Technology equipment (projector, smart board, software)	• Whiteboards and projectors for classroom and labs • Python • An active internet connection.
Other equipment (depending on the nature of the specialty)	None

F. Assessment of Course Quality

Assessment Areas/Issues	Assessor	Assessment Methods
Effectiveness of teaching	Students	Indirect (Course evaluation survey form)
Effectiveness of students assessment	CRC / QAU / HoD	Direct (Course reports / result analysis)
Quality of learning resources	Track leaders / CRC	Indirect (Review, meetings and star rating with suggestions for further modification and improvements)
The extent to which CLOs have been achieved	CRC / QAU	Direct (CLO assessment template further verified at course coordinator, Track leader and QAU level)
Other		

Assessor (Students, Faculty, Program Leaders, Peer Reviewer, Others (specify)

Assessment Methods (Direct, Indirect)

G. Specification Approval Data

COUNCIL /COMMITTEE	DEPARTMENT COUNCIL
REFERENCE NO.	
DATE	15/10/2022