

MODULE DESCRIPTION FORM

نموذج وصف المادة الدراسية

Module Information				
معلومات المادة الدراسية				
Module Title	Artificial Neural Engineering		Module Delivery	
Module Type	Elective		☒ Theory ☐ Lecture ☒ Lab ☐ Tutorial ☐ Practical ☐ Seminar	
Module Code	MIET4107			
ECTS Credits	4			
SWL (hr/sem)	100			
Module Level	UGIV	Semester of Delivery		7
Administering Department	MIET	College	Faculty of engineering techniques	
Module Leader	Dr. Haider Mahdi		e-mail	Eng.Hayder@gmail.com
Module Leader's Acad. Title	Professor		Module Leader's Qualification	Ph.D.
Module Tutor	Dr. Haider Mahdi		e-mail	E-mail
Peer Reviewer Name	Dr. Haider Mahdi		e-mail	Eng.Hayder@gmail.com
Scientific Committee Approval Date	15/3/2026	Version Number	1.0	

Relation with other Modules				
العلاقة مع المواد الدراسية الأخرى				
Prerequisite module	MIET1206, MIET3102		Semester	UG I- S2 UG III – S5
Co-requisites module	None		Semester	

Module Aims, Learning Outcomes and Indicative Contents	
أهداف المادة الدراسية ونتائج التعلم والمحتويات الإرشادية	

Module Aims أهداف المادة الدراسية	1. Introduce the biological inspiration of artificial neural network. 2. List some of applications of artificial neural networks 3. Introduce the simplified mathematical model of the neuron. 4. Explain how these artificial neurons can be interconnected to form a variety of network architectures. 5. Show how the architectures of artificial neural networks can be used to solve a practical problems. 6. Show how to classify the learning rules as supervised, unsupervised and reinforcement learning rules. 7. Introduce some of learning rules for classification, regression, clustering and prediction problems.
Module Learning Outcomes مخرجات التعلم للمادة الدراسية	1. The student will be able to design an artificial neural networks for linear Regression by using backpropagation algorithm. 2. The student will be able to design an artificial neural network for pattern Classification problems. 3. The student will be able to design an artificial neural networks for clustering Problems using competitive learning rules. 4. The student will be able to design an artificial neural networks for prediction Problems using dynamic networks. 5. In general the student will be able to read the problem requirements and how to design the neural network for this problem. 6. Using genetic algorithm for solution optimization. 7. Design a control system using fuzzy logic. 8. apply the A.I in medical system 9. the concept of Biological inspiration 10. How simulate the human brain behavior. 11. Apply of fuzzy logic in diagnosis of medical. 12. Using Expert system in medical
Indicative Contents المحتويات الإرشادية	Indicative content includes the following. - Introduction: History , Applications , Biological Inspiration (3hrs) - Neuron Model and Network Architecture: Single – Multiple Input Neuron, Transfer Functions, Single – Multiple Layers of Neurons, Recurrent Networks (2hrs). - Pattern Recognition Example: Perceptron, Hamming and Hopfield network (3hrs). - Perceptron network: Perceptron Architecture, Perceptron Learning Rule (2hrs). - Signal and Weight Vector Spaces: linear vector space, inner product , orthogonality , Norm , Gram-Schmidt Orthogonalization (3hrs). - Linear Transformations for Neural Networks: Linear Transformations, Matrix Representations, Change of Basis, Eigenvalues and Eigenvectors, Diagonalization (3hrs). - Supervised Hebbian Learning: Linear Associator, The Hebb Rule, Pseudoinverse Rule, Application (2hrs). - Performance Surfaces and Optimum Points: Taylor Series, Directional Derivatives, Minima, Necessary Conditions for Optimality, Quadratic Functions (3hrs).

	- Performance Optimization: Steepest Descent, Newton's Method, Conjugate Gradient (2hrs). - Widrow-Hoff Learning: ADALINE Network, Mean Square Error, LMS Algorithm, Analysis of Convergence, Adaptive Filtering (2hrs). - Backpropagation: Multilayer Perceptrons, The Backpropagation Algorithm, Batch vs. Incremental Training (3hrs). - Variations on Backpropagation: Heuristic Modifications of Backpropagation, Numerical Optimization Techniques (2hrs). - Generalization: Early Stopping, Regularization, Bayesian Regularization (3hrs). - Dynamic Networks: Real Time Recurrent Learning, Backpropagation-Through-Time (3hrs). - Associative Learning: Unsupervised Hebb Rule, Instar Rule, Outstar Rule (2hrs). - Competitive Networks: Self-Organizing Feature Maps, Learning Vector Quantization (3hrs). - Radial Basis Networks: Radial Basis Network, Training RBF Networks, Linear Least Squares, Orthogonal Least Squares (2hrs). - Genetic Algorithm : Mathematical equation solving using genetic algorithm , Neural network learning using genetic algorithm (3hrs). - Fuzzy Logic : examples of control system design based fuzzy logic algorithm (3hrs).
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Learning and Teaching Strategies

استراتيجيات التعلم والتعليم

Strategies	Assessment is based on hand-in assignments, written exam, Case study, Quizzes, report presentation, Practical testing
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Student Workload (SWL)

الحمل الدراسي للطالب

Structured SWL (h/sem) الحمل الدراسي المنتظم للطالب خلال الفصل	64	Structured SWL (h/w) الحمل الدراسي المنتظم للطالب أسبوعياً	4
Unstructured SWL (h/sem) الحمل الدراسي غير المنتظم للطالب خلال الفصل	36	Unstructured SWL (h/w) الحمل الدراسي غير المنتظم للطالب أسبوعياً	2
Total SWL (h/sem) الحمل الدراسي الكلي للطالب خلال الفصل	100		

Module Evaluation

تقييم المادة الدراسية

		Time/Number	Weight (Marks)	Week Due	Relevant Learning Outcome
Formative assessment	Quizzes	4	20% (20)	3,6,9,12	All
	Assignments	2	5% (5)	6,12	All
	Projects / Lab.	7	15% (10)	Continuous	All
	Report	1	5% (5)	14	All
Summative assessment	Midterm Exam	2 hr	10% (10)	8	All
	Final Exam	4 hr	50% (50)	16	All
Total assessment			100% (100 Marks)		

Delivery Plan (Weekly Syllabus)

المنهاج الاسبوعي النظري

	Material Covered
Week 1	- Introduction to the artificial intelligence - Machine learning
Week 2	- Perceptron learning rule
Week 3	- Supervised Hebb learning rule
Week 4	- Widrow – Hoff learning rule - Adaptive noise cancellation design using neural network
Week 5	- Multi- layer perceptron - Backpropagation learning rule
Week 6	- Variations of Backpropagation Algorithm
Week 7	- Mid Term
Week 8	Associative learning/ Kohonen self-organization
Week 9	- Competitive networks + Deep learning (Deep Recurrent Neural Network & Deep convolution Neural Network)
Week 10	- Expert system
Week 11	- Hopfield networks
Week 12	- Introduction to the Genetic algorithm
Week 13	- Fuzzy logic
Week 14	- <i>Machine Learning Classification/ Machine Learning Linear Regression</i>

Week 15	- Applications of A.I in medical Engineering - Preparing for the final exam
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Delivery Plan (Weekly Lab. Syllabus) المنهاج الاسبوعي للمختبر	
	Material Covered
Week 1	- Review of MATLAB programing.
Week 2	- Perceptron learning rule MATLAB programming .
Week 3	- Supervised Hebb learning rule MATLAB programming.
Week 4	- Widrow – Hoff learning rule MATLAB programming. - Adaptive noise cancellation design using neural network with MATLAB programming.
Week 5	- Incremental Backpropagation learning rule MATLAB programming. - Batch Backpropagation learning rule MATLAB programming.
Week 6	- Levenberge – Marquardt algorithm MATLAB programming.
Week 7	- Golden Section Search algorithm MATLAB programming.
Week 8	- Instar , Outstar , Hebbian Supervised learning rules MATLAB programming.
Week 9	- Learning Vector Quantization learning rule MATLAB programming.
Week 10	- Linear Least Square Error learning rule MATLAB programming.
Week 11	- MATLAB program for mathematical equation solution optimization using genetic algorithm
Week 12	- Fuzzy logic implementation using MATLAB program
Week 13	- Introduction to the KNIME program
Week 14	- Machine Learning classification using KNIME program
Week 15	- Machine Learning Linear Regression using KNIME program

Learning and Teaching Resources مصادر التعلم والتدريس

	Text	Available in the Library?
Required Texts	Neural Network Design By HAGAN	Yes
Recommended Texts	Fundamental of Neural Network By Luerene	No
Websites		

Grading Scheme مخطط الدرجات				
Group	Grade	التقدير	Marks (%)	Definition
Success Group (50 - 100)	A - Excellent	امتياز	90 - 100	Outstanding Performance
	B - Very Good	جيد جدا	80 - 89	Above average with some errors
	C - Good	جيد	70 - 79	Sound work with notable errors
	D - Satisfactory	متوسط	60 - 69	Fair but with major shortcomings
	E - Sufficient	مقبول	50 - 59	Work meets minimum criteria
Fail Group (0 - 49)	FX – Fail	راسب (قيد المعالجة)	(45-49)	More work required but credit awarded
	F – Fail	راسب	(0-44)	Considerable amount of work required
Note: Marks Decimal places above or below 0.5 will be rounded to the higher or lower full mark (for example a mark of 54.5 will be rounded to 55, whereas a mark of 54.4 will be rounded to 54. The University has a policy NOT to condone "near-pass fails" so the only adjustment to marks awarded by the original marker(s) will be the automatic rounding outlined above.				



عميد الكلية : أ.د. هارون عبد الكاظم شهد

التاريخ : 2026 / 3 / 15



رئيس القسم : أ.د. محمود شاكر نصر

التاريخ : 2026 / 3 / 15

اسم التدريسي : أ.د. حيدر مهدي

التاريخ : 2026 / 3 / 15