

MODULE DESCRIPTION FORM

نموذج وصف المادة الدراسية

Module Information				
معلومات المادة الدراسية				
Module Title	Information Theory and coding		Module Delivery	
Module Type	Core		☒ Theory ☐ Lecture ☒ Lab ☒ Tutorial ☐ Practical ☐ Seminar	
Module Code	CET4101			
ECTS Credits	6.00			
SWL (hr/sem)	180			
Module Level	4	Semester of Delivery		7
Administering Department	CET	College	EETC	
Module Leader	Name: Mahmood Farhan Mosleh		e-mail	E-mail: drmahmoodfarhan@gmail.com
Module Leader's Acad. Title	Professor		Module Leader's Qualification	Ph.D.
Module Tutor	Asst. Prof. Dr. Oras Ahmed Shareef		e-mail	dr.oras@mtu.edu.iq
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Scientific Committee Approval Date	13/06/2023		Version Number	1.0

Relation with other Modules			
العلاقة مع المواد الدراسية الأخرى			
Prerequisite module		Semester	
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. To develop problem solving skills and understanding of information theory through the application of techniques. 2. To understand the information representation. 3. This course deals with the basic concept of source coding. 4. To represent the information depending on the probabilities of events. 5. To compress the data by various types of compression. 6. To detect and correct the errors using channel coding methods.
Module Learning Outcomes مخرجات التعلم للمادة الدراسية	1. Having a skill to calculate the probability of any event. 2. Modeling the information transmission system. 3. Defined the information of noisy channel and posteriori probabilities. 4. Representation the information source based on Shannon . 5. Measure the information using entropies. 6. Represent various types of channel model. 7. Measure the entropy for various distribution methods. 8. Having a skill of modeling various types of channels as a matrix. 9. Measure the capacity of various types channels. 10. Improve the data rate using various types of source code algorithms. 11. Having a basic skill of error detection and corrections
Indicative Contents المحتويات الإرشادية	Indicative content includes the following. <u>Part A – Information theory</u> Random variable, Shannon representation method, entropy, Information transmission system. Source entropy, Marginal Entropy. [20hrs] <u>Part B – Channels</u> Types of channel model, channel matrix, Channel capacity. [20 hrs] <u>Part C – Source Coding</u> Fixed and variable length code, types of source code, measure of code efficiency, data compression, [25hrs] <u>Part d – Channel Coding</u> Need for channel code, redundancy data, block code, convolutional codes Revision problem classes for each above classes [20 hrs]

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Learning and Teaching Strategies

استراتيجيات التعلم والتعليم

Strategies	Type something like: The main strategy that will be adopted in delivering this module is to encourage students' participation in the exercises, while at the same time refining and expanding their critical thinking skills. This will be achieved through classes, interactive tutorials and by considering type of simple experiments involving some sampling activities that are interesting to the students.
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Student Workload (SWL)

الحمل الدراسي للطالب

Structured SWL (h/sem) الحمل الدراسي المنتظم للطالب خلال الفصل	88	Structured SWL (h/w) الحمل الدراسي المنتظم للطالب أسبوعياً	6.2
Unstructured SWL (h/sem) الحمل الدراسي غير المنتظم للطالب خلال الفصل	92	Unstructured SWL (h/w) الحمل الدراسي غير المنتظم للطالب أسبوعياً	6.5
Total SWL (h/sem) الحمل الدراسي الكلي للطالب خلال الفصل	180		

Module Evaluation

تقييم المادة الدراسية

		Time/Number	Weight (Marks)	Week Due	Relevant Learning Outcome
Formative assessment	Quizzes	2	10% (10)	4, 12	LO #1-3, LO #4-9
	Assignments	2	10% (10)	2, 12	LO # 1-10
	Projects / Lab.	1	10% (10)	Continuous	
	Report	1	10% (10)	13	LO # 1-10
Summative assessment	Midterm Exam	2 hr	20% (20)	10	LO # 1-6
	Final Exam	4hr	40% (40)	16	All
Total assessment			100% (100 Marks)		

Delivery Plan (Weekly Syllabus)

المنهاج الاسبوعي النظري

	Material Covered
Week 1	Review of related probability and statistics related topics.
Week 2	Model of information transmission system. Common sense definition of information Logarithmic measure of information. Self-information.
Week 3	Shannon representation diagram of information source. Parameters of discrete channel.
Week 4	Average information (entropy) of a discrete and continuous source, maximum source entropy. Source efficiency
Week 5	Transition probability matrix of channel, discrete noiseless and noisy channel models, uniform channel. Ternary symmetric channel.
Week 6	Information transmission over symmetric channel, noiseless channel, binary symmetric channel, ternary symmetric channel.
Week 7	Memory and memory less information channels .Binary Erasure channel (BEC).
Week 8	Capacity of discrete channel, channel capacity for noiseless channel. Channel efficiency and redundancy. Channel capacity for symmetric channels.
Week 9	Sampling of continuous source. Sampling Theorem. Nyquist theorem for transmission over band limited continuous channel. Shannon-Hartly channel capacity theorem.
Week 10	Source encoding; fixed and variable length codes. Prefix property. Average length of source code. Source code efficiency and redundancy.
Week 11	Fano coding, Shannon- Fano methods.
Week 12	Huffman code, data compression
Week 13	Channel Coding in Digital Communication Systems. Forward Error Correction (FEC)
Week 14	Block codes. Cyclic Redundancy Check (CRC)
Week 15	Repetition Codes, Single Parity Check Codes
Week 16	Preparatory week before the final Exam

Delivery Plan (Weekly Lab. Syllabus)

المنهاج الاسبوعي للمختبر

	Material Covered
Week 1	Lab 1: Self information measurements
Week 2	Lab 2: Entropy measuring for multi-messages
Week 3	Lab 3: Mutual information measurements.
Week 4	Lab 4: Various channel representation.
Week 5	Lab 5: Losses channel measurements
Week 6	Lab 6: Data Compression applications
Week 7	Lab 7: Channel losses measurements

Learning and Teaching Resources

مصادر التعلم والتدريس

	Text	Available in the Library?
Required Texts	Thomas M. Cover, Joy A. Thomas, Elements of Information Theory, John Wiley & Sons, Inc. 1991	Yes
Recommended Texts	Coding Theory: Algorithms, Architectures, and Applications, Andreu Neubbauer, John Wiley & Sons, 2007	No
Websites	https://www.coursera.org/browse/physical-science-and-engineering/electrical-engineering	

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.