



Ministry of Higher Education and
Scientific Research - Iraq
Al-Mansour University College
Department of Communication Engineering



الملحق 4: وصف المادة الدراسية

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	COM 36112		
ECTS Credits	6		
SWL (hr/sem)	150		
Module Level	UGIII	Semester of Delivery	
Administering Department	BSc - COMM	College	Al-Mansour University College
Module Leader		e-mail	
Module Leader's Acad. Title		Module Leader's Qualification	
Module Tutor	Name (if available)	e-mail	E-mail
Peer Reviewer Name	Name	e-mail	E-mail
Scientific Committee Approval Date	13-9-2025	Version Number	1.0

Relation with other Modules			
العلاقة مع المواد الدراسية الأخرى			
Prerequisite module	None	Semester	
Co-requisites module	None	Semester	



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Module Aims, Learning Outcomes and Indicative Contents

أهداف المادة الدراسية ونتائج التعلم والمحتويات الإرشادية

Module Objectives أهداف المادة الدراسية	In this course, the student will acquire the following skills: 1. Understand the fundamentals of information theory and channel capacity 2. Understand and explain the principles of coding techniques used in digital communication systems 3. Recognize advances in coding theory in next-generation broadband communication systems. 4. Perform independent work in wireless system design with some creative problem-solving ability. 5. Effectively communicate through presentations, technical writing, and research discussion. 6. Appreciate the benefits of teamwork through collaboration with other professionals.
Module Learning Outcomes مخرجات التعلم للمادة الدراسية	By the end of the semester, students should be able to: 1. Understand the theoretical and conceptual basis of information theory. 2. Determine the amount of information per symbol and information rate of a discrete memoryless source and design lossless source codes for discrete memoryless sources to improve the efficiency of information transmission. 3. Evaluate the information capacity of discrete memoryless channels determine possible code rates achievable on such channels and apply the Shannon-Hartley theorem for information transmission on Gaussian channels to determine the capacity. 4. Appreciate information-theoretic results as fundamental limits on the performance of communication systems 5. Understand and apply the principles of information theory and can detect and correct errors using the correction theory. 6. Work in groups and function on multi-disciplinary teams. 7. Identify, formulate, and solve engineering-related information theory problems. 8. Use the techniques, skills, and modern engineering tools necessary for engineering practice in telecommunications applications.
Indicative Contents المحتويات الإرشادية	Indicative content includes the following. • Course reviewing and introduction (6 hrs) • Source entropy (24 hrs) • The techniques of source coding (12 hrs) • Error control coding (channel coding), detection and correction of error. (28 hrs)
Description	Review the Probability: Joint probability, Conditional Probability, Introduction to information measurement: Information theory, Information source, Self-information. Entropy, Source entropy rate, Mutual information, Types of channels: Discrete memoryless channels: Channel representation, Channel matrix, Special channels: Loss less channel, Noise less channel, Deterministic channel, BCS, TSC. Transformation, marginal entropy, joint and conditional entropies. Channel capacity, channel efficiency and redundancy. Cascading channel, Continuous channel, Capacity of gaussian channel. The techniques of source coding and data compression: Mathematical Model of Information



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Source; average code length, classification of cod, code efficiency and redundancy. Entropy coding: Shannon-Fano Codes, Shannon Codes, Huffman Coding. Types of Errors. Error control coding (channel coding): Source of Errors; Information Rate; Linear Block Codes; Minimum Distance & Correction. Hamming Code: Hamming weight, Hamming distance. Convolution Encoder: A convolutional encoder, Encoder representation, State Diagram, Trellis Diagram. The Viterbi Decoding Algorithm: Maximum Likelihood Decoding. Cyclic Code: Generator Polynomial of a Cyclic Code, Generator Matrix of a Cyclic Code, Syndrome Calculation and Error Detection.

Learning and Teaching Strategies

استراتيجيات التعلم والتعليم

Strategies

In this course, students are guided by:

- Using different examples.
- Using different styles of discussion that aim to connect the theoretical and practical sides.
- Asking questions and giving exercises that require analysis and conclusions related to lectures.
- Encourage students to participate in discussions and do the practical work.
- Encourage students to work in groups.

Student Workload (SWL)

الحمل الدراسي للطالب محسوب لـ ١٥ اسبوعا

Structured SWL (h/sem) الحمل الدراسي المنتظم للطالب خلال الفصل	78	Structured SWL (h/w) الحمل الدراسي المنتظم للطالب أسبوعيا	5
Unstructured SWL (h/sem) الحمل الدراسي غير المنتظم للطالب خلال الفصل	72	Unstructured SWL (h/w) الحمل الدراسي غير المنتظم للطالب أسبوعيا	4.8
Total SWL (h/sem) الحمل الدراسي الكلي للطالب خلال الفصل	150		



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Module Evaluation

تقييم المادة الدراسية

		Time/Number	Weight (Marks)	Week Due	Relevant Learning Outcome
Formative assessment	Quizzes	2	20% (10)	6 and 12	LO #1 to #3 and #4 to #6
	Assignments	2	10% (5)	2 and 13	LO #3 to #6
	Projects / Lab.	-	-	-	-
	Report	1	10% (10)	13	LO #3, #4 and #6
Summative assessment	Midterm Exam	2hr	10% (10)	9	LO #1 - #5
	Final Exam	3hr	50% (50)	16	All
Total assessment			100% (100 Marks)		

Delivery Plan (Weekly Syllabus)

المنهاج الاسبوعي النظري

	Material Covered
Week 1	Review the Probability: Joint probability, Conditional Probability, Introduction to information measurement: Information theory, Information source, Self-information.
Week 2	Entropy, Source entropy rate, Mutual information, Types of channels: Discrete memory-less channels: Channel representation, Channel matrix, Special channels: Loss less channel, Noise less channel, Deterministic channel, BCS, TSC.
Week 3	Transformation, marginal entropy, joint and conditional entropies.
Week 4	Channel capacity, channel efficiency and redundancy.
Week 5	Cascading channel, Continuous channel, Capacity of gaussian channel.
Week 6	The techniques of source coding and data compression: Mathematical Model of Information Source; average code length, classification of cod, code efficiency and redundancy.



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Week 7	Entropy coding: Shannon-Fano Codes, Shannon Codes.
Week 8	Huffman Coding.
Week 9	Types of Errors. Error control coding (channel coding): Source of Errors; Information Rate; Linear Block Codes; Minimum Distance & Correction.
Week 10	Hamming Code: Hamming weight, Hamming distance.
Week 11	Convolution Encoder: A convolutional encoder, Encoder representation
Week 12	Convolution Encoder: State Diagram, Trellis Diagram.
Week 13	The Viterbi Decoding Algorithm: Maximum Likelihood Decoding.
Week 14	Cyclic Code: Generator Polynomial of a Cyclic Code, Generator Matrix of a Cyclic Code
Week 15	Cyclic Code: Syndrome Calculation and Error Detection.
Week 16	Preparatory week before the final exam

Delivery Plan (Weekly Lab. Syllabus)

المنهاج الاسبوعي للمختبر

	Material Covered



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Learning and Teaching Resources

مصادر التعلم والتدريس

	Text	Available in the Library?
Required Texts	"Digital Communication" by: J.G. Proakis "Modern Digital and Analog Communication Systems" by Lathi "FUNDAMENTALS of INFORMATION THEORY and CODING DESIGN" by: Roberto Togneri and Christopher J.S. deSilva. "FUNDAMENTALS OF COMMUNICATION SYSTEMS " Second Edition, by: John G. Proakis and Masoud Salehi.	No
Recommended Texts	" Information coding techniques " second edition, by: R Avudaiammal. "ESSENTIALS OF ERROR-CONTROL CODING" by: Jorge Castiñeira Moreira and Patrick Guy Farrell.	No
Websites	NONE	



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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.