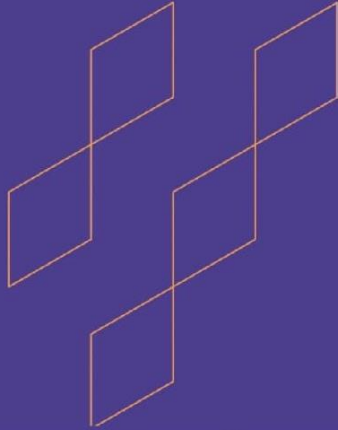




Course Specification

(Postgraduate Programs)

Course Title:	Information Theory
Course Code:	2202-532
Program:	Master in Electrical Engineering
Department:	Electrical Engineering
College:	College of Engineering
Institution:	King Faisal University
Version:	V2
Last Revision Date:	17 April 2025



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A. General information about the course:

1. Course Identification:

1. Credit hours: (3)				
2. Course type				
A.	☐ University	☐ College	☒ Department	☐ Track
B.	☐ Required		☒ Elective	
3. Level/year at which this course is offered: Level 3/2nd year				
4. Course General Description:				
The fundamentals of Shannon's information theory are covered in this course. Theoretical limits of data compression and information transmission via communication channels are investigated. Entropy, data compression, channel coding and channel capacity, and the rate distortion theory are discussed as well.				
5. Pre-requirements for this course (if any):				
Students need to have basic knowledge in probability and random variables.				
6. Co-requirements for this course (if any):				
None				
7. Course Main Objective(s):				
To master essential topics on information theory widely used in communication systems such as rate of transmission of information, entropy, mutual information, noiseless coding theorem, noisy channels, the coding theorem for finite state zero memory channels and channel capacity.				

2. Teaching Mode: (mark all that apply)

No	Mode of Instruction	Contact Hours	Percentage
1	Traditional classroom	45	100%
2	E-learning		
3	Hybrid - Traditional classroom - E-learning		
4	Distance learning		



3. Contact Hours: (based on the academic semester)

No	Activity	Contact Hours
1.	Lectures	45
2.	Laboratory/Studio	
3.	Field	
4.	Tutorial	
5.	Others (specify).....	
	Total	45

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

Code	Course Learning Outcomes	Code of PLOs aligned with the program	Teaching Strategies	Assessment Methods
1.0	Knowledge and understanding			
1.1	Explain the information rate of various information sources.	K1	Lectures	HW and Exams
1.2	Discuss the information capacity of discrete memoryless channels and the possible code rates that can be achieved on such channels.	K1	Lectures	HW and Exams
1.3	Demonstrate the main concepts of rate-distortion theory	K1	Lectures	HW and Exams
1.4	Demonstrate the main concepts in network information	K1	Lectures	HW and Exams

Code	Course Learning Outcomes	Code of PLOs aligned with the program	Teaching Strategies	Assessment Methods
	theory including the broadcast, multiple access, and interference channels.			
2.0	Skills			
2.1	Calculate the information rate of various information sources.	S1	Lectures with Illustrative MATLAB Simulations	HW and Project(s)
2.2	Evaluate the information capacity of discrete memoryless channels and the possible code rates that can be achieved on such channels.	S1	Lectures with Illustrative MATLAB Simulations	HW and Project(s)
2.3	Derive the channel capacity in the discrete time case	S1	Lectures with Illustrative MATLAB Simulations	HW and Project(s)
2.4	Derive the channel capacity in the continuous time case	S1	Lectures with Illustrative MATLAB Simulations	HW and Project(s)
2.5	Use MATLAB in simulation projects and/or homework to solve computational problems in Information Theory, and show this work in a presentation and/or a report.	S2	Lectures with Illustrative MATLAB Simulations	HW and Project(s)
3.0	Values, autonomy, and responsibility			
3.1	Use MATLAB in simulation projects and/or homework to	V1	Lectures with Illustrative	HW and Project(s)





Code	Course Learning Outcomes	Code of PLOs aligned with the program	Teaching Strategies	Assessment Methods
	solve computational problems in Information Theory, and show this work in a presentation and/or a report.		MATLAB Simulations	
3.2	Read literature in Information Theory and write a review article on a selected topic.	V2	Lectures	Review Article and Presentation

C. Course Content:

No	List of Topics	Contact Hours
1.	Uncertainty, Information, and Entropy Data Compression Discrete Memoryless Channels (DMC) Mutual Information Channel Capacity Differential Entropy Gaussian Channel	27
2.	Rate Distortion Theory Broadcast Channels Multiple Access Channels The interference channel	18
Total		45

D. Students Assessment Activities:

No	Assessment Activities *	Assessment timing (in week no)	Percentage of Total Assessment Score
1.	Project(s) / Homework / Presentation(s)	Once in every three weeks	35%
2.	Midterm Exam	Week 8	25%
3.	Final Exam	Week 16	40%
	Total		100%

*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	Thomas M. Cover and Joy A. Thomas, Elements of Information Theory, 2nd ed., Wiley, 2006.
Supportive References	1 Abbas El Gamal and Young-Han Kim, Network Information Theory, 1st ed., Cambridge University Press, 2012.
Electronic Materials	KFU Blackboard: https://bblms.kfu.edu.sa/ KFU Electronic Library: https://www.kfu.edu.sa/en/Deans/Library/Pages/elibrary1.aspx IEEE Communications Society: https://www.comsoc.org/
Other Learning Materials	

2. Educational and Research Facilities and Equipment Required:

Items	Resources
facilities (Classrooms, laboratories, exhibition rooms, simulation rooms, etc.)	Computer Labs to simulate Computer Assignments
Technology equipment (Projector, smart board, software)	Data show with multimedia interface
Other equipment (Depending on the nature of the specialty)	MATLAB

F. Assessment of Course Quality:

Assessment Areas/Issues	Assessor	Assessment Methods
Effectiveness of teaching	Students	Indirect- Online Survey
Effectiveness of students' assessment	Students and Faculty	Direct and Indirect Assessment
Quality of learning resources	Students and Faculty	Indirect- Online Survey
The extent to which CLOs have been achieved	Students and Faculty	Direct and Indirect Assessment
Other	None	None

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

Assessment Methods (Direct, Indirect)



G. Specification Approval Data:

COUNCIL /COMMITTEE	EE DEPARTMENT QUALITY COMMITTEE
REFERENCE NO.	MEETING # 10
DATE	APRIL 19, 2025

