



Ministry of Higher Education and  
Scientific Research - Iraq  
University of Diyala  
College of Engineering  
Department of Engineering



## الملحق 4: وصف المادة الدراسية

# MODULE DESCRIPTION FORM

## نموذج وصف المادة الدراسية

Module Information			
معلومات المادة الدراسية			
Module Title	Probability and Random Processes		Module Delivery
Module Type	Core		<input checked="" type="checkbox"/> Theory <input type="checkbox"/> Lecture <input type="checkbox"/> Lab <input checked="" type="checkbox"/> Tutorial <input type="checkbox"/> Practical <input type="checkbox"/> Seminar
Module Code	COE 210		
ECTS Credits	5		
SWL (hr/sem)	125		
Module Level	UGII	Semester of Delivery	
Administering Department	BSc - COMM	College	College of Engineering
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	2024/9/1	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

<b>Module Objectives</b> أهداف المادة الدراسية	<ol style="list-style-type: none"> <li>1. The objective of this module is to provide students with a comprehensive understanding of the fundamental principles of probability and random processes.</li> <li>2. developing a solid foundation in probability theory, understanding various types of random variables and their distributions.</li> <li>3. Exploring the concepts of random vectors and processes.</li> <li>4. Learning how to apply these principles to practical problems and real-world scenarios, particularly in the fields of communication engineering.</li> </ol>
<b>Module Learning Outcomes</b> مخرجات التعلم للمادة الدراسية	<ol style="list-style-type: none"> <li>1. Understand and apply the basic concepts of probability, including joint and conditional probability, Bayes' theorem, and statistical independence.</li> <li>2. Define and distinguish between discrete and continuous random variables, and work with their cumulative distribution functions, probability mass functions, and probability density functions.</li> <li>3. Calculate and interpret expectations, moments, and functions of random variables.</li> <li>4. Analyze random vectors and variables through joint, marginal, and conditional distributions and densities, and understand the concepts of correlation, covariance, and higher moments.</li> <li>5. Apply the concepts of independent, uncorrelated, and orthogonal random variables to various problems.</li> <li>6. Explore the properties and applications of random and stationary processes, including renewal processes, queues, Wiener processes, and Gaussian processes.</li> </ol>
<b>Indicative Contents</b> المحتويات الإرشادية	<p><b>Indicative content includes the following.</b></p> <ol style="list-style-type: none"> <li>1- <b>Elementary Concepts in Probability:</b> <ul style="list-style-type: none"> <li>• Introduction to Probability and Counting</li> <li>• Joint and Conditional Probability</li> <li>• Bayes' Theorem</li> <li>• Statistical Independence</li> <li>• Bernoulli Trials</li> </ul> </li> <li>2- <b>Counting methods (4 types of counting)</b></li> <li>3- <b>Discrete and Continuous Random Variables:</b> <ul style="list-style-type: none"> <li>• Cumulative Distribution Functions (CDF)</li> <li>• Probability Mass Functions (PMF) and Probability Density Functions (PDF)</li> <li>• Families of Discrete and Continuous Random Variables</li> </ul> </li> </ol>

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	<ul style="list-style-type: none"> <li>• Expectation and Moments</li> <li>• Functions of Random Variables</li> </ul> <p><b>4- Random Vectors and Variables:</b></p> <ul style="list-style-type: none"> <li>• Joint, Marginal, and Conditional Distributions and Densities</li> <li>• Correlation, Covariance, and Higher Moments</li> <li>• Independent, Uncorrelated, and Orthogonal Random Variables</li> <li>• Sum of Random Variables and Other Functions</li> <li>• Jointly Gaussian Random Variables</li> <li>• Application to Estimation</li> </ul>
<p style="text-align: center;"><b>Description</b></p>	<p>Elementary concepts in probability: Introduction to Probability and Counting, Joint and Conditional Probability, Bayes' theorem Statistical Independence; Bernoulli Trials. Discrete and continuous random variables: Cumulative distribution, probability mass, and probability density functions; families of discrete and continuous random variables, expectation; moments, functions of a random variables. Random vectors and variables: Joint, marginal and conditional distributions and densities; correlation, covariance and higher moments; independent, uncorrelated and orthogonal random variables; sum of random variables (and other functions); jointly Gaussian random variables; application to estimation. Random and Stationary Processes.</p>

<p style="text-align: center;"><b>Learning and Teaching Strategies</b> استراتيجيات التعلم والتعليم</p>	
<p style="text-align: center;"><b>Strategies</b></p>	<p><b>In this course, students are guided by:</b></p> <ul style="list-style-type: none"> <li>• Using different examples.</li> <li>• Using different styles of discussion that aim to connect the theoretical and practical sides.</li> <li>• Asking questions and giving exercises that require analysis and conclusions related to lectures.</li> <li>• Encourage students to participate in discussions and do the practical work.</li> <li>• Encourage students to work in groups.</li> <li>• Using brainstorm and imagination to encourage student to solve problem</li> </ul>



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### Student Workload (SWL)

الحمل الدراسي للطلاب محسوب ل ١٥ اسبوعا

<b>Structured SWL (h/sem)</b> الحمل الدراسي المنتظم للطلاب خلال الفصل	<b>78</b>	<b>Structured SWL (h/w)</b> الحمل الدراسي المنتظم للطلاب أسبوعيا	<b>5</b>
<b>Unstructured SWL (h/sem)</b> الحمل الدراسي غير المنتظم للطلاب خلال الفصل	<b>47</b>	<b>Unstructured SWL (h/w)</b> الحمل الدراسي غير المنتظم للطلاب أسبوعيا	<b>4.8</b>
<b>Total SWL (h/sem)</b> الحمل الدراسي الكلي للطلاب خلال الفصل	<b>125</b>		

### Module Evaluation

تقييم المادة الدراسية

		Time/Number	Weight (Marks)	Week Due	Relevant Learning Outcome
Formative assessment	Quizzes	1	10% (10)	4, 8 and 12	LO #1 to #6,
	Assignments	2	10% (20)	7 and 13	LO #1 to #6, LO #7 to #14
	Projects / Lab.				
	Report	2	5% (10)	13	All
Summative assessment	Midterm Exam	1hr	10% (10)	9	LO #1 - #6
	Final Exam	3hr	50% (50)	16	All
Total assessment			100% (100 Marks)		

### Delivery Plan (Weekly Syllabus)

المنهاج الاسبوعي النظري

	Material Covered
<b>Week 1</b>	Introduction to Probability and Counting
<b>Week 2</b>	Joint and Conditional Probability
<b>Week 3</b>	Bayes' Theorem and Statistical Independence
<b>Week 4</b>	Counting methods (draw with and without replacement)
<b>Week 5</b>	Counting methods (draw with and without order)
<b>Week 6</b>	Introduction to discrete random variables
<b>Week 7</b>	Bernoulli trials and Probability mass functions (PMF) and examples



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<b>Week 8</b>	Expectation, Moments, and Functions of Random Variables in discrete RV
<b>Week 9</b>	<b>Mid term</b>
<b>Week 10</b>	Introduction to continuous random variables, Probability density functions (PDF) and cumulative distribution functions (CDF)
<b>Week 11</b>	Key continuous distributions and their applications
<b>Week 12</b>	Expectation, Moments, and Functions of Random Variables in continuous random variable
<b>Week 13</b>	Random Vectors - Joint, Marginal, and Conditional Distributions
<b>Week 14</b>	Correlation, Covariance, and Higher Moments
<b>Week 15</b>	Independent, Uncorrelated, and Orthogonal Random Variables
<b>Week 16</b>	Random and Stationary Processes

### Delivery Plan (Weekly Lab. Syllabus)

المنهاج الاسبوعي للمختبر

	Material Covered
<b>Week 1</b>	
<b>Week 2</b>	
<b>Week 3</b>	
<b>Week 4</b>	
<b>Week 5</b>	
<b>Week 6</b>	
<b>Week 7</b>	
<b>Week 8</b>	
<b>Week 9</b>	
<b>Week 10</b>	
<b>Week 11</b>	
<b>Week 12</b>	
<b>Week 13</b>	
<b>Week 14</b>	
<b>Week 15</b>	

### Learning and Teaching Resources

مصادر التعلم والتدريس



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	Text	Available in the Library?
Required Texts	<ul style="list-style-type: none"> <li>H. Pishro-Nik, "Introduction to probability, statistics, and random processes", Kappa Research LLC, 2014.</li> </ul>	Yes
Recommended Texts		No
Websites	<a href="https://www.probabilitycourse.com">https://www.probabilitycourse.com</a> ,	

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.