

# MODULE DESCRIPTION FORM

## نموذج وصف المادة الدراسية

Module Information			
معلومات المادة الدراسية			
Module Title	Multi Variable Calculus		Module Delivery
Module Type	Basic learning activities		<input checked="" type="checkbox"/> Theory <input checked="" type="checkbox"/> Lecture <input type="checkbox"/> Lab <input checked="" type="checkbox"/> Tutorial <input type="checkbox"/> Practical <input type="checkbox"/> Seminar
Module Code	ATU12022		
ECTS Credits	5		
SWL (hr/sem)	125		
Module Level	1	Semester of Delivery	
Administering Department	ATU12	College	PMTEC
Module Leader	Name	e-mail	E-mail
Module Leader's Acad. Title	Professor	Module Leader's Qualification	Ph.D.
Module Tutor	Name (if available)	e-mail	E-mail
Peer Reviewer Name	Name	e-mail	E-mail
Scientific Committee Approval Date		Version Number	

Relation with other Modules			
العلاقة مع المواد الدراسية الأخرى			
Prerequisite module	Single variable calculus	Semester	1
Co-requisites module	Algebra	Semester	4

## Module Aims, Learning Outcomes and Indicative Contents

### أهداف المادة الدراسية ونتائج التعلم والمحتويات الإرشادية

<p><b>Module Objectives</b> أهداف المادة الدراسية</p>	<ol style="list-style-type: none"> <li>1. To develop problem solving skills and understanding of mathematical Equations through the application of techniques.</li> <li>2. The ability to apply knowledge in mathematics, science, and engineering.</li> <li>3. To understand <b>Differential Equations</b>, Double Integrals and Triple Integrals, etc.</li> <li>4. To understand <b>Polar Coordinates</b> and <b>Special Functions</b> problems.</li> <li>5. To Sketching of Geometric Shapes</li> </ol>
<p><b>Module Learning Outcomes</b> مخرجات التعلم للمادة الدراسية</p>	<p>Important: Write at least 6 Learning Outcomes, better to be equal to the number of study weeks.</p> <ol style="list-style-type: none"> <li>1. Selects and applies knowledge of mathematics, engineering, technology, and other sciences to solve engineering problems that require the application of applied principles, procedures, or methodologies.</li> <li>2. To Recognize between type of Differential Equations.</li> <li>3. understanding with solving skills of Differential Equations.</li> <li>4. To understand various method associated with Non-Homogeneous Differential Equations.</li> <li>5. Definition with understand the Mechanism <b>Partial Differentiation</b></li> <li>6. understanding Chain Rule and Total Differential.</li> <li>7. Learning how to Sketch the Geometric Shapes</li> <li>8. Understanding the Double Integrals, Triple Integrals and Applications.</li> <li>9. Learning how to solve Gama Function, Beta Function.</li> <li>10. To recognize Special Curve (Line, Circle, Conic Section) and Rotation of Axis</li> </ol>
<p><b>Indicative Contents</b> المحتويات الإرشادية</p>	<p><b>Indicative content includes the following.</b></p> <p><b><u>Part A -Ordinary Linear Differential Equations.</u></b></p> <p>- 1<sup>st</sup> order differential equations. {Separable, Homogeneous, Exact, Linear Bernoulli}, 2<sup>nd</sup> Order Differential Equations. {Reducible to 1<sup>st</sup> order, Homogeneous. Non-Homogeneous} Higher Order Differential Equations. {Homogeneous, Non-Homogeneous, Applications}. [16 hrs],</p> <p><b><u>Part B - Partial Differentiation</u></b></p> <p>Definition, Mechanism of Differentiation, Functions of Two Variables, Functions of Higher Variables., Transformation {Chain Rule, Total Differential}, Directional Derivative {Maxima, Minima and Saddle Points, Lagrange Theorem}. [15 hrs]</p> <p><b><u>Part C – Integrals:</u></b></p> <p>Sketching of Geometric Shapes, Double Integrals and Triple Integrals, Applications. [6 hrs]</p> <p><b><u>Part D – Special Functions:</u></b></p> <p>Gama Function and Beta Function. [6 hrs].</p> <p><b><u>Part E– Polar Coordinates:</u></b></p> <p>Polar Curve Representation, Sketching of Polar Curve, General Curve., Special Curve (Line, Circle, Conic Section), Rotation of Axis, The Arc Length of Polar Curve, Surface</p>

	Area of Rotation, The Angle Between the Tangent Line and Radius Vector for a Polar Curve, Slope of Tangent {Asymptotes, Plane Area} [15 hrs]
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<b>Learning and Teaching Strategies</b> <b>استراتيجيات التعلم والتعليم</b>	
<b>Strategies</b>	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 types of simple experiments involving some sampling activities that are interesting to the students.

<b>Student Workload (SWL)</b> <b>الحمل الدراسي للطالب محسوب لـ ١٥ اسبوعا</b>			
<b>Structured SWL (h/sem)</b> الحمل الدراسي المنتظم للطالب خلال الفصل	63	<b>Structured SWL (h/w)</b> الحمل الدراسي المنتظم للطالب أسبوعيا	4
<b>Unstructured SWL (h/sem)</b> الحمل الدراسي غير المنتظم للطالب خلال الفصل	62	<b>Unstructured SWL (h/w)</b> الحمل الدراسي غير المنتظم للطالب أسبوعيا	4
<b>Total SWL (h/sem)</b> الحمل الدراسي الكلي للطالب خلال الفصل	<b>125</b>		

<b>Module Evaluation</b> <b>تقييم المادة الدراسية</b>					
		Time/Number	Weight (Marks)	Week Due	Relevant Learning Outcome
<b>Formative assessment</b>	<b>Quizzes</b>	3	10% (10)	6,10 and 14	LO #1, #2 and #5, LO #6, #7 and #10 LO #11, #12 and #13
	<b>Assignments</b>	5	10% (10)	2 and 13	LO #3, #4 and #6, #7
	<b>Projects / Lab.</b>	1	10% (10)	0	0
	<b>Report</b>	2	10% (10)	0	0
<b>Summative assessment</b>	<b>Midterm Exam</b>	2hr	10% (10)	7	LO #1 - #7
	<b>Final Exam</b>	3hr	50% (50)	16	All
<b>Total assessment</b>			100% (100 Marks)		

## Delivery Plan (Weekly Syllabus)

### المنهاج الاسبوعي النظري

	Material Covered
<b>Week 1</b>	<b>Ordinary Linear Differential Equations</b> <ul style="list-style-type: none"> <li>- 1<sup>st</sup> order differential equations</li> <li>- Separable</li> <li>- Homogeneous.</li> </ul>
<b>Week 2</b>	<ul style="list-style-type: none"> <li>- Exact</li> <li>- Linear</li> <li>- Bernoulli</li> </ul>
<b>Week 3</b>	<ul style="list-style-type: none"> <li>- 2<sup>nd</sup> Order Differential Equations</li> <li>- Reducible to 1<sup>st</sup> order</li> <li>- Homogeneous.</li> </ul>
<b>Week 4</b>	<ul style="list-style-type: none"> <li>- Non-Homogeneous</li> </ul>
<b>Week 5</b>	<ul style="list-style-type: none"> <li>- Higher Order Differential Equations</li> <li>- Homogeneous</li> <li>- Non-Homogeneous</li> <li>- Applications</li> </ul>
<b>Week 6</b>	<b>Partial Differentiation</b> <ul style="list-style-type: none"> <li>- Definition</li> <li>- Mechanism of Differentiation</li> <li>- Functions of Two Variables</li> <li>- Functions of Higher Variables</li> </ul>
<b>Week 7</b>	<ul style="list-style-type: none"> <li>- Transformation</li> <li>- Chain Rule</li> <li>- Total Differential</li> </ul>
<b>Week 8</b>	<ul style="list-style-type: none"> <li>- Gradient, Divergence, and Curl of Vector</li> <li>- Equation of Normal Line and Tangent Plane</li> </ul>
<b>Week 9</b>	<ul style="list-style-type: none"> <li>- Directional Derivative</li> <li>- Maxima, Minima and Saddle Points</li> <li>- Lagrange Theorem</li> </ul>
<b>Week 10</b>	<ul style="list-style-type: none"> <li>- Sketching of Geometric Shapes</li> <li>- Double Integrals</li> <li>- Triple Integrals</li> <li>- Applications</li> </ul>
<b>Week 11</b>	<b>Special Functions</b> <ul style="list-style-type: none"> <li>- Gamma Function</li> <li>- Beta Function</li> </ul>
<b>Week 12</b>	<b>Polar Coordinates</b> <ul style="list-style-type: none"> <li>- Polar Curve Representation</li> <li>- Sketching of Polar Curve</li> <li>- General Curve</li> </ul>
<b>Week 13</b>	<ul style="list-style-type: none"> <li>- Special Curve (Line, Circle, Conic Section)</li> </ul>

	- Rotation of Axis
<b>Week 14</b>	- The Arc Length of Polar Curve - Surface Area of Rotation - The Angle Between The Tangent Line and Radius Vector For a Polar Curve.
<b>Week 15</b>	- Slope of Tangent - Asymptotes - Plane Area
<b>Week 16</b>	<b>Preparatory week before the final Exam</b>

Learning and Teaching Resources		
مصادر التعلم والتدريس		
	Text	Available in the Library?
<b>Required Texts</b>	Thomas Calculus Early Transcendentals Single Variable 13th	Yes
<b>Recommended Texts</b>	Engineering Mathematics - 5th Edition [K A Stroud].	No
<b>Websites</b>	<a href="https://www.khanacademy.org/math/calculus-1">https://www.khanacademy.org/math/calculus-1</a> . <a href="https://www.mathsisfun.com/">https://www.mathsisfun.com/</a>	

Grading Scheme				
مخطط الدرجات				
Group	Grade	التقدير	Marks %	Definition
<b>Success Group (50 - 100)</b>	<b>A</b> - Excellent	امتياز	90 - 100	Outstanding Performance
	<b>B</b> - Very Good	جيد جدا	80 - 89	Above average with some errors
	<b>C</b> - Good	جيد	70 - 79	Sound work with notable errors
	<b>D</b> - Satisfactory	متوسط	60 - 69	Fair but with major shortcomings
	<b>E</b> - Sufficient	مقبول	50 - 59	Work meets minimum criteria
<b>Fail Group (0 – 49)</b>	<b>FX</b> – Fail	راسب (قيد المعالجة)	(45-49)	More work required but credit awarded
	<b>F</b> – Fail	راسب	(0-44)	Considerable amount of work required
<b>Note:</b> 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.				