Module (Mathematics I) Catalogue

2022-2023

College/ Institute	Erbil Technical Engineering College	
Department	Mechanical and Energy Engineering Techniques	
Module Name	Mathematics I	
Module Code	MAT105	
Degree	Technical Diploma ☐ Bachler ■ High Diploma ☐ Master ☐ PhD ☐	
Semester	First	
Qualification	PhD in Mechanical Engineering	
Scientific Title	Lecturer	
ECTS (Credits)	7	
Module type	Prerequisite ☐ Core ■ Assist. ☐	
Weekly hours	4 hrs	
Weekly hours (Theory)	(4) hr Class	(52) Total hrs Workload
Weekly hours (Practical)	( )hr Class	( )Total hrs Workload
Number of Weeks	12 weeks	
Lecturer (Theory)	Dr. Dlair O. Ramadan	
E-Mail & Mobile NO.	Dlair.o.ramadan@epu.edu.iq , 07702374010	
Lecturer (Practical)	Mrs. Sheelan Fareeq Abdulwahab	
E-Mail & Mobile NO.	sheelan.abdulwahab@epu.edu.iq	
Websites		

Course Book

Course Description	Calculus is the base for different scientific specifications. To explain any natural phenomenon, we translate this phenomenon to a mathematical model which lets us deal with the problem easily. Also, when we have lab data, we can graph these data and get best curve for these points and find a function for this curve by using calculus. Topics studied include the review (line, circles, parabolas, functions, limits and continuity), Differentiation, application of derivatives, integration, application of definite integrals, transcendental functions, techniques of integration, complex number, Infinite sequences and series, introduction to matrices and how to solve linear equation, vectors and the geometry of space. It is very important to emphasize that this is a problem-oriented class and the only way that the material can be mastered is with practice solving problems in addition to homework problems.
Course objectives	At the end of this course the student will be able to: 1. To provide an introduction to the fundamentals of calculus. 2. To learn the application of mathematics in real life problems and analyzing the results.
Student's obligation	1. Homework will be assigned periodically. 2. Students are responsible to do homework on their own. 3. There will be several quizzes during the academic year, not necessarily announced. The quiz contains the materials covered in previous lectures, homework or to be covered that day. 4. Any quiz or test missed without a supported documented and excused absence will represent a zero. 5. Attendance and participation in the lecture are mandatory and will be considered in the grading. 6. Students should bring calculators, rulers, pen and pencils to be used during the lectures.
Required Learning Materials	Data show and white board are used throughout the lectures and the lecture notes will be uploaded to the Moodle platform before the lecture day.

Evaluation	Task	Weight (Marks)	Due Week	Relevant Learning Outcome
	Paper Review			

	Assignments	Homework	10%		
		Class Activity	2%		
		Report	8%		
		Seminar	8%		
		Essay			
		Project			
	Quiz		8%		
	Lab.				
	Midterm Exam		24%		
	Final Exam		40%		
	Total		100%		

Specific learning outcome:	By the end of the year the student should be able to demonstrate ability to explain the mathematical skills that related to the engineering information's. Know the basic science related to mathematics
Course References:	1. Calculus by Thomas, 11th Edition, 2005. 2. Calculus by James Stewart, 5th Edition, 2003. 3. Calculus and Its Applications by Marvin L. Bittinger, 10th Edition, 2011. 4. Schaum's Outline of Calculus

Course topics (Theory)	**Week**	**Learning Outcome**
Introduction: Cartesian coordinates, increments, the distance formula, midpoint formula, slope of a straight line. Equations of a straight line, equations of a circle.	1	Demonstrate an understanding of how to write and graph linear equations by determining the intercepts, or by determining the slope and a point on the line. Students will demonstrate the ability to write the equation of the circle as well.
Functions, domain and range, inequalities, absolute value, the domain and range of two functions.	2	Develop an understanding of how to compute the domain and range of functions and inequalities.
Composite functions, graph the function, even and odd functions, shifting a graph of a function, scaling (stretching, compressing) and reflecting.	3	Students will be able to graph different functions including linear, quadratic and exponential functions.
Trigonometric functions	4	At the end of this lecture, students will be able to Use right triangles to evaluate the six trigonometric functions. Students also will be able to know and draw the graphs of the six trigonometric functions and their variations.
Limits and continuity: the limit of a function, properties of limits, one-sided limits.	5	Student will be able to compute limits

Existing of the limit function, infinity, limits at infinity, important limits, continuity.	6	Define and analyse limits and continuity for complex functions as well as consequences of continuity.
Derivatives: tangent line to the curve, derivative as a function, notations of derivatives, differentiation formula.	7	Apply derivative concepts to find tangent lines to level curves and to solve problems.
Chain rule, implicit differentiation, higher order derivatives, derivative of trigonometric functions, velocity and acceleration, l'Hopital's rule	8	Solve problems in a range of mathematical applications using the derivative.
Application of Derivatives _ Rate of Change	9	Students will be able to find the rate of changes of a quantity with respect to the other quantity.
Application of Derivatives _ Maxima, Minima and Mean Value Theorem	10	Students will be able to find the maxima, minima, and point of inflection of a curve. Maxima and minima are the peaks and valleys of a curve, whereas the point of inflection is the part of the curve where the curve changes its nature (from convex to concave or vice versa).
Application of Derivatives _ Graphing of Functions	11	Students will be able to use the derivative to determine the absolute minimum and maximum values of a function. However, there is a lot more information about a graph that can be determined from the first derivative of a function
Application of Derivatives _ Optimization	12	In optimization problems we are looking for the largest value or the smallest value that a function can take. We saw how to solve one kind of optimization problem in the Absolute Extrema section where we found the largest and smallest value that a function would take on an interval.

Practical Topics	**Week**	**Learning Outcome**
Questions Example Design		

Q^1: *A)* Determine the point that is equidistant from the points A (-1, 7), B (6, 6) and C (5, -1). *(8 marks)*

B) For what value of K will be the line $Kx - 3y = 4K$ have be perpendicular to the line $x - 6y = 2$. *(8 marks)*

Q²: A) If the position of a particle moving on a coordinate line is given by $s = \sqrt{t} + \dfrac{25}{\sqrt{t}}, \ t > 0$

, find its position and acceleration when it first stops, also find the particle's speed each time the acceleration is zero. **(6 marks)**

B) Evaluate the following limits: **(6 marks)**

a) $\displaystyle\lim_{c \to 0} \frac{(x+c)^2 - x^2}{c}$, **b)** $\displaystyle\lim_{x \to -1}\left(\frac{1}{x+1} + \frac{2}{x^2 - 1} \right)$, **c)** $\displaystyle\lim_{x \to \infty} \frac{\cos x}{x}$

Q³: A) Find the area between the parabola $x = y^2$ and the line $y = x - 2$. **(6 marks)**

B) Use logarithmic differentiation to find the derivative of y with respect to the given independent variable: **(6 marks)**

$y = \dfrac{\theta \sin \theta}{\sqrt{\sec \theta}}$, **b)** $y = \dfrac{x\left(1 - x^2\right)^2}{\left(1 + x^2\right)^{1/2}}$, **c)** $y = \sqrt[3]{\dfrac{x(x-2)}{x^2 + 1}}$
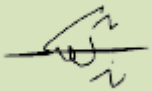
Extra notes:

External Evaluator

This module catalogue is well organised, covered a wide range of assignment methods which makes it sufficient for students' understanding and knowledge.

1- The course objective is quite clear. It meets the standard requirement for engineering competences by international mechanical engineering organisations; for example, Institute of Mechanical Engineers (IMechE) -the UK.
2- The references are up to dated references.
3- All course topics included in this catalogue is essential for further understanding of Mechanical Engineering and practise them during engineering projects.

Hereby, I confirm that this module catalogue is extremely useful and sufficient in terms of scope and quality for the first-year students in the Department of Mechanical and Energy Engineering at Erbil Polytechnic University.

Dr. Zhwan Dilshad Ibrahim
11/10/2022