Ministry of Higher Education and Scientific research
Salahaddin University College of Engineering

Department of Aviation Engineering

College of …Engineering….

University of Salahaddin….

Subject: Mathematics I

Course Book 1st year

Lecturer's name: Maikey Zaki Bia Khorani

Academic Year: 2022/2023

Introduction

Competence-Based Education (CBE)

Competency-based education is the pedagogical approach base on the student about how to master their skills, also for designing an academic program, which concentrates on competences (knowledge, skill, attitude), it clearly identifies the competencies that the student must manage, as it is an approach to teaching-learning. As with the promise of serving the students better it has increased employment. competency-based is long-lasting and transformative for education. CBE core is the student-centered learning approach, it might be a course or credit-based or not. This method meets different learning abilities and will lead to an efficient student learning outcome. CBE is a system when the learner goes to the learning process and learner can say what they can do in this learning process, we need need to change the education system as the technology changes and to integrate these changes we need to equip skills to help the society, and economy to be able to compete with others because without a good education we can not afford all of these. Some characteristics of CBE are competency-based program, producing proficient and prepared graduates, increasing student engagement, and exploring diverse learning opportunities.

To try to reflect on the possibility of applying this type of education in Kurdistan; Competency-based education is likely to be long lasting and transformative for the education in Kurdistan, as to apply the CBE in Kurdistan; we need the quality of CBE which can be satisfied in multiple ways; Workforce partners, good subjects which must be included in the competency in the faculties, cooperation with industries and foreign companies to establish good roots with sustainability to long-lasting projects.

The main challenges if this system can be applied in Kurdistan can be identified from different perspectives; first and foremost to include different criteria such as the program mission, working life, very productive curriculum, using relevant pedagogical methods, guidelines to the study for the students, assessment, all these lead to best learning outcome and competences, and if CBE will be applied in Kurdistan, there should be multiple changes, and as a teacher, we always think to improve the learning experience of the students that learn in the schools, and universities; This will prepare the students for the next stage of their life. The students must be given the support they need to master the subject and inherent skills, and this will make the students in Kurdistan moving forward based on what they are capable of, and the lead to the best learning outcome and competencies which should be

proven by action. We should start to do the grading based on the performance of each student without any bias. One of the important changes is to apply more core applied subjects in the universities rather than the general subjects, cooperating with industries for the scientific sections, and while in the literature to cooperate with very famous novel writers who have big companies and big funds, moreover with other university specialities to have contacts with similar companies. Another idea would be that the students during their studies also have a job with the same field of their studies, and learn things directly during their work as well, as well as participating in researches and development, and this can not be done without faculties instructing this by proving a good curriculum with cooperation with stakeholders with common interests.

Reflecting on the way of delivering the learning materials for the first week of this module using the same as this pedagogy course will be very beneficial, as the teachers Dr Khalil and Dr Wala were more like a facilitator to us, and this module was very well organized, as to start on with students doing presentations, and they involved all of us in it y participating, also it was very good to me to read some articles. From the beginning I learnt that; the competency-based education module is divided into three themes which are competency-based education, Bologna process, and competency-based curriculum. It was very useful to align all the references which were used in this module for us, I felt much more energetic and well prepared when I was given the content beforehand.

Competence-Based Curriculum(CBC)

The competency-based curriculum is a curriculum that is based on what the learners will do (competences) tasks rather than what the learners will be expected to know. This curriculum is learner-centered and is adaptive to the needs of students, teachers, and society

The elements and criteria of CBC are leading to the learning outcome, the first is the mission the curriculum should have a clear Mission which has sustainability, also Work relevance it should be designed based on the labour market and the skills which are needed for it, Pedagogical approach choosing the one suits the model and how choosing the right pedagogical methods e.g. seminars, problem-based learning, Guidance to the students, Assessment tools to know what kind of assessment suits this model we teach e.g. formative and summative, and Alignment which means all the criteria work together to achieve the learning outcome for all the elements mentioned above, and all elements must support each other.

Ministry of Higher Education and Scientific research
Salahaddin University College of Engineering

Course Catalog

1- General Information

Course Title	Mathematics I
Course Code	
Department	Aviation Engineering
Prerequisites course code	
Course Coordinator	Maikey Zaki Bia Khorani
Email	maikey.bia@su.edu.krd
Other Course Teacher(s) / Tutor(s)	
Class Hours	3
Office Hours	Sunday 12:00- 14:00 Monday 12:00- 14:00 Tuesday 11:00- 12:30 Thursday 9:00-14:00
Course Type	Mathematics I
Offer In Academic Year	Fall Semester

Course Name	*Code*	*Regular Semester*
Mathematics I		Fall

Local Credit	*ECTS Credit*	*Lecture (hour/week)*	*Application (hour/week)*	*Laboratory (hour/week)*
4	4	4	4	0

Prerequisites	**:**	Bas Mathematics

Course Language	**:**	English

Course Level	**:**	Bachelor		
Course Type	**:**	University	Compulsory	Elective
			X	
Course Category	**:**	Core Courses	Major Area Courses	General Cultural Courses
			X	
Mode of Delivery	**:**	Face-to-face	Distance Learning	
		X		
Course Coordinator	**:**	Maikey Zaki Bia Khorani		
Lecturer(s)	**:**	Maikey Zaki Bia Khorani		
Assistant(s)	**:**			

2- Course Description

COURSE DESCRIPTION
This course Mathematics II has a theoretical part which makes the students firstly understand and learn the theory then they apply it in the Aviation laboratory and also apply those algorithms using programming languages either MatLab. The theoretical part introduces the students to the Mathematics equations and its applications in Aviation Engineering, as it plays an important role in almost all areas of our life. Today, much of this information is represented and processed digitally, with applications ranging from different Aviation laboratory practices, from medicine to robotics to remote sensing. However, this course will encourage students to understand and apply different applications in Aviation Engineering using Mathematical formulas , and implementing what the students have learned in the theoretical, to apply the algorithms, and create real-life applications, and this will improve the basic foundation of students in processing programming applications and which they can develop their understanding about different areas from Aviation engineering skills in creating programming algorithms for different applications in Aviation. E.g Applying Bernoulli equations in the Wind tunnel at the Aviation Laboratory.

Contents and workload hours from face to face lectures
Main topics to be covered in this course are:

Salahadding University College of Engineering			
ACADEMIC CALENDER			
Date	PROGRAMME	Module Name and code /Content discription	Work load (hrs)
00 Sept.- 00 Sep.2021		**Mathmatics**	**95**
FALL SEMESTER (#1)			
00 Sep 2021- 00 Jan 2022			
00 Sept.- 00 Sep.2021	Week 1	Function and Graphs (Introduction, Definition of Function, Graphing Functions, Absolute function, Inversed function)	
00 Sept.-00 Sep.2021	Week 2	Derivatives and applications of derivatives (Definition of Derivative, Derivative of ratial function, Derivative of implicit function, composite function and their derivatives(chain rule), Parametric function and their derivatives)	
00 Sept.-00 Oct.2021	Week 3	rigonometric function and their derivatives (Definition of trigonometric function, Graph of trigonometric function, Derivatives of trigonometric function) Applications of derivatives (Slope, second derivatives, and their signs, Second derivatives of parametric function, Approximation by differentiation, Optimization techniques: Finding maxima and minima)	
00 Oct.-00 Oct.2021	Week 4	Integrals, Applications of finite integrals (Definition of integration, Integration of algebraic functions, Integration of trigonometric functions, Application of integral [Area: Area under a curve and x or y axis, area between curves, Volumes: Volume By disk method(slices); solid of revolution; By shells; By washer method)	
00 Oct.-00 Oct.2021	Week 5	Transcendental functions: (Logarithmic, exponential, trigonometric, & hyperbolic functions) Natural logarithmic function (Graph of Logarithmic (y=ln), Prosperities of Logarithmic(ln), Derivative of Logarithmic(ln), Integration of Logarithmic(ln)) Exponential function (Graph of exponential, Prosperities of exponential , Derivative of exponential, Integration of exponential) Exponential function general case ( )	

		Trigonometric function and their inverse function (Derivatives of inverse trigonometric function, Integration of inverse trigonometric function, properties of inverse trigonometric function) Hyperbolic functions (Definition of hyperbolic function, Graph of hyperbolic functions, properties between hyperbolic function)	
00 Oct.-00 Oct.2021	Week 6	Integral methods (Standard form of integration, Integration of problems need transformation [Integral containing forms Integral containing form (ax2+bx+c)] , Integration by parts, Integration containing trigonometric function, Integration by partial fractions, Other methods)	
00 Oct.-00 Nov.2021	**Week 7**	Midterm	
00 Nov.-00 Nov.2021	Week 8	Vectors (vector representation, operation & product): (Definitions, Representations of vectors in Plan and space, Scalar Product (dot product))	
00 Nov.-00 Nov.2021	Week 9	Polar coordinates system: (Polar system, Relation between polar and Cartesian coordinates, Polar equation, Intersection point between polar curves(equation), Graph of polar equation, Area enclosed by polar curves)	
00 Nov.-00 Nov.2021	Week 10	Differential Equations: (Basic concepts, Definitions, Direction fields, First Order DE's [Linear DE's, Separable DE's, Exact DE's, Bernoulli DE's])	
00 Nov.-00 Nov.2021	Week 11	Function of more than one Variables: (Definition of Function of several variables, Cartesian coordinates, Partial derivatives of function of one variable, two variables, three variables, tangent planes, differentials, the chain rule of functions of several variables, Differentials, Chain Rules)	
00 Dec.-00 Dec.2021	Week 12	Ordinary Differential Equations (ODE) and Applications: (Definitions, differential equations, ordinary differential equations and non-differential equations, order of differential equations, characteristic Equations and its derivations of all types of roots , Solution of the second order differential equations)	
00 Dec.-00 Dec.2021	Week 13	Multiple Integrals: (Definitions, Double integration, Cartesian and polar co-ordinates, change of order of integration, Change of Variables between Cartesian and polar co-ordinates, Area as a double integral, Cylindrical and Spherical Coordinates, Volume as a triple integral, Gradient, Divergence and Curl – Directional derivative, Green's theorem in a plane, Gauss divergence theorem and Stoke's theorem, Double Integrals)	
00 Dec.-00 Dec.2021	Week 14	Matrices and Determinants (Definition of matrix, Operations of matrix, Definition of Determinants, Value of Determinants of order (n<=3), Value of Determinants of order n (general method),	

		Solving simultaneous linear equations using the inverse matrix method (Grammer rule))	
00 Dec.-00 Dec.2022	Final examination (2 Weeks)		
00 Dec.-00 Jan.2022			
00Jan.-00 Jan.2022	**Online Results**		
SEMESTER BREAK (00 January -00 February 2022)			
SPRING SMESTER (00 February 2022- 00 May 2022)			

Pedagogical Methods
1. Presentation 2. Exhibits 3. Brainstorm and Practice 4. Games 5. Simulations 6. Role-playing 7. Discussion 8. Interaction 9. Modeling 10. Facilitation 11. Collaboration 12. Scientific Trips (Visiting companies with similar interests) 13. Motivation 14. Flipped classroom

Assessment
Using formative assessment, by using the survey to know the basic knowledge of students in mathematics and programming applications. Assessment for the learners before the progress of teaching, and moving to the next step. Quizzes 5 % Homeworks 5 % Activity 5 % Attendance 5 % Midterm 20 % Final Theoretical Exam 60 %

Using summative assessment in a kind of a survey, which asks the opinions of my students about the lecture. And in their ideas about improving the course for better.

ECTS

Mathematics I has a 4 ECTS

Salahaddin University Erbil College of Engineering						
Program: Diploma (ECTS)						
Total No. of Weeks/Semester:	15 weeks					
Department name:	Aviation Engineering			X	Y	Z
Module Name:	Mathmatics I			4	0	0
Module Code:						

ECTS Workload Calculation Form							
Activity	S	Description		Activity Type	No.	Time Factor	Workload
Course	1	Theory	In class	f	15	4	60
	2		Online	f			0
	3	Preparation (1.5 theory)		h	3	6	18
	4	Practical		f	0	0	0
	5	Preparation (0.5 practical)		h	0	0	0
	6	Tutorial		f	0	0	0
Assignment	7	Homework		h	7	1.5	10.5
	8	Report		h	0	2	0
	9	Seminar		h	1	3	3
	10	Paper		h	0	8	0

	11	Essay		h		6	0
	12	Project		h	0	8	0
Assessment	13	Quiz		h	4	0.5	2
	14	Mid Term	Theory	f	1	2	2
	15		Preparation	h	1	12	12
	16		Practical	f	0	0	0
	17		Preparation	h	0	0	0
	18	Final	Theory	f	1	2	2
	19		Preparation	h	1	12	12
	20		Practical	f	0	0	0
	21		Preparation	h	0	0	0
Face to face hours (f)/12 week			5.33	Face to face hours (f)			64
Home hours (h)/14 week			3.59	Home hours (h)			57.5
Total hours/14 week			7.59	Total hours			121.5
ECTS (Total hours/ 27)							**5**

*f: Face to face activity hours h: Household activity hours
X: Theoretical class hours/ week Y: Practical hours/ week Z: Tutorial hours/ week
** Underlined numbers must not be changed.

Course Learning Outcomes (CLOs)

On the successful completion of this course, the students will be able to:

1. Apply Mathematics I to be used also in Aviation Engineering application and Aviation Engineering.
2. Design and implement processings according to mathematical equations, and the on latter can implement those mathematical equations and algorithms by using matlab or python programming languages.
3. Apply and recognize Mathematical algorithms and use them in real applications for Aviation Engineering.
4. Analyze any problem and solve it then connect it to real life applications.

5. Demonstrate an application of Aviation Engineering purposes.
6. Design Matlab application tools (making algorithms) that can be used to process Aviation algorithms.
7. Theoretical foundations and modern applications in Mathematics.
8. Applying Mathematical Algorithms using Matlab/Python functions.
9. Build Matlab optional toolboxes including Mathematics of Aviation, and applying the build up functions.
10. Apply processing in the Mathematical Algorithms, and decompose an image into its sine and cosine components, such as analysis, filtering, reconstruction and compression of different Aviation algorithms.

Course teaching and learning activities

This course's main point is making students apply those mathematical equations in the Aviation laboratory and later on the computer as well as some equations are used with the devices in the Aviation Laboratory in practice, what they received in the theoretical part. So, the practical part will apply programming Matlab or python on computers, which they learn during the theoretical part.
And in this way, students will be the center of the class and will learn how to create applications that will be useful tools to apply in scientific and engineering careers.
As well as, this will be followed by a theoretical part which will include an introduction and explanation about each algorithm separately and its functions as well.
And all of the students will be encouraged to apply these activities in the practical class practically and will be given time to complete this application they choose by the end of the semester, and this class will encourage the students to be creative and critical thinkers to invent other useful algorithms and design built up functions and tools in Matlab to be used later by the next generations as well.

Course Assessment tools

Assessment tools	Descriptions	weight
Class Quizzes (4)	Students will be encouraged to prepare for the class in parallel with the teacher.	*5 %*
Class Homeworks (4)	Students will be encouraged to prepare themselves at home for the next class in parallel with the teacher.	*5 %*
Class Activity	Students will be encouraged to participate, in topics related to Mathematics and will discover the applications and programs that can be beneficial to apply in real-life applications	5 %
Class Attendance	Students will be encouraged to work as a group, and attend the class and as a team, and will be participating to deliver the materials in the class and will make	5 %

	the students feel more responsible.	
Midterm	Students will have a written exam related to the previous practices and materials theoretically 20%	20 %
Final Exam	Students will have an oral exam at the end of the semester if they get a signature from the teacher, and if they accomplished all the previous assessments one by one, this oral exam is to make sure that they students applied and put in action the application they created and put a sustainable goal behind it.	60%

In term studies	**Number**	**Percentage of Grade**
Attendance	14	5%
Lab Quizzes	4	5 %
Homework	1	5 %
Special Course Internship		
Activity	4	5%
Presentations		
Seminar		
Midterm	1	20 %
Final	1	60 %
	Total	100 %
Percentage of in_term studies		40%
Percentage of finals		60%
	Total	100%

Course Assessment Tools

Course learning outcome and assessment mapping course learning outcome mapping

Mapping
Mapping of assessment tools to the learning outcome

No	Course learning Outcome	*Level of contribution				
		1	2	3	4	5
1	Theoretical foundations and modern applications in Mathematics				X	
2	Apply basic algorithms to be used also in Aviation Engineering Laboratories					X
3	Design and implement processings on Aviation, and implement algorithms.				X	
4	Apply and recognize image processing algorithms and use them in real applications for human computer interaction.			X		
5	Analyze Mathematical models used in Aviation Engineering		X			
6	Demonstrate an application of Aviation Engineering.				X	

7	Applying Mathematical Exercise and solving different problems how to handle this in Aviation laboratory.					X
8	Design Matlab application tools (making algorithms) that can be used to solve different Mathematical problems.					X
9	Applying Image processing fundamentals and Mathematical exercises				X	
10	Build Matlab optional toolboxes including Aviation applications, and applying Mathematical algorithm using the build up functions.			X		
11	Apply processing in the Problems in Mathematics, and decompose a problem into its sine and cosine components, such as analysis, filtering, reconstruction and compression.					X

Course/Module LOs, Content, Assessment Mapping

No	Course Topics	Weeks	Learning Outcome
1	Differential Equations	Week1	**1**
2	First Order DE's	Week2	**1, and 9**
3	Ordinary Differential Equations (ODE) and Applications:	Week3	**1, 2, 3, 4, and 5**
4	Special Functions	Week4	**1, 9, and 11**
5	Fourier Series and Fourier Transforms	Week5	**1, 2, 3 , 7, and 9**
6	Bessel and Legendre Series, Fourier-Bessel Series, Fouries-Legendre Series.	Week6	**3, 7, 8, and 9**
7	Midterm	Week7	
8	Orthogonal sets of function	Week8	**1, 5, 6, 8,and 9**
9	Some boundary value problems;	Week9	**1 ,5, 6 ,8,and 9**
10	Discrete Fourier Transforms (DFT),Fast Fourier Transforms(FFT),	Week10	**5,and 8**
11	Laplace Transforms ,Laplace Transform and ODE,	Week11	**4, 5, and 8**

12	step, impulse, and frequency response from transfer functions, Convolution integrals, impulse and step responses,	Week12	**1, 5, and 8**
13	solutions to PDEs, Solving PDEs,	Week13	**1, 8, and 10**
14	Solving PDEs in MATLAB using FFT, Singular value decomposition (SVD) and Data Science	Week14	**1, and 10**
15	Recap	Week15	**1, and 11**

Assessment Tools	**Weeks**	**LOs**	**Weight**
4 Quizzes	**3,5,9, and 13**	**Students will do brainstorms in theoretical and apply these in practice in the laboratories (1, 2, 3)**	5 %
4 Homeworks	**2, 4, 10, and 12**	**Students will apply at home to put out in action and apply these LOs in practical(1, 5, 8, 9, and 11)**	5 %
1 Report	**6**	**Students will apply more in practice what they researched for their report (3, 7, 8, and 9)**	5 %
1 Seminar	**11**	**Students will be responsible with the teacher to deliver and apply these LOs (4, 5, and 8)**	5 %
1 Project, Or	**7**	**Students will research and apply for a project with one of the companies or a faculty or will perform a midterm exam to demonstrate their abilities(4, 5, 6, and 10)**	20 %
Midterm	**7**		
Final Exam Orally	**16**	**The students will do an oral exam to know which application can be maintained and performed in this module(1 to 11)**	60 %

References

supported refs:

Websites

Note//

Excel sheet link calculation for ECTS and workload, assignments, quizzes, …
https://docs.google.com/spreadsheets/d/18vQ47wulMztRGOeOCIl8RarJW1MXGkKO/edit?usp=sharing&ouid=113794216519074746182&rtpof=true&sd=true