12. Course Specification of Mathematics 2

I. Course Identification and General Information:							
1.	Course Title:	Mathematics 2					
2.	Course Code & Number:	FR003					
3.	Credit hours:	C.H				Total	
		Th.	Tu.	Pr.	Tr.		
		2	-	2	-	3	
4.	Study level/ semester at which this course is offered:	First Year - Second Semester					
5.	Pre –requisite (if any):	Mathematics 1(FR001)					
6.	Co –requisite (if any):	None.					
7.	Program (s) in which the course is offered:	Electrical Engineering					
8.	Language of teaching the course:	English and Arabic.					
9.	Location of teaching the course:	Classes at the Faculty of Engineering					
10.	Prepared By:	Asst. Prof. Dr. Adnan Khalid Al-Salihi.					
11.	Date of Approval	March 2020					

II. Course Description:

This course introduces students to the topics of integral calculus. The course describes the most important ideas, fundamental concepts, theorems, and examples of integration, plane and space vectors, infinite sequences and series, Taylor and Maclaurin series, and parametric equations. The theoretical concepts will be supported by practical engineering examples and applications.

III. Course Intended learning outcomes (CILOs) of the course		Referenced PILOs
a1	Demonstrate a depth of knowledge of concepts and theories of integral calculus, vectors and series, appropriate to the engineering applications.	A1

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a2	Identify the most important and appropriate techniques of integrations and used the applicable methods in studying physics and various disciplines of engineering.	A2
a3	Recognize the connection between differential and integral calculus.	A2
b1	Construct mathematical models of problems related to science and Electrical engineering and then solve and analyze the model.	B1, B2
b2	Test improper integrals and infinite sequences and series for convergence.	B3
c1	Calculate the volume of solids, lengths of smooth curves, area of a surface of revolution, work done by a variable force, etc. by means a definite integral.	C1
c2	Graph parametric equations and determine curve orientations	
c3	Apply the definite integral to determine solutions to problems in science and engineering including center of mass of a lamina, length of curve and the area of surface revolution, force, fluid pressure vectors. .	C4
d1	Effectively manage tasks, time, and resources.	D1
d2	Communicate and work effectively in group and individually.	D4

(A) Alignment Course Intended Learning Outcomes of Knowledge and Understanding to Teaching Strategies and Assessment Strategies:

Course Intended Learning Outcomes	Teaching strategies	Assessment Strategies
a1- Demonstrate a depth of knowledge of concepts and theories of integral calculus, vectors and series, appropriate to the engineering applications.	▪ Active lectures ▪ Tutorials	▪ Written tests ▪ Homework ▪ presentations
a2- Identify the most important and appropriate techniques of integrations and used the applicable methods in studying physics and various disciplines of engineering.	▪ Active lectures ▪ Tutorials	▪ Written tests ▪ Homework ▪ presentations
a3- Recognize the connection between differential and integral calculus.	▪ Active lectures ▪ Tutorials	

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(B) Alignment Course Intended Learning Outcomes of Intellectual Skills to Teaching Strategies and Assessment Strategies:		
Course Intended Learning Outcomes	Teaching strategies	Assessment Strategies
b1- Construct a mathematical models of problems related to science and Electrical engineering and then solve and analyze the model.	▪ Active lectures ▪ Tutorials	▪ Written tests ▪ Homework ▪ presentations
b2- Test improper integrals and infinite sequences and series for convergence.		

© Alignment Course Intended Learning Outcomes of Professional and Practical Skills to Teaching Strategies and Assessment Strategies:		
Course Intended Learning Outcomes	Teaching strategies	Assessment Strategies
c1- Calculate the volume of solids, lengths of a smooth curves, area of a surface of revolution, work done by a variable force, etc. by means a definite integral.	▪ Active lectures ▪ Team work (group learning)	▪ Written tests ▪ Homework ▪ presentations
c2- Graph parametric equations and determine curve orientations.	▪ Active lectures ▪ Team work (group learning)	▪ Written tests ▪ Homework ▪ presentations
c3- Apply the definite integral to determine and solutions to problems in science a engineering including center of mass of lamina, length of curve and the area of surface revolution, force, fluid pressure vectors	▪ Active lectures ▪ Team work (group learning)	▪ Written tests ▪ Homework ▪ presentations

(D) Alignment Course Intended Learning Outcomes of Transferable Skills to Teaching Strategies and Assessment Strategies:		
Course Intended Learning Outcomes	Teaching strategies	Assessment Strategies
d1- Effectively manage tasks, time, and resources.	▪ Team work (group learning)	▪ Presentations, ▪ Reports

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d2- in	Communicate and work effectively group and individually.	▪ Team work (group learning)	▪ Presentations, ▪ Reports

IV. Course Content:

A – Theoretical Aspect:

Order	Units/Topics List	Learning Outcomes	Sub Topics List	Number of Weeks	Contact hours
1.	Anti-derivatives and Sigma Notation.	a1, a3, b1,c1,c3	▪ Definition and Notation. ▪ Rules for Anti-derivatives. ▪ Sigma Notation ▪ Area and Riemann Sums and Definite Integrals. ▪ Properties of the Definite Integral.	1	2
2.	The Fundamental Theorem of Calculus	a1,a3	▪ Calculation of the Definite Integral. ▪ Average Value of a Function. ▪ Change of Variable in a Definite Integral Indefinite Integration.	1	2
3.	Basic rule of integration	a1,a2,	▪ Basic rule of integration ▪ Integration by Substitution ▪ Numerical Integration.	1	2
4.	Integration of elementary functions.	a1,a2,	▪ Integration of the Natural Logarithmic Functions. ▪ Integration of Trigonometric Functions. ▪ Integration of Inverse Trigonometric Functions. ▪ Integration Hyperbolic Functions. ▪ Integration of Inverse Hyperbolic Functions	2	4
5.	Applications of Integration	a1,a2, b1,c1, c3	▪ Area of a Region Between Two Curves Volume: The Disk Method	2	4

			Volume: The Shell Method Arc Length and Surfaces of Revolution Applications in Physics and Engineering Differential Equations: Growth and Decay. ▪ Moments and center of mass of a Lamina		
6.	Vectors	a1, a2, d1,d2	▪ Vectors in the Plane Space Coordinates and Vectors in Space The Dot Product of Two Vectors The Cross Product of Two Vectors in Space	1	2
7.	Vectors and the Geometry of Space	a1,a2,c2,d1	▪ Plane Curves and Parametric Equations. ▪ Lines and Planes in Space Surfaces in Space Cylindrical and Spherical Coordinates	1	2
8.	Techniques of integrations	a1, a21,b1, c1, c3,d1,d2	▪ Integration by Part ▪ Integration by successive. ▪ Integration by Substitution. ▪ Integrals by Partial Fractions. ▪ Integration by Tables and Other Integration Techniques	2	4
9.	Improper Integrals	a1, a2, b2 b1, c3, d1,	▪ Indeterminate Forms and L'Hôpital's Rule. ▪ Improper Integrals ▪ Properties of improper integrals.	1	2
10.	Sequences And Series	a1, a2, c2	▪ Sequences ▪ Series and Convergence ▪ The Integral and Comparison Tests Other Convergence Tests.	1	2

11.	Power Series	a1, a2,b2, d1	▪ Taylor Polynomials and Approximations ▪ Power Series ▪ Representation of Functions by Power Series ▪ Taylor and Maclaurin Series	1	2
Number of Weeks /and Units Per Semester				**14**	**28**

B - Practical Aspect:

Order	Tasks/ Experiments	Number of Weeks	Contact hours	Learning Outcomes
1.	Anti-derivatives and the definite integral: Tutorial 1	1	2	a1, a3, b1,c1,c3
2.	The Fundamental Theorem of Calculus: Tutorial 2	1	2	a1,a3
3.	Basic rule of integration: Tutorial 3	1	2	a1,a2
4.	Integration of elementary functions: Tutorial 4 & 5	2	4	a1,a2,
5.	Applications of Integration: Tutorial 6&7	2	4	a1,a2, b1,c1, c3
6.	Vectors and the Geometry of Space:: Tutorial 8 &9	2	4	a1,a2,c2,d1
7.	Techniques of integrations: Tutorial 10 & 11	2	4	a1, a21,b1, c1, c3,d1,d2
8.	Improper Integrals: Tutorial 12	1	2	a1,a2 ,b2, b1, c2,d1,
9.	Sequences and Series: Tutorial 13	1	2	a1, a2, c2
10.	Power Series: Tutorial 14	1	2	a1, a2,b2, d1
Number of Weeks /and Units Per Semester		**14**	**28**	

V. Teaching strategies of the course:

- Lectures,
- Tutorials,
- Exercises and home works,
- Interactive class discussions
- Presentations.

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VI. Assignments:

No.	Assignments	Aligned CILOs(symbols)	Week Due	Mark
1.	Assignments on anti-derivatives, Sigma Notation and basic rule of integration.	a1, a2, a3, b1, c1, c2	2nd, 3rd, 4th	2.5
2.	Individual written assignments or in groups on Applications of Integration	a1, a2, b1, b3, c1 , c2	6th, 7th	2.5
3.	Assignments on Techniques of integrations	a1, a2, b1, c1, c2	8th, 9th	2.5
4.	Assignments on Improper Integrals and Sequences and Series	a1,a2,b1,c1,c3	12th,13th	2.5
	Total			**10**

VII. Schedule of Assessment Tasks for Students During the Semester:

No.	Assessment Method	Week Due	Mark	Proportion of Final Assessment	Aligned Course Learning Outcomes
1.	Oral presentations and Quizzes	4th ,6th &12th	7.5	5%	a1, a2,a3,b1,b2, c1,c3
2.	Individual written assignments or in groups	3rd ,5th 9th,11th,13th	7.5	5%	a1, a2 ,b1, c1,c3
3.	Mid-term Exam	8th	30	20 %	a1, a2,a3, b1 c1, c3, d1
4.	Final Exam	16th	105	70 %	a1, a2,b1, b2, c1,c2,c3
5	**Total**		**150**	**100%**	

VIII. Learning Resources:

- *Written in the following order: (Author - Year of publication – Title – Edition – Place of publication – Publisher).*

1- Required Textbook(s) (maximum two).

1. Larson, R., & Hodgkins, A. V. (2012). College algebra and calculus: an applied approach. Nelson Education.

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	2. Tomas calculus 12edition, Addison-Wesley pearson.2010.
2- Essential References.	
	1. John Bird, Engineering Mathematics. Published by Elsevier Ltd. Fifth edition 2007. **2.** Calculus, Howard Anton, Fifth Edition, John Wiley & Sons, Inc. New York Chi Chester Brisbane Toronto Singapore.1995. **3.** Larson, R., Hostetler, R. P., & Edwards, B. H. (2007). Essential Calculus: Early Transcendental Functions. Cengage Learning. **4.** Larson, R. (2012). Precalculus with limits. Cengage Learning.
3- Electronic Materials and Web Sites *etc*.	
	1. https://www.khanacademy.org/ **2.** www.math.com/ **3.** https://ocw.mit.edu/courses/mathematics/ **4.** https://uwaterloo.ca/mathematics-online-learning/

IX. Course Policies:

1.	**Class Attendance:** A student should attend not less than 75 % of total hours of the subject; otherwise he will not be able to take the exam and will be considered as exam failure. If the student is absent due to illness, he/she should bring an approved statement from university Clinic
2.	**Tardy:** For late in attending the class, the student will be initially notified. If he repeated lateness in attending class he will be considered as absent.
3.	**Exam Attendance/Punctuality:** A student should attend the exam on time. He is Permitted to attend an exam half one hour from exam beginning, after that he/she will not be permitted to take the exam and he/she will be considered as absent in exam-
4.	**Assignments & Projects:** The assignment is given to the students after each chapter; the student has to submit all the assignments for checking on time-
5.	**Cheating:** For cheating in exam, a student will be considered as failure. In case the cheating is repeated three times during his/her study the student will be disengaged from the Faculty-
6.	**Plagiarism**:

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	Plagiarism is the attending of a student the exam of a course instead of another student. If the examination committee proved a plagiarism of a student, he will be disengaged from the Faculty. The final disengagement of the student from the Faculty should be confirmed from the Student Council Affair of the university.
7.	**Other policies:** - Mobile phones are not allowed to use during a class lecture. It must be closed, otherwise the student will be asked to leave the lecture room - Mobile phones are not allowed in class during the examination. Lecture notes and assignments my given directly to students using soft or hard copy

Reviewed By	**Vice Dean for Academic Affairs and Post Graduate Studies: Asst. Prof. Dr. Tarek A. Barakat** **President of Quality Assurance Unit: Assoc. Prof. Dr. Mohammed Algorafi** **Name of Reviewer from the Department: Assoc. Prof. Dr. Riyad A. Muharram.**
	Deputy Rector for Academic Affairs Asst. Prof. Dr. Ibrahim AlMutaa **Assoc. Prof. Dr. Ahmed Mujahed** **Asst. Prof. Dr. Munasar Alsubri**

Head of Department Asst. Prof. Dr. Adel Ahmed Al-Shakiri	Quality Assurance Unit Assoc. Prof. Dr. Mohammad Algorafi	Dean of the Faculty Prof. Dr. Mohammed AL-Bukhaiti	Academic Development Center & Quality Assurance Assoc. Prof. Dr. Huda Al-Emad	Rector of Sana'a University Prof. Dr. Al-Qassim Mohammed Abbas

12. Template for Course Plan of Mathematics 2

I. Information about Faculty Member Responsible for the Course:

Name of Faculty Member	Dr. Adnan Alsalihi	**Office Hours**					
Location& Telephone No.	Sana'a university 770499879	**SAT**	**SUN**	**MON**	**TUE**	**WED**	**THU**
E-mail	Adnans2000@gmail.com						

II. Course Identification and General Information:

1-	Course Title:	Mathematics 2				
2-	Course Number & Code:	FR003				
3-	Credit hours:	C.H				Total
		Th.	Tu.	Pr.	Tr.	
		2	-	2	-	3
4-	Study level/year at which this course is offered:	First Year - Second Semester				
5-	Pre –requisite (if any):	Mathematics 1(FR001)				
6-	Co –requisite (if any):	None				
7-	Program (s) in which the course is offered	Electrical Engineering				
8-	Language of teaching the course:	English and Arabic				
9-	System of Study:	Credit Hours				
10-	Mode of delivery:	Full Time				
11-	Location of teaching the course:	Classes at the Faculty of Engineering				

III. Course Description:

This course introduces students to the topics of integral calculus. The course describes the most important ideas, fundamental concepts, theorems, and examples of integration, plane and space vectors, infinite sequences and series, Taylor and Maclaurin series, and parametric equations. The theoretical concepts will be supported by practical engineering examples and applications.

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IV. Intended learning outcomes (ILOs) of the course:

- Brief summary of the knowledge or skill the course is intended to develop**:**

1. Demonstrate a depth of knowledge of concepts and theories of integral calculus, vectors and series, appropriate to the engineering applications.
2. Identify the most important and appropriate techniques of integrations and used the applicable methods in studying physics and various disciplines of engineering.
3. Recognize the connection between differential and integral calculus.
4. Construct mathematical models of problems related to science and Electrical engineering and then solve and analyze the model.
5. Test improper integrals and infinite sequences and series for convergence.
6. Calculate the volume of solids, lengths of smooth curves, area of a surface of revolution, work done by a variable force, etc. by means a definite integral.
7. Graph parametric equations and determine curve orientations
8. Apply the definite integral to determine solutions to problems in science and engineering including center of mass of a lamina, length of curve and the area of surface revolution, force, fluid pressure vectors.
9. Effectively manage tasks, time, and resources.
10. Communicate and work effectively in group and individually.

V. Course Content:

A – Theoretical Aspect:

Order	Units/Topics List	Sub Topics List	Number of Weeks	Contact hours
1.	Anti-derivatives and Sigma Notation.	▪ Definition and Notation. ▪ Rules for Anti-derivatives. ▪ Sigma Notation ▪ Area and Riemann Sums and Definite Integrals. ▪ Properties of the Definite Integral.	1st	2
2.	The Fundamental Theorem of Calculus	▪ Calculation of the Definite Integral. ▪ Average Value of a Function. ▪ Change of Variable in a Definite Integral Indefinite Integration.	2nd	2
3.	Basic rule of integration	▪ Basic rule of integration ▪ Integration by Substitution ▪ Numerical Integration.	3rd	2
4.	Integration of elementary functions.	▪ Integration of the Natural Logarithmic Functions. ▪ Integration of Trigonometric Functions. ▪ Integration of Inverse Trigonometric Functions. ▪ Integration Hyperbolic Functions. ▪ Integration of Inverse Hyperbolic Functions	4th ,5th	4
5.	Applications of Integration	▪ Area of a Region Between Two Curves Volume: The Disk Method Volume: The Shell Method Arc Length and Surfaces of Revolution Applications in Physics and Engineering	6th ,7th	4

		Differential Equations: Growth and Decay. ▪ Moments and center of mass of a Lamina		
6.	Mid-Term Exam		8th	2
7.	Vectors	▪ Vectors in the Plane Space Coordinates and Vectors in Space The Dot Product of Two Vectors The Cross Product of Two Vectors in Space	9th	2
8.	Vectors and the Geometry of Space	▪ Plane Curves and Parametric Equations. ▪ Lines and Planes in Space Surfaces in Space Cylindrical and Spherical Coordinates	10th	2
9.	Techniques of integrations	▪ Integration by Part ▪ Integration by successive. ▪ Integration by Substitution. ▪ Integrals by Partial Fractions. ▪ Integration by Tables and Other Integration Techniques	11th ,12th	4
10.	Improper Integrals	▪ Indeterminate Forms and L'Hôpital's Rule. ▪ Improper Integrals ▪ Properties of improper integrals.	13th	2
11.	Sequences And Series	▪ Sequences ▪ Series and Convergence ▪ The Integral and Comparison Tests Other Convergence Tests.	14th	2
12.	Power Series	▪ Taylor Polynomials and Approximations ▪ Power Series ▪ Representation of Functions by Power Series ▪ Taylor and Maclaurin Series	15th	2

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13.	Final Exam		16th	2
Number of Weeks /and Units Per Semester			**16**	**32**

B - Practical Aspect:

Order	Tasks/ Experiments	Number of Weeks	Contact hours
1.	Anti-derivatives and the definite integral: Tutorial 1	1st	2
2.	The Fundamental Theorem of Calculus: Tutorial 2	2nd	2
3.	Basic rule of integration: Tutorial 3	3rd	2
4.	Integration of elementary functions: Tutorial 4 & 5	4th ,5th	4
5.	Applications of Integration: Tutorial 6&7	6th ,7th	4
6.	Vectors and the Geometry of Space:: Tutorial 8 &9	8th ,9th	4
7.	Techniques of integrations: Tutorial 10 & 11	10th ,11th	4
8.	Improper Integrals: Tutorial 12	12th	2
9.	Sequences and Series: Tutorial 13	13th	2
10.	Power Series: Tutorial 14	14th	2
Number of Weeks /and Units Per Semester		**14**	**28**

VI. Teaching strategies of the course:

- Lectures,
- Tutorials,
- Exercises and Homework,
- Interactive class discussions
- Presentations.

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VII. Assignments:

No.	Assignments	Aligned CILOs(symbols)	Week Due	Mark
1.	Assignments on anti-derivatives, Sigma Notation and basic rule of integration.	a1, a2, a3, b1, c1, c2	2nd, 3rd, 4th	2.5
2.	Individual written assignments or in groups on Applications of Integration	a1, a2, b1, b3, c1 , c2	6th, 7th	2.5
3.	Assignments on Techniques of integrations	a1, a2, b1, c1, c2	8th, 9th	2.5
4.	Assignments on Improper Integrals and Sequences and Series	a1,a2,b1,c1,c3	12th,13th	2.5
	Total			**10**

VIII. Schedule of Assessment Tasks for Students During the Semester:

No.	Assessment Method	Week Due	Mark	Proportion of Final Assessment
1.	Oral presentations and Quizzes	4th ,6th &12th	7.5	5%
2.	Individual written assignments or in groups	3rd ,5th 9th,11th,13th	7.5	5%
3.	Mid-term Exam	8th	30	20 %
4.	Final Exam	16th	105	70 %
5	**Total**		**150**	**100%**

IX. Learning Resources:

- *Written in the following order: (Author - Year of publication – Title – Edition – Place of publication – Publisher).*

1- Required Textbook(s) (maximum two).

1. Larson, R., & Hodgkins, A. V. (2012). College algebra and calculus: an applied approach. Nelson Education.
2. Tomas calculus 12edition, Addison-Wesley pearson.2010.

2- Essential References.

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	2. Calculus, Howard Anton, Fifth Edition, John Wiley & Sons, Inc. New York Chi Chester Brisbane Toronto Singapore.1995. **3.** Larson, R., Hostetler, R. P., & Edwards, B. H. (2007). Essential Calculus: Early Transcendental Functions. Cengage Learning. **4.** Larson, R. (2012). Precalculus with limits. Cengage Learning.
3- Electronic Materials and Web Sites *etc*.	
	1. https://www.khanacademy.org/ **2.** www.math.com/ **3.** https://ocw.mit.edu/courses/mathematics/ **4.** https://uwaterloo.ca/mathematics-online-learning/

X. Course Policies:

1.	**Class Attendance:** A student should attend not less than 75 % of total hours of the subject; otherwise he will not be able to take the exam and will be considered as exam failure. If the student is absent due to illness, he/she should bring an approved statement from university Clinic
2.	**Tardy:** For late in attending the class, the student will be initially notified. If he repeated lateness in attending class he will be considered as absent.
3.	**Exam Attendance/Punctuality:** A student should attend the exam on time. He is Permitted to attend an exam half one hour from exam beginning, after that he/she will not be permitted to take the exam and he/she will be considered as absent in exam-
4.	**Assignments & Projects:** The assignment is given to the students after each chapter; the student has to submit all the assignments for checking on time-
5.	**Cheating:** For cheating in exam, a student will be considered as failure. In case the cheating is repeated three times during his/her study the student will be disengaged from the Faculty-
6.	**Plagiarism**: Plagiarism is the attending of a student the exam of a course instead of another student. If the examination committee proved a plagiarism of a student, he will be disengaged from the Faculty. The final disengagement of the student from the Faculty should be confirmed from the Student Council Affair of the university.
7.	**Other policies:**

	- Mobile phones are not allowed to use during a class lecture. It must be closed, otherwise the student will be asked to leave the lecture room - Mobile phones are not allowed in class during the examination. Lecture notes and assignments my given directly to students using soft or hard copy