29Course Specification of Mathematics (5).

I. Course Identification and General Information:							
1	**Course Title:**	***Mathematics (5)***					
2	**Course Code & Number:**	BR201					
3	**Credit hours:**	C.H				**Credit Hours**	
		Th.	**Tu.**	**Pr.**	**Tr.**		
		2	2			3	
4	**Study level/ semester at which this course is offered:**	3rd Year/ 1st semester					
5	**Pre –requisite (if any):**	Mathematics 4					
6	**Co –requisite (if any):**						
8	**Program (s) in which the course is offered:**	Bachelor of Science in Civil Engineering (B.S.C.E.)					
9	**Language of teaching the course:**	English and Arabic					
10	**Location of teaching the course:**	Classes					
11	**Prepared by:**	Dr. Adnan Al-Salihi					
12	**Date of Approval**						

Prepared by	Head of Department	Quality Assurance Unit	Dean of the Faculty	Academic Development Center & Quality Assurance
	Dr. Abdulkareem Yahya Al khattabi	Ass. Prof. Dr. Mohammad Algorafi	Prof. Dr. Mohammed AL-Bukhaiti	Ass. Prof. Dr. Huda Al-Emad

Rector of Sana'a University
Prof. Dr. Al-Qassim Mohammed Abbas

II. Course Description:

This course introduces students to differential equations. Topics to be covered include: basic concepts, classification and formation of differential equations (ODEs and PDEs), general and particular solutions. They are solutions of ordinary differential equations (first order, second order and higher orders) by various methods geometric and physical applications. Partial differential equations, solutions of PDEs using Lagrange's method for first order quasi-linear equations, some physical models (heat, wave, Laplace equations), Physical application using separation of variables partial differential equations.

III. Course Intended learning outcomes (CILOs) of the course		Referenced PILOs
a.1	Recognize the basic concepts of differential equations and their solutions as well as a variety of related solution methods.	**A1**
a.2	Identify the most important and appropriate techniques for solving various types of differential equations.	**A3**
b.1	Classify the differential equations according to their types, order, degree, linearity and homogeneity and suggest the suitable method for solving every kind.	**B1**
b.2	Demonstrate proficiency in choose appropriate mathematical methods for solve a civil engineering problem governing by the ordinary and partial differential equations, as well as analyze, interpret the results and predict behavior.	**B2**
c.1	Apply the theorems and techniques for solving differential equations to solve practical engineering problems (e.g. Suspension Bridges).	**C3**
c.2	Solve the different types of DEs analytically (e.g. exact, homogeneous, linear, systems of linear differential equations and linear higher order, etc.) that describe models occurring in civil engineering.	**C3**
d.1	Effectively manage tasks, time, and resources.	**D2**
d.2	Communicate and work effectively in group and individually.	**D1**

(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- Recognize the basic concepts of differential equations and their solutions as well as a variety of related solution methods.	- Lectures. - Tutorials	- Written tests - Written assessment. - Report, homework and assignments.
a2- Identify the most important and appropriate techniques for solving various types of differential equations.	- Lectures. - Tutorials	- Written tests - Written assessment. - Report, homework and assignments.

(B) Alignment Course Intended Learning Outcomes of Intellectual Skills to Teaching Strategies and Assessment Strategies:		
Course Intended Learning Outcomes	Teaching strategies	Assessment Strategies
b1- Classify the differential equations according to their types, order, degree, linearity and homogeneity and suggest the suitable method for solving every kind.	- Lectures. - Tutorials	- Written tests - Written assessment. - Report, homework and assignments
b2-Demonstrate proficiency in choose appropriate mathematical methods for solve a civil engineering problem governing by the ordinary and partial differential equations, as well as analyze, interpret the results and predict behavior	- Lectures. - Tutorials	- Written tests - Written assessment. - Report, homework and assignments

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C 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- Demonstrate proficiency in choose appropriate mathematical methods for solve a civil engineering problem governing by the ordinary and partial differential equations, as well as to analyze, interpret the results and predict behavior.	- Lectures. - Tutorials	- Written tests - Written assessment. - Report, homework and assignments
c2- Solve the different types of DEs analytically (e.g. exact, homogeneous, linear, systems of linear differential equations and linear higher order, etc.) that describe models occurring in civil engineering.	- Lectures. - Tutorials	- Written tests - Written assessment. - Report, homework and assignments

(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.	- Lectures. - Tutorials	- Written tests - Written assessment. - Report, homework and assignments
d2- Communicate and work effectively in group and individually.	- Lectures. - Tutorials	- Written tests - Written assessment. - Report, homework and assignments

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IV. Course Content:

A – Theoretical Aspect:

Order	Units/Topics List	Learning Outcomes	Sub Topics List	Number of Weeks	Contact hours
1	Introduction of differential equations.	a1, b1, c2	- Basic concepts and definitions. - Classification of differential equations, types, order and degree, linear and nonlinear, homogeneous and non-homogeneous equations.	1	2
2	Formulation and solutions of differential equations.	a1, c2, d1	-Formulation of Differential equation for family of curves. -Solution of D. Es (General and particular) -Boundary and initial conditions.	2	2
3	First order ordinary differential equations	a1, a2, b1, c2, d1, d2	-Separable equations. -Homogeneous equations and equations reducible to homogeneous equations. -Exact equations, equations reducible to exact equations. -Integral factor. -Linear equations, equations reducible to exact equations (Bernoull's and Riccati equation).	3	6
4	Homogeneous Higher order ODEs with constant coefficients	a1, a2, b1, c2	-Linear independence and linear dependence -Homogenous equations with constant coefficients.	1	2
5	Nonhomogeneous Higher order ODEs	a1, a2, b1, c2	-Operator method.	1	4

	with constant coefficients		-Undetermined coefficients method. -Method of variations of parameter.		
6	Higher order ODEs with variable coefficients and applications	a1, a2, b1, b2, c1, c2	-Cauchy-Euler Equation. -Lagrange Equation. -Applications on nth order differential equations.	1	2
7	Systems of Differential Equations	a1, a2, b1, c2, d1, d2	-Systems of Ordinary Differential Equations	1	2
8	Partial Differential Equations	a1, b1, c2	-Introduction and classification of PDEs. -PDEs in Physics and Engineering	1	2
9	Linear PDEs of the First Order.	a1, a2, c2, d2	-Solution of linear PDEs of first order (Complete integral, lagrange's method)	2	2
10	Linear PDEs of the Second Order and Methods of solution of Linear PDEs of 2^{nd} and Application	a1, a2, b1, b2, c1, c2, d1	-Classification the 2nd order PDEs -Solutions of Initial Value problems -Method of Separation of Variables using, heat, wave and Laplace equations. Method of Separation of Variables apply to, heat, wave and Laplace equations. -Geometric and Physical applications for ODEs and PDEs (The vibrating string, Heat flow, Two – Dimensional heat flow,)	1	2
Number of Weeks /and Units Per Semester				**14**	**28**

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B – Tutorial Aspect:				
Order	**Tasks/ Experiments**	**Number of Weeks**	**contact hours**	**Learning Outcomes**
1	Introduction of differential equations: Tutorial 1	1	**2**	a1, b1, c2
2	Formulation and solutions of differential equations: Tutorial 2	1	**2**	a1, c2, d1
3	First order ordinary differential equations: Tutorial 3, 4, & 5	3	**6**	a1, a2, b1, c2, d1, d2
4	Homogeneous Higher order ODEs with constant coefficients Tutorial 6	1	**2**	a1, a2, b1, c2
5	Nonhomogeneous Higher order ODEs with constant coefficients: Tutorial 7 & 8	2	**4**	a1, a2, b1, c2
6	Higher order ODEs with variable coefficients and applications: Tutorial 9	1	**2**	a1, a2, b1, b2, c1, c2
7	Systems of Differential Equations: Tutorial 10	1	**2**	a1, a2, b1, c2, d1, d2
8	Partial Differential Equations: Tutorial 11	1	**2**	a1, b1, c2
9	Linear PDEs of the First Order: Tutorial 12	1	**2**	a1, a2, c2, d2
10	Linear PDEs of the Second Order and Methods of solution of Linear PDEs of 2nd and Application: Tutorial 13 & 14	2	**4**	a1, a2, b1, b2, c1, c2, d1
Number of Weeks /and Units Per Semester		**14**	**28**	

V. Teaching strategies of the course:

- Lectures
- Tutorials

VI. Assignments:

No	Assignments	Aligned CILOs(symbols)	Week Due	Mark

Prepared by — Head of Department: Dr. Abdulkareem Yahya Al khattabi

Quality Assurance Unit: Ass. Prof. Dr. Mohammad Algorafi

Dean of the Faculty: Prof. Dr. Mohammed AL-Bukhaiti

Academic Development Center & Quality Assurance: Ass. Prof. Dr. Huda Al-Emad

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1	Coursework assignments	a1, a2, b1, b2, c1, c2, d1	During of semester	3.5
2	Quiz 1	a1, a2, b1, c1, c2, d1	4th	1
3	Quiz 2	a1, a2, b2, c2, d2	10th	1
4	Report	a2, b2, c2	5th	2

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	Written assignment	During of semester	7.5	5%	a1, a2, b1, b2, c1, c2, d1
2	Quizzes	4th & 10th	7.5	5%	a1, a2, b1, b2, c1, c2, d1
3	Midterm exam	8th week	30	20%	a1, a2, b1, b2, c1, c2
4	Final exam	End of semester	105	70%	a1, a2, b1, b2, c1, c2, d2
	sum		**150**	**100%**	

Prepared by

Head of Department
Dr. Abdulkareem Yahya Al khattabi

Quality Assurance Unit
Ass. Prof. Dr. Mohammad Algorafi

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Academic Development Center & Quality Assurance
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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- Advanced Engineering Mathematics, Sixth Edition by Dennis G. Zill, Jones & Bartlett Learning, 2017.
2- A Text Book Of Engineering Mathematics, Vol (II), by Dr.Rajesh Pandey, word press, First edition, 2010.

2- Essential References.

1- Higher Engineering Mathematics, Fifth Edition by John Bird, Elsevier Ltd. 2006
2- Schaum's Outline of Theory and problems of Differential Equations in SI Metric Units, Frank Ayres, Jr. First Edition, McGRAW-HILL BOOKCOMPANY, 1981.

3- Electronic Materials and Web Sites *etc*.

1- wolframMathworld
http://mathworld.wolfram.com/topics/CalculusandAnalysis.html

IX. Course Policies:	
1	**Class Attendance**: The students should have more than 75 % of attendance according to rules and regulations of the faculty.
2	**Tardy:** The students should respect the timing of attending the lectures. They should attend within 1 minutes from starting of the lecture.
3	**Exam Attendance/Punctuality**: The student should attend the exam on time. The punctuality should be implemented according to rules and regulations of the faculty for midterm exam and final 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:** If any cheating occurred during the examination, the student is not allowed to continue and he/she has to face the examination committee for enquiries.
6	**Plagiarism:** The student will be terminated from the Faculty, if one student attends the exam on another behalf according to the policy, rules and regulations of the university.
7	**Other policies:** • All the teaching materials should be kept out the examination hall. • The mobile phone is not allowed. • There should be a respect between the student and his teacher.

Reviewed By	**Vice Dean for Academic Affairs and Post Graduate Studies** **Dr. Tarek A. Barakat** **Dr. Mohammad Algorafi**
	Deputy Rector for Academic Affairs Dr. Ibrahim AlMutaa **Dr. Ahmed mujahed** **Dr. Munaser Alsubri**

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Template for Course Plan (Syllabus) of Mathematics (5)

I. Information about Faculty Member Responsible for the Course:							
Name of Faculty Member	Dr. Adnan Al-salihi	**Office Hours**					
Location& Telephone No.	00967770499879	**SAT**	**SUN**	**MON**	**TUE**	**WED**	**THU**
E-mail	Adnans2000@gmail.com						

II. Course Identification and General Information:						
1	**Course Title:**	***Mathematics (5)***				
2-	**Course Number & Code:**	BR201				
3-	**Credit hours:**	**C.H**				**Credit Hours**
		Th.	**Tu.**	**Pr.**	**Tr.**	
		2	2			3
4-	**Study level/year at which this course is offered:**	3rd Year/ Level 1st semester				
5-	**Pre –requisite (if any):**	Mathematics 4				
6-	**Co –requisite (if any):**					
7-	**Program (s) in which the course is offered**	Bachelor of Science in Civil Engineering (B.S.C.E.)				
8-	**Language of teaching the course:**	English and Arabic				
9-	**System of Study:**	Credit Hours System				
10-	**Mode of delivery:**	Full Time				
11-	**Location of teaching the course:**	Classes				

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III. Course Description:

This course introduces students to differential equations. Topics to be covered include: basic concepts, classification and formation of differential equations (ODEs and PDEs), general and particular solutions. They are solutions of ordinary differential equations (first order, second order and higher orders) by various methods geometric and physical applications. Partial differential equations, solutions of PDEs using Lagrange's method for first order quasi-linear equations, some physical models (heat, wave, Laplace equations), Physical application using separation of variables partial differential equations.

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

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

a.1. Recognize the basic concepts of differential equations and their solutions as well as a variety of related solution methods.
a.1. Identify the most important and appropriate techniques for solving various types of differential equations.
b.1. Classify the differential equations according to their types, order, degree, linearity and homogeneity and suggest the suitable method for solving every kind.
b.2. Demonstrate proficiency in choose appropriate mathematical methods for solve a civil engineering problem governing by the ordinary and partial differential equations, as well as analyze, interpret the results and predict behavior.
c.1. Apply the theorems and techniques for solving differential equations to solve practical engineering problems (e.g. Suspension Bridges).
c.2. Solve the different types of DEs analytically (e.g. exact, homogeneous, linear, systems of linear differential equations and linear higher order, etc.) that describe models occurring in civil engineering.
d.1. Effectively manage tasks, time, and resources.
d.2. Communicate and work effectively in group and individually.

V. Course Content:

- **Distribution of Semester Weekly Plan Of course Topics/Items and Activities.**

A – Theoretical Aspect:

Order	Topics List	Sub Topics List	Week Due	Contact Hours
1	Introduction of differential equations.	- Basic concepts and definitions. Classification of differential equations, types, order and degree, linear and nonlinear, homogeneous and non-homogeneous equations.	1	2
2	Formulation and solutions of differential equations.	-Formulation of Differential equation for family of curves. -Solution of D. Es (General and particular) Boundary and initial conditions.	2	2
3	First order ordinary differential equations:	-Separable equations. -Homogeneous equations and equations reducible to homogeneous equations. -Exact equations, equations reducible to exact equations. -Integral factor. Linear equations, equations reducible to exact equations (Bernoull's and Riccati equation).	3,5	6
4	Homogeneous Higher order ODEs with constant coefficients	-Linear independence and linear dependence Homogenous equations with constant coefficients.	6	2
5	NonHomogeneous Higher order ODEs with constant coefficients	-Operator method. -Undetermined coefficients method. Method of variations of parameter.	7	4

6	Midterm Exam		8	2
7	NonHomogeneous Higher order ODEs with constant coefficients	-Operator method. -Undetermined coefficients method. Method of variations of parameter.	9	2
8	Higher order ODEs with Variable coefficients and applications: Cauchy-Euler Equation and Lagrange Equation	-Cauchy-Euler Equation. -Lagrange Equation. Applications on nth order differential equations.	10	2
	Systems of Differential Equations	Systems of Ordinary Differential Equations	11	2
9	Partial Differential Equations	-Introduction and classification of PDEs. PDEs in Physics and Engineering	12	2
10	Linear PDEs of the First Order.	Solution of linear PDEs of first order (Complete integral, lagrange's method)	13	2
11	Linear PDEs of the Second Order and Methods of solution of Linear PDEs of 2nd and Application:	-Classification the 2nd order PDEs -Solutions of Initial Value problems -Method of Separation of Variables using, heat, wave and Laplace equations. Method of Separation of Variables apply to, heat, wave and Laplace equations. Geometric and Physical applications for ODEs and PDEs (The vibrating string, Heat flow, Two – Dimensional heat flow,)	14,15	4
12	Final Exam		16	2
Number of Weeks /and Units Per Semester			**16**	**32**

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B – Tutorial Aspect:			
Order	**Topics List**	**Week Due**	**Contact Hours**
1	Introduction of differential equations: Tutorial 1	1	**2**
2	Formulation and solutions of differential equations: Tutorial 2	2	**2**
3	First order ordinary differential equations: Tutorial 3, 4, & 5	3,4,5	**6**
4	Homogeneous Higher order ODEs with constant coefficients Tutorial 6	6	**2**
5	Nonhomogeneous Higher order ODEs with constant coefficients: Tutorial 7 & 8	7,8	**4**
6	Higher order ODEs with variable coefficients and applications: Tutorial 9	9	**2**
7	Systems of Differential Equations: Tutorial 10	10	**2**
8	Partial Differential Equations: Tutorial 11	11	**2**
9	Linear PDEs of the First Order: Tutorial 12	12	**2**
10	Linear PDEs of the Second Order and Methods of solution of Linear PDEs of 2nd and Application: Tutorial 13 & 14	13,14	**4**
Number of Weeks /and Units Per Semester		**14**	**28**

VI. Teaching strategies of the course:

- Lectures
- Tutorials

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VII. Assignments:

No	Assignments	Aligned CILOs(symbols)	Week Due	Mark
1	Coursework assignments	a1, a2, b1, b2, c1, c2, d1	During of semester	3.5
2	Quiz 1	a1, a2, b1, c1, c2, d1	4th	1
3	Quiz 2	a1, a2, b2, c2, d2	10th	1
4	Report	a2, b2, c2	5th	2

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

Assessment	Type of Assessment Tasks	Week Due	Mark	Proportion of Final Assessment
1	Written assignment	During of semester	7.5	5%
2	Quizzes	4th & 10th	7.5	5%
3	Midterm exam	8th week	30	20%
4	Final exam	End of semester	105	70%
	sum		**150**	**100%**

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X. Course Policies:	
Unless otherwise stated, the normal course administration policies and rules of the Faculty of ----- apply. For the policy, see: ----------	
1	**Class Attendance:** The students should have more than 75 % of attendance according to rules and regulations of the faculty.
2	**Tardy:** The students should respect the timing of attending the lectures. They should attend within 1 minutes from starting of the lecture.
3	**Exam Attendance/Punctuality:** The student should attend the exam on time. The punctuality should be implemented according to rules and regulations of the faculty for midterm exam and final 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.
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