36Course Specification of Mathematics 6

I. Course Identification and General Information:							
1.	Course Title:	***Mathematics 6***					
2.	Course Code & Number:	BR202					
3.	Credit hours:	C.H.				**Credit Hours**	
		Th.	**Tu.**	**Pr.**	**Tr.**		
		2	2	-		3	
4.	Study level/ semester at which this course is offered:	Second Level / Second Semester.					
5.	Pre –requisite (if any):	Mathematics 5 (BR201)					
6.	Co –requisite (if any):	None					
7.	Program (s) in which the course is offered:	Mechatronics, Mechanical ,Civil, Elictric Engineering Departments.					
8.	Language of teaching the course:	English Language.					
9.	Location of teaching the course:	Faculty of Engineering, Sana'a University.					
10.	Prepared By:	Associate Prof. Dr. Yasser ALhuri.					
11.	Date of Approval:	January 2020.					

II. Course Description:

This course will emphasize the numerical analysis methods to provide approximation solution to common problems formulated in science and engineering. The emphasis of the course will be the thorough study of numerical algorithms to understand the guaranteed accuracy that various methods provide.
The focus of the course is the numerical methods using the following computational techniques: error analysis, numerical solutions to nonlinear equations, solution methods for linear system, interpolation, numerical differentiation, numerical integration, and the numerical solutions of ordinary differential equations.

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

III. Course Intended learning outcomes (CILOs) of the course		Referenced PILOs
a1.	Define the concept of Numerical Analysis Methods and Error Analysis.	**A1**
a2.	Identify some Numerical Methods and appropriate techniques for solving Nonlinear Equations, Linear system and finding the Interpolation.	**A3**
b1.	Examine different Numerical Methods to solve Applied Problems.	**B1**
b2.	Investigate the Numerical Analysis in solving 1D and 2D Civil Problems.	**B2**
c1.	Apply various techniques of numerical methods to solve the mathematics problems	**C3**
d1.	Co-operate with team members to share different knowledges.	**D3**
d2.	Assess to tasks with the support of the different resources.	**D5**

(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. Know the concept of Numerical Analysis Methods and Error Analysis.	• Active Lectures. • Tutorials.	• Written Assessment. • Final exam
a2. Identify some Numerical Methods and appropriate techniques for solving Nonlinear Equations, Linear system and finding the Interpolation.	• Active Lectures. • Tutorials.	• Written Assessment. • Final exam.
a3. Establish Numerical Analysis to approximate Integration, Differentiation and Ordinary Differential Equations Problems.	• Active Lectures. • Tutorials.	• Written Assessment. • Final exam

(B) Alignment Course Intended Learning Outcomes of Intellectual Skills to Teaching Strategies and Assessment Strategies:		
Course Intended Learning Outcomes	Teaching strategies	Assessment Strategies
b1. Examine different Numerical Methods to solve Applied Problems.	• Active Lectures. • Tutorials.	• Written Assessment. • Final exam
b2. Investigate the Numerical Analysis in solving 1D and 2D Civil Problems.	• Active Lectures. • Tutorials.	• Written Assessment. • Final exam

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

(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. Apply various techniques of numerical methods to solve the mathematics problems	• Active Lectures. • Tutorials.	• Written Assessment. • Final exam

(D) Alignment Course Intended Learning Outcomes of Transferable Skills to Teaching Strategies and Assessment Strategies:		
Course Intended Learning Outcomes	Teaching strategies	Assessment Strategies
d1. Co-operate with team members to share different knowledges.	• Case Studies.	• Written Assessment.
d2. Assess to tasks with the support of the different resources.	• Case Studies.	• Written Assessment.

IV. Course Content:

A – Theoretical Aspect:

Order	Units/Topics List	Learning Outcomes	Sub Topics List	Number of Weeks	Contact Hours
1.	Error Analysis	a1,b2,c1,d1	- Accuracy, Precision and Error Definitions. -Round-Off Errors. -Truncation Errors.	**1**	**2**
2.	Numerical Methods for solving Nonlinear Equations of one variable	a2 ,b1,c1,d1	-Bisection Method. - False position Method. - Fixed – Point iteration. - Newton – Raphson. - Secant Methods.	**3**	**6**
3.	Linear Systems	a2 ,b1,c1,d1,d2	-Gauss elimination. - Pivoting. - LU factorization. - Jacobi Method. - Gauss Seidel.	**2**	**4**
4.	The Interpolation	a2,b1,b2,c1, d1,d2	Direct Fit Polynomial.		**2**

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

			Newton Interpolating Polynomials. Lagrange Interpolating Polynomials. Newton's Divided-Difference Interpolating Polynomials.	**1**	
5.	The Interpolation	a2,b1,b2,c1, d1,d2	Direct Fit Polynomial. Newton Interpolating Polynomials. Lagrange Interpolating Polynomials. Newton's Divided-Difference Interpolating Polynomials.	**2**	**4**
6.	Numerical Differentiation	a3,b1,b2,c1, d1	Derivatives of Unequally Spaced Data. Derivatives and Integrals for Data with Errors.	**1**	**2**
7.	Numerical Integration	a3,b1,b2,c1, d1,d2	The Trapezoidal Rule. Simpson's Rules.	**2**	**4**
8.	Numerical Solutions of Ordinary Differential Equations	a3,b1,b2,c1, d1,d2	Euler's Method Runge-Kutta Method.	**2**	**4**
Number of Weeks /and Units Per Semester				**14**	**28**

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

B – Tutorial Aspect:				
Order	**Tasks/ Experiments**	**Number of Weeks**	**Contact hours**	**Learning Outcomes**
1.	Tutorial_1 **Error Analysis**	**1**	**2**	a1,b2,c1,d1
2.	Tutorial_2+3+4 **Numerical Methods for solving Nonlinear Equations of one variable**	**3**	**6**	a2 ,b1,c1,d1
3.	Tutorial_5+6 **Linear Systems**	**2**	**4**	a2 ,b1,c1,d1,d2
4.	Tutorial_7+8+9 **The Interpolation**	**3**	**6**	a2,b1,b2,c1,d1,d2
5.	Tutorial_10 **Numerical Differentiation**	**1**	**2**	a3,b1,b2,c1,d1
6.	Tutorial_11+12 **Numerical Integration**	**2**	**4**	a3,b1,b2,c1,d1,d2
7.	Tutorial_13+14 **Numerical Solutions of Ordinary Differential Equations**	**2**	**4**	a3,b1,b2,c1,d1,d2
Number of Weeks /and Units Per Semester		**14**	**28**	

V. Teaching strategies of the course:

- Active Lectures.
- Tutorials.
- Case Studies.

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

VI. Assignments:

No	Assignments	Aligned CILOs(symbols)	Week Due	Mark
1.	**Error Analysis** Tutorial_1	a1,b2,c1,d1	First Week	3
2.	**Numerical Methods for solving Nonlinear Equations of one variable** Tutorial_2+3+4	a2 ,b1,c1,d1	Second,Third and Fourth Weeks	9
3.	**Linear Systems** Tutorial_5+6	a2 ,b1,c1,d1,d2	Fifth and Sixth Weeks	6
4.	**The Interpolation** Tutorial_7+8+9	a2,b1,b2,c1,d1,d2	Seventh, Eight and Ninth Weeks	9
5.	**Numerical Differentiation** Tutorial_10	a3,b1,b2,c1,d1	Tenth Week	3
6.	**Numerical Integration** Tutorial_11+12	a3,b1,b2,c1,d1,d2	Eleventh and Twelfth Weeks	6
7,	**Numerical Solutions of Ordinary Differential Equations** Tutorial_13+14	a3,b1,b2,c1,d1,d2	Thirteenth and Fourteen Weeks	9

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.	Assessment (Work Sample such as Portfolios).	1-14	45	30 %	All
2.	Final Exam.	15	105	70 %	All
	Total	**16**	**150**	**100%**	

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

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

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- Richard L.Burden and J.Doyglass Faires. 2011 Numerical Analysis, 9th ed. Brooks ⁄Col, Cengage Learning.
2- Chapra S. C. and Canale R. P. (2015) Numerical Methods For Engineers, 7th ed. McGraw-Hill Education.

2- Essential References.

1- Xin-She Yang., 2007, Applied Engineering Mathematics. University of Cambridge, Cambridge, United Kingdom Pub.

3- Electronic Materials and Web Sites etc.

- http://ocw.mit.edu/courses/
- http://depts.washington.edu/amath/
- http://www.esam.northwestern.edu/index.html

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

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 10 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 rulesand regulations of the faculty for mid term 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 has to face the examination committee for enquiries.
6.	**Plagiarism**: The student will be terminated from the Faculty, if one student attend 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**

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

Template for Course Plan (Syllabus) of Mathematics 6

I. Information about Faculty Member Responsible for the Course:								
Name of Faculty Member	Dr. Yasser Alhuri	**Office Hours**						
Location& Telephone No.	Department of Basic Engineering Science 00967773038653	**SAT**	**SUN**	**MON**	**TUE**	**WED**	**THU**
E-mail	yasseralhuri@yahoo.com						

II. Course Identification and General Information:						
1.	**Course Title:**	***Mathematics 6***				
2.	**Course Number & Code:**	BR202				
3.	**Credit hours:**	**C.H**				**Credit Hours**
		Th.	**Tu.**	**Pr.**	**Tr.**	
		2	2	-		3
4.	**Study level/year at which this course is offered:**	Second Level / Second Semester.				
5.	**Pre –requisite (if any):**	Mathematics 5 (BR201)				
6.	**Co –requisite (if any):**	None				
7.	**Program (s) in which the course is offered**	Mechatronics, Mechanical ,Civil, Electric Engineering Departments.				
8.	**Language of teaching the course:**	English Language.				
9.	**System of Study:**	Classes				
10.	**Mode of delivery:**	Lecture				
11.	**Location of teaching the course:**	Faculty of Engineering				

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

III. Course Description:

This course will emphasize the numerical analysis methods to provide approximation solution to common problems formulated in science and engineering. The emphasis of the course will be the thorough study of numerical algorithms to understand the guaranteed accuracy that various methods provide.
The focus of the course is the numerical methods using the following computational techniques: error analysis, numerical solutions to nonlinear equations, solution methods for linear system, interpolation, numerical differentiation, numerical integration, and the numerical solutions of ordinary differential equations.

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

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

a1. Define the concept of Numerical Analysis Methods and Error Analysis. A1
a2. Identify some Numerical Methods and appropriate techniques for solving Nonlinear Equations, Linear system and finding the Interpolation. A3
b1. Examine different Numerical Methods to solve Applied Problems. B1
b2. Investigate the Numerical Analysis in solving 1D and 2D Civil Problems. B2
c1. Apply various techniques of numerical methods to solve the mathematics problems C3
d1. Co-operate with team members to share different knowledges. D3
d2. Assess to tasks with the support of the different resources. D5

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.	Error Analysis	- Accuracy, Precision and Error Definitions. -Round-Off Errors. -Truncation Errors.	1	2
2.	Numerical Methods for solving Nonlinear Equations of one variable	-Bisection Method. - False position Method. - Fixed – Point iteration. - Newton – Raphson. - Secant Methods.	2,4	4
3.	Linear Systems	-Gauss elimination. - Pivoting. - LU factorization. - Jacobi Method. - Gauss Seidel.	5,6	4
4.	The Interpolation	- Direct Fit Polynomial. - Newton Interpolating Polynomials. - Lagrange Interpolating Polynomials. - Newton's Divided-Difference Interpolating Polynomials.	7	2
5.	Midterm Exam		8	2
6.	The Interpolation	- Direct Fit Polynomial. - Newton Interpolating Polynomials. - Lagrange Interpolating Polynomials. - Newton's Divided-Difference Interpolating Polynomials.	9,10	4
7.	Numerical Differentiation	- Derivatives of Unequally Spaced Data. - Derivatives and Integrals for Data with Errors.	11	2

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

8.	Numerical Integration	- The Trapezoidal Rule. - Simpson's Rules.	12,13	4
9.	Numerical Solutions of Ordinary Differential Equations	- Euler's Method - Runge-Kutta Method.	14,15	4
10.	Final Exam		16	2
Number of Weeks /and Units Per Semester			**16**	**32**

B – Tutorial Aspect:

Order	Tasks/ Experiments	Number of Weeks	Contact Hours
1.	**Error Analysis** Tutorial_1	1	2
2.	**Numerical Methods for solving Nonlinear Equations of one variable** Tutorial_2+3+4	2,3,4	6
3.	**Linear Systems** Tutorial_5+6	5,6	4
4.	**The Interpolation** Tutorial_7+8+9	7,8,9	6
5.	**Numerical Differentiation** Tutorial_10	10	2
6.	**Numerical Integration** Tutorial_11+12	11,12	4
7.	**Numerical Solutions of Ordinary Differential Equations** Tutorial_13+14	13,14	4
Number of Weeks /and Units Per Semester		**14**	**28**

VI. Teaching strategies of the course:

- Active Lectures.

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

- Tutorials.
- Case Studies.

VII. Assignments:

No	Assignments	Aligned CILOs(symbols)	Week Due	Mark
1.	**Error Analysis** Tutorial_1	a1,b2,c1,d1	First Week	3
2.	**Numerical Methods for solving Nonlinear Equations of one variable** Tutorial_2+3+4	a2 ,b1,c1,d1	Second,Third and Fourth Weeks	9
3.	**Linear Systems** Tutorial_5+6	a2 ,b1,c1,d1,d2	Fifth and Sixth Weeks	6
4.	**The Interpolation** Tutorial_7+8+9	a2,b1,b2,c1,d1,d2	Seventh, Eight and Ninth Weeks	9
5.	**Numerical Differentiation** Tutorial_10	a3,b1,b2,c1,d1	Tenth Week	3
6.	**Numerical Integration** Tutorial_11+12	a3,b1,b2,c1,d1,d2	Eleventh and Twelfth Weeks	6
7,	**Numerical Solutions of Ordinary Differential Equations** Tutorial_13+14	a3,b1,b2,c1,d1,d2	Thirteenth and Fourteen Weeks	9

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

No.	Assessment Method	Week Due	Mark	Proportion of Final Assessment	Aligned Course Learning Outcomes
1.	Assessment (Work Sample such as Portfolios).	1-14	45	30 %	all
2.	Final Exam.	15	105	70 %	all
	Total	**16**	**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- Richard L.Burden and J.Doyglass Faires. 2011 Numerical Analysis, 9th ed. Brooks ⁄Col, Cengage Learning.
2- Chapra S. C. and Canale R. P. (2015) Numerical Methods For Engineers, 7th ed. McGraw-Hill Education.

2- Essential References.

1- Xin-She Yang., 2007, Applied Engineering Mathematics. University of Cambridge, Cambridge, United Kingdom Pub.

3- Electronic Materials and Web Sites etc.

- http://ocw.mit.edu/courses/
- http://depts.washington.edu/amath/
- http://www.esam.northwestern.edu/index.html

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

X. 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 10 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 mid term 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 has to face the examination committee for enquiries .
6.	**Plagiarism**:The student will be terminated from the Faculty, if one student attend 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.