Sana'a University
Faculty of Engineering
Department: Basic Engineering Sciences
Title of the Program: B.Sc. of Electrical Engineering .

Course Specification of Engineering Mathematics

I. Course Identification and General Information:

1.	Course Title:	Engineering Mathematics.				
2.	Course Code & Number:	BR223.				
3.	Credit hours:	**C.H.**				Total C.R.
		Th.	Tu.	Pr	Tr.	
		2	-	-	2	3
4.	Study level/ semester at which this course is offered:	Therd Level (First Semester).				
5.	Pre –requisite (if any):	Mathematics 1 (FR001), Mathematics 2 (FR003), Linear Algebra (BR121), Differential Equations (BR122).				
6.	Co –requisite (if any):	None				
7.	Program (s) in which the course is offered:	Electrical Engineering Departments.				
8.	Language of teaching the course:	English /Arabic.				
9.	Location of teaching the course:	Faculty of Engineering,				
10.	Prepared By:	Associate Prof. Dr. Yasser ALhuri.				
11.	Date of Approval:					

II. Course Description:

This course deals with topics which provide students to relevant mathematical tools required in the analysis of problems in engineering and scientific professions.

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, the numerical solutions of differential equations (ODEs and PDE) that arise in engineering and the physical sciences and Fourier transforms with it's applications in PDEs.

Prepared by
Assoc. Prof. Dr.
Yasser ALhuri.

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

III.	Course Intended learning outcomes (CILOs) of the course	Referenced PILOs
a1.	Know the concept of Numerical Analysis Methods and Error Analysis.	A1, A3
a2.	Identify some Numerical Methods and appropriate techniques for solving Nonlinear Equations, Linear system and finding the Interpolation relevent to Electrical engineering prosesses.	A1, A3
a3.	Establish Numerical Analysis to approximate Integration, Differentiation and Ordinary Differential Equations Problems.	A1
a4.	Define Fourier series, Complex and Integral and how use it to solve (PDEs) for Electrical engineering problems.	A1
b1.	Examine different Numerical Methods to solve Applied engineering Problems.	B1,B3
c1.	Apply various techniques of numerical methods to approximate the solution of some mathematics problems which haven't exact or analytical solution for Electrical Engineering practices.	C1,C4
d1.	Co-operate with team members to share different knowledges.	D1
d2.	Assess to tasks with the support of the different resources.	D2

(A) Alignment Course Intended Learning Outcomes of Knowledge and UndeA1rstanding 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 Assessmen. -Final exam
a2. Identify some Numerical Methods and appropriate techniques for solving Nonlinear Equations, Linear system and finding the Interpolation relevent to Electrical engineering prosesses.	-Active Lectures. -Tutorials.	-Written Assessment. -Final exam.

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Assoc. Prof. Dr. Yasser ALhuri.	Asst. Prof. Dr. Adel Ahmed Al-Shakiri	Assoc. Prof. Dr. Mohammad Algorafi	Prof. Dr. Mohammed AL-Bukhaiti	Center & Quality Assurance Assoc. Prof. Dr. Huda Al-Emad

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a3.	Establish Numerical Analysis to approximate Integration, Differentiation and Ordinary Differential Equations Problems.	-Active Lectures. -Tutorials.	-Written Assessment. -Final exam
a4.	Define Fourier series, Complex and Integral and how use it to solve (PDEs) for Electrical engineering problems.	-Active Lectures. -Tutorials.	-Written Assessment.

(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 engineering Problems.	-Active Lectures. -Tutorials.	-Written Assessment. -Final exam

(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 approximate the solution of some mathematics problems which haven't exact or analytical solution for Electrical Engineering practices.	-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.

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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,c1,d1,d2	- 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,d2	-Bisection Method. - False position Method. - Fixed – Point iteration. - Newton – Raphson. - Secant Methods.	2	4
3.	The Interpolation	a2,b1,c1,d1, d2	-Direct Fit Polynomial. -Newton Interpolating Polynomials. -Lagrange Interpolating Polynomials. -Newton's Divided-Difference Interpolating Polynomials.	2	4
4.	Numerical Differentiation	a3,b1,c1,d1, d2	-Derivatives of Unequally Spaced Data. -Derivatives and Integrals for Data with Errors.	1	2

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5.	Numerical Integration	a3,b1,c1,d1, d2	-The Trapezoidal Rule. -Simpson's Rules.	1	2
6.	Numerical Methods to solve (ODEs)	a3,b1,c1,d1, d2	-Euler's Method. - Runge-Kutta methods.	1	2
7.	Numerical Methods to solve (PDEs)	a3,a4,b1,c1, d1,d2	-Finite Difference Methods for Parabolic PDEs.	1	2
			-Finite Difference Methods for Hyperbolic PDEs.	1	2
			-Finite Difference Methods for Elliptic PDEs	1	2
8.	Fourier Series	a4,b1,c1,d1, d2	-Computation of Fourier Series. -Fourier cosine and sine Series.	1	2
9.	Complex Fourier and Integral	a4,b1,c1,d1, d2	-The complex form of Fourier Series. -The Fourier Integral.	1	2
10.	Applications of Fourier series to Differential Equations	a4,b1,c1,d1, d2	-Applications Fourier series to Ordinary and Partial Differential Equations.	1	2
Number of Weeks /and Units Per Semester				**14**	**28**

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Order	Tasks/ Experiments	Number of Weeks	Contact hours	Learning Outcomes
**B - Practical Aspect:**				
1.	Tutorial_1 Error Analysis	1	2	a1,c1,d1
2.	Tutorial_2+3 Numerical Methods for solving Nonlinear Equations of one variable	2	4	a2 ,b1,c1,d1,d2
3.	Tutorial_4+5 TheInterpolation	2	4	a2,b1,c1,d1,d2
4.	Tutorial_6 Numerical Differentation	1	2	a3,b1,c1,d1,d2
5.	Tutorial_7 Numerical Integrtion	1	2	a3,b1,c1,d1,d2
6.	Tutorial_8 Numerical Solutions of Ordinary Differential Equations	1	2	a3,b1,c1,d1,d2
7.	Tutorials_9+10+11 Numerical Solutions of PDEs	3	6	a3,a4,b1,c1,d1,d2
8.	Tutorials_12 Computation of Fourier Series, Fourier cosine and sine Series.	1	2	a4,b1,c1,d1,d2
9.	Tutorials_13 The complex form of Fourier Series, The Fourier Integral. The Discrete and Fast Fourier Transforms.	1	2	a4,b1,c1,d1,d2
10.	Tutorials_14 Applications Fourier Series to Differential Equation.	1	2	a4,b1,c1,d1,d2
\multicolumn{2}{l}{**Number of Weeks /and Units Per Semester**}	**14**	**28**	

V. Teaching strategies of the course:

- Active Lectures.
- Tutorials.
- The use of Computer and Web-Based Learning.
- Design Work and Project.
- Case Studies.
- Independent Learning.
- Directed Self Study.
- Group Learning and Problem Based Learning.

VI. Assignments:

No	Assignments	Aligned CILOs(symbols)	Week Due	Mark
1.	Tutorial_1 **Error Analysis**	a1,c1,d1	1st	2
2.	Tutorial_2+3 **Numerical Methods for solving Nonlinear Equations of one variable**	a2 ,b1,c1,d1,d2	2th & 3th	4
3.	Tutorial_4+5 **TheInterpolation**	a2,b1,c1,d1,d2	4th & 5th	6
4.	Tutorial_6 **Numerical Differentation**	a3,b1,c1,d1,d2	6th	2
5.	Tutorial_7 **Numerical Integrtion**	a3,b1,c1,d1,d2	7th	2
6.	Tutorial_8 **Numerical Solutions of Ordinary Differential Equations**	a3,b1,c1,d1,d2	8th	2
7.	Tutorials_9+10+11 **Numerical Solutions of PDEs**	a3,a4,b1,c1,d1,d2	9th -11th	6

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8.	Tutorials_12 **Computation of Fourier Series, Fourier cosine and sine Series.**	a4,b1,c1,d1,d2	12th	2	
9.	Tutorials_13 **The complex form of Fourier Series, The Fourier Integral.** **The Discrete and Fast Fourier Transforms.**	a4,b1,c1,d1,d2	13th	2	
10.	Tutorials_14 **Applications Fourier Series to Differential Equation.**	a4,b1,c1,d1,d2	14th	2	
	Total			**30**	

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.	16	105	70 %	all
	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- Xin-She Yang., 2007, Applied Engineering Mathematics. University of Cambridge, Cambridge, United Kingdom Pub.

    2- Richard L.Burden and J.Doyglass Faires. 2011 Numerical Analysis, 9th ed.

    3- Brooks /Col, Cengage Learning.

2- Essential References.

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	1- Sastry S.S., 2004, Engineering Mathematics V.2 Asoke Pub., India. **2-** Coddington E. A., 1989, an Introduction to Ordinary Differential Equations, Dover Pub. **3-** Chapra S. C. and Canale R. P. (2015) Numerical Methods For Engineers, 7th ed. McGraw-Hill Education.
3- Electronic Materials and Web Sites *etc*.	
	1. http://ocw.mit.edu/courses/ **2.** http://depts.washington.edu/amath/ **3.** http://www.esam.northwestern.edu/index.html **4.** http://www.seas.harvard.edu/academics/undergraduate/applied-math

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 a proof 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 fail. In case the cheating is repeated three times during his/her study the student will be disengaged from the Faculty-

| Prepared by
Assoc. Prof. Dr.
Yasser ALhuri. | 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 |

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6.	**Plagiarism**: Plagiarism is the attending of a student the exam of a course instead of another student. If the examination committee proofed 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**

Prepared by	Head of Department	Quality Assurance Unit	Dean of the Faculty	Academic Development
Assoc. Prof. Dr. Yasser ALhuri.	Asst. Prof. Dr. Adel Ahmed Al-Shakiri	Assoc. Prof. Dr. Mohammad Algorafi	Prof. Dr. Mohammed AL-Bukhaiti	Center & Quality Assurance Assoc. Prof. Dr. Huda Al-Emad

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Sana'a University
Faculty of Engineering
Department: Basic Engineering Sciences
Title of the Program: B.Sc. of Electrical Engineering .

Template for Course Plan (Syllabus)- Engineering Mathematics

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:	Engineering Mathematics.				
2-	Course Number & Code:	BR223.				
3-	Credit hours:	C.H				Total
		Th.	Tu.	Pr.	Tr.	
		2	-	-	2	3
4-	Study level/year at which this course is offered:	Third Level (First Semester).				
5-	Pre –requisite (if any):	Mathematics 1 (FR001), Mathematics 2 (FR003), Linear Algebra (BR121), Differential Equations (BR122).				
6-	Co –requisite (if any):	None				
7-	Program (s) in which the course is offered	Elecrical Engineering Departments.				
8-	Language of teaching the course:	English/Arabic.				
9-	System of Study:	Credit Hours				
10-	Mode of delivery:	Full Time				
11-	Location of teaching the course:	Faculty of Engineering				

III.   Course Description:

This course deals with topics which provide students to relevant mathematical tools required in the analysis of problems in engineering and scientific professions.

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, the numerical solutions of differential equations (ODEs and PDE) that arise in engineering and the physical sciences and Fourier transforms with it's applications in PDEs.

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

- Brief summary of the knowledge or skill the course is intended to develop:
    1. Know the concept of Numerical Analysis Methods and Error Analysis.
    2. Identify some Numerical Methods and appropriate techniques for solving Nonlinear Equations, Linear system and finding the Interpolation relevent to Electrical engineering prosesses.
    3. Establish Numerical Analysis to approximate Integration, Differentiation and Ordinary Differential Equations Problems.
    4. Define Fourier series, Complex and Integral and how use it to solve (PDEs) for Electrical engineering problems.
    5. Examine different Numerical Methods to solve Applied engineering Problems.
    6. Apply various techniques of numerical methods to approximate the solution of some mathematics problems which haven't exact or analytical solution for Electrical Engineering practices.
    7. Co-operate with team members to share different knowledges.
    8. Assess to tasks with the support of the different resources.

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Assoc. Prof. Dr.	Asst. Prof. Dr. Adel	Assoc. Prof. Dr.	Prof. Dr. Mohammed	Center & Quality Assurance
Yasser ALhuri.	Ahmed Al-Shakiri	Mohammad Algorafi	AL-Bukhaiti	Assoc. Prof. Dr. Huda Al-Emad

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	V. Course Content:			
	A – Theoretical Aspect:			
Order	**Units/Topics List**	**Sub Topics List**	**Number of Weeks**	**Contact Hours**
1.	Error Analysis	- Accuracy, Precision and Error Definitions. -Round-Off Errors. -Truncation Errors.	1st	2
2.	Numerical Methods for solving Nonlinear Equations of one variable	-Bisection Method. - False position Method. - Fixed – Point iteration. - Newton – Raphson. - Secant Methods.	2nd ,3rd	4
3.	The Interpolation	-Direct Fit Polynomial. -Newton Interpolating Polynomials. -Lagrange Interpolating Polynomials. -Newton's Divided-Difference Interpolating Polynomials.	4th ,5th	4
4.	Numerical Differentiation	-Derivatives of Unequally Spaced Data. -Derivatives and Integrals for Data with Errors.	6th	2
5.	Numerical Integration	-The Trapezoidal Rule. -Simpson's Rules.	7th	2
6.	Numerical Methods to solve (ODEs)	-Euler's Method. - Runge-Kutta methods.	8th	2
7.	Med term exam		9th	2

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8.	Numerical Methods to solve (PDEs)	-Finite Difference Methods for Parabolic PDEs.	10th	2
		-Finite Difference Methods for Hyperbolic PDEs.	11th	2
		-Finite Difference Methods for Elliptic PDEs	12th	2
9.	Fourier Series	- Computation of Fourier Series. - Fourier cosine and sine Series.	13th	2
10.	Complex Fourier and Integral	-The complex form of Fourier Series. -The Fourier Integral.	14th	2
11.	Applications of Fourier series to Differential Equations	-Applications Fourier series to Ordinary and Partial Differential Equations.	15th	2
12.	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.	Tutorial_1 Error Analysis	1st	2
2.	Tutorial_2+3 Numerical	2nd ,3rd	4

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	Methods for solving Nonlinear Equations of one variable		
3.	Tutorial_4+5 TheInterpolation	4th , 5th	4
4.	Tutorial_6 Numerical Differentation	6th	2
5.	Tutorial_7 Numerical Integrtion	7th	2
6.	Tutorial_8 Numerical Solutions of Ordinary Differential Equations	8th	2
7.	Tutorials_9+10+11 Numerical Solutions of PDEs	9th , 10th , 11th	6
8.	Tutorials_12 Computation of Fourier Series, Fourier cosine and sine Series.	12th	2
9.	Tutorials_13 The complex form of Fourier Series, The Fourier Integral. The Discrete and Fast Fourier Transforms.	13th	2
10.	Tutorials_14 Applications Fourier Series to Differential Equation.	14th	2
Number of Weeks /and Units Per Semester		**14**	**28**

VI. Teaching strategies of the course:

- Active Lectures.
- Tutorials.
- The use of Computer and Web-Based Learning.
- Design Work and Project.
- Case Studies.
- Independent Learning.

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- Directed Self Study.
- Group Learning and Problem Based Learning.

	VII. Assignments:			
No	**Assignments**	**Aligned CILOs(symbols)**	**Week Due**	**Mark**
1.	Tutorial_1 **Error Analysis**	a1,c1,d1	1st	2
2.	Tutorial_2+3 **Numerical Methods for solving Nonlinear Equations of one variable**	a2 ,b1,c1,d1,d2	2th & 3th	4
3.	Tutorial_4+5 **TheInterpolation**	a2,b1,c1,d1,d2	4th & 5th	6
4.	Tutorial_6 **Numerical Differentation**	a3,b1,c1,d1,d2	6th	2
5.	Tutorial_7 **Numerical Integrtion**	a3,b1,c1,d1,d2	7th	2
6.	Tutorial_8 **Numerical Solutions of Ordinary Differential Equations**	a3,b1,c1,d1,d2	8th	2
7.	Tutorials_9+10+11 **Numerical Solutions of PDEs**	a3,a4,b1,c1,d1,d2	9th -11th	6
8.	Tutorials_12 **Computation of Fourier Series, Fourier cosine and sine Series.**	a4,b1,c1,d1,d2	12th	2
9.	Tutorials_13 **The complex form of Fourier Series, The Fourier Integral.** **The Discrete and Fast Fourier Transforms.**	a4,b1,c1,d1,d2	13th	2
10.	Tutorials_14	a4,b1,c1,d1,d2	14th	2

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	Applications Fourier Series to Differential Equation.			
	Total			**30**

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

No.	Assessment Method	Week Due	Mark	Proportion of Final Assessment
1.	Assessment (Work Sample such as Portfolios).	1-14	45	30 %
2.	Final Exam.	16	105	70 %
	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. Xin-She Yang., 2007, Applied Engineering Mathematics. University of Cambridge, Cambridge, United Kingdom Pub.
2. Richard L.Burden and J.Doyglass Faires. 2011 Numerical Analysis, 9th ed.
3. Brooks /Col, Cengage Learning.

2- Essential References.

1. Sastry S.S., 2004, Engineering Mathematics V.2 Asoke Pub., India.
2. Coddington E. A., 1989, an Introduction to Ordinary Differential Equations, Dover Pub.
3. Chapra S. C. and Canale R. P. (2015) Numerical Methods For Engineers, 7th ed. McGraw-Hill Education.

3- Electronic Materials and Web Sites *etc*.

1. http://ocw.mit.edu/courses/
2. http://depts.washington.edu/amath/
3. http://www.esam.northwestern.edu/index.html
4. http://www.seas.harvard.edu/academics/undergraduate/applied-math

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	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 a proof 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 fail. 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 proofed 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

Prepared by	Head of Department	Quality Assurance Unit	Dean of the Faculty	Academic Development
Assoc. Prof. Dr.	Asst. Prof. Dr. Adel	Assoc. Prof. Dr.	Prof. Dr. Mohammed	Center & Quality Assurance
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