



## 55 Course Specification of Foundation Engineering2

I. Course Identification and General Information:					
1	Course Title:	Foundation Engineering 2			
2	Course Code & Number:	CE401			
3	Credit hours:	C.H			Credit Hours
		Th.	Tu.	Pr.	Tr.
		3	2		
4	Study level/ semester at which this course is offered:	5th Level/ first semester			
5	Pre –requisite (if any):	Foundation Engineering 1			
6	Co –requisite (if any):	-----			
8	Program (s) in which the course is offered:	Civil Engineering			
9	Language of teaching the course:	English+ Arabic			
10	Location of teaching the course:	Class room			
11	Prepared By:	Dr. ZIYAD ALGBOBY &En. SADDAM ALHADAMA			
12	Date of Approval				

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## II. Course Description:

This course deals with advanced topics in civil engineering **specially** in structure related to the deep foundations, Retaining Walls, Sheet Pile Walls, and, Soil Improvement and Ground Modification. In addition, this course provides the **students with knowledge** of the available depending on the piles type, load carried, estimating pile capacity and, Calculating pile capacity with SPT results. Also, **it** deals with Frictional Resistance, Point Bearing Capacity, Pile Load Tests, Settlement of Piles, Group Piles. Moreover, this course is **concerned** with Gravity and Cantilever Retaining Walls, Application of Lateral Earth Pressure Theories to Design, Stability of Retaining Walls, Overturning, Sliding along the Base, Bearing Capacity Failure. **Besides, it addresses topics such as** Sheet Pile Walls, Cantilever Sheet Pile Walls, Anchored Sheet-Pile Walls, Braced-Cut Design, and Pressure Envelope for Cuts in Layered Soil, and Design of Various Components of a Braced Cut. Finally, this course discusses Soil Improvement and Ground Modification.

III. Course Intended learning outcomes (CILOs) of the course		Referenc d PILOs
a.1	<b>Determine</b> the basics of analysis and design of Pile Foundations, Retaining Walls, Sheet Pile Walls, and methods of Soil Improvement.	A1
a.2	Identify how analyses, and design the Pile Foundations, Retaining Walls, and Sheet Pile Walls.	A3
a.3	Show the impact of environmental, and safety in determine and design the Pile Foundations, Retaining Walls, Sheet Pile Walls also in soil improvement.	A4
b.1	<b>Analyze</b> the Pile Foundations, Retaining Walls, and Sheet Pile Walls and explain the results of the analysis.	B1
b.2	Develop appropriate mathematical equations for analyzing and design the Pile Foundations, Retaining Walls, and Sheet Pile Walls.	B2
b.3	Demonstrate proficiency in the integration of information and processes in design Pile Foundations, Retaining Walls, and Sheet Pile Walls.	B3
b.4	Consider the economic, social, and environmental issues in Pile Foundations, Retaining Walls, and Sheet Pile Walls design.	B4
c.1	Design the Pile Foundations, Retaining Walls, and Sheet Pile Walls using code of practice considering all design criteria.	C2

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c.2	Use techniques to analyze and design of Pile Foundations, Retaining Walls, and Sheet Pile Walls.	C3
c.3	Perform feasibility studies for deciding Pile Foundations, Retaining Walls, and Sheet Pile Walls.	C4
d.1	Write project report including calculation and drawing.	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- <b>Determine</b> the basics of analysis and design of Pile Foundations, Retaining Walls, Sheet Pile Walls, and methods of Soil Improvement.	Lecture Multimedia Presentations Presentations Tutorial Reading	Problem set- Written exam- Written assignment
a2- Identify how analyses, and design the Pile Foundations, Retaining Walls, and Sheet Pile Walls.	Lecture Individual/group projects Presentations	Project - Written exam- Written assignment
a3- Show the impact of environmental, and safety in determine and design the Pile Foundations, Retaining Walls, Sheet Pile Walls also in soil improvement.	Lecture Individual/group projects Presentations	Project - Written exam- Written assignment

(B) Alignment Course Intended Learning Outcomes of Intellectual Skills to Teaching Strategies and Assessment Strategies:		
Course Intended Learning Outcomes	Teaching strategies	Assessment Strategies
b1- <b>Analyze</b> the Pile Foundations, Retaining Walls, and Sheet Pile Walls and explain the results of the analysis.	Lecture Multimedia Presentations Presentations Tutorial Reading	Participation- Written assignment- Project
b2- Develop appropriate mathematical equations for analyzing and design the	Case study- Tutorial Individual/group projects	Project- Written assignment

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Pile Foundations, Retaining Walls, and Sheet Pile Walls.	Presentations	
<b>b3-</b> Demonstrate proficiency in the integration of information and processes in design Pile Foundations, Retaining Walls, and Sheet Pile Walls.	Presentations Tutorial	Written exam - Project
<b>b4-</b> Consider the economic, social, and environmental issues in Pile Foundations, Retaining Walls, and Sheet Pile Walls design.	Presentations Tutorial Case study	Written exam - Project

**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
<b>c1-</b> Design the Pile Foundations, Retaining Walls, and Sheet Pile Walls using code of practice considering all design criteria.	Lecture Presentations Tutorial Reading	Written assignment- Written exam -Project
<b>c2-</b> Use techniques to analyze and design of Pile Foundations, Retaining Walls, and Sheet Pile Walls.	Case study- Individual/group projects Presentations	Written assignment- Written exam -Project
<b>c3-</b> Perform feasibility studies for deciding Pile Foundations, Retaining Walls, and Sheet Pile Walls.	Lecture Presentations Tutorial	Written assignment- Group work

**(D) Alignment Course Intended Learning Outcomes of Transferable Skills to Teaching Strategies and Assessment Strategies:**

Course Intended Learning Outcomes	Teaching strategies	Assessment Strategies
<b>d1-</b> Write project report including calculation and drawing.	Case study	d1- Write the project design report including calculation and drawing

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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	Pile Foundations	a1,a3,b1, b3,b4,c1,c3	<ul style="list-style-type: none"> <li>• Introduction.</li> <li>• Piles type.</li> <li>• Load carried.</li> <li>• Subsoil conditions.</li> <li>• Location of the water table.</li> <li>• Calculation of allowable loads on piles</li> <li>• Deformation behavior,</li> <li>• Load Transfer.</li> <li>• Estimating pile capacity.</li> <li>• Calculating pile capacity with SPT results.</li> <li>• Pile-driving and vibrating formulas.</li> <li>• Frictional Resistance.</li> <li>• Point Bearing Capacity</li> <li>• Pile Load Tests.</li> <li>• Settlement of Piles.</li> <li>• Group Piles.</li> <li>• Group Efficiency Mechanism.</li> <li>• Ultimate Capacity of Group Piles</li> </ul>	6	18
2	Retaining Walls	a1,a3,b1, b3,b4,c1,c3	<ul style="list-style-type: none"> <li>• Introduction.</li> <li>• Gravity and Cantilever Walls.</li> <li>• Application of Lateral Earth Pressure.</li> <li>• Theories to Design.</li> <li>• Stability of Retaining Walls.</li> <li>• Check for Overturning.</li> <li>• Check for Sliding along the Base.</li> <li>• Check for Bearing Capacity Failure.</li> </ul>	1	3
3	Retaining Walls	a1,a3,b1, b3,b4,c1,c3	<ul style="list-style-type: none"> <li>• Introduction.</li> <li>• Gravity and Cantilever Walls.</li> </ul>	2	6

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IV. Course Content:					
A – Theoretical Aspect:					
Order	Units/Topics List	Learning Outcomes	Sub Topics List	Number of Weeks	contact hours
			<ul style="list-style-type: none"> <li>• Application of Lateral Earth Pressure.</li> <li>• Theories to Design.</li> <li>• Stability of Retaining Walls.</li> <li>• Check for Overturning.</li> <li>• Check for Sliding along the Base.</li> <li>• Check for Bearing Capacity Failure.</li> </ul>		
4	Sheet Pile Walls	a1,a3,b1, b3,b4,c1,c3	<ul style="list-style-type: none"> <li>• Introduction.</li> <li>• Sheet Pile Walls.</li> <li>• Cantilever Sheet Pile Walls.</li> <li>• Anchored Sheet-Pile Walls,</li> <li>• Braced-Cut Design.</li> <li>• Pressure Envelope for Cuts in Layered Soil,</li> <li>• Design of Various Components of a Braced Cut.</li> </ul>	2	6
5	Soil Improvement and Ground Modification	a1,a3	Soil Improvement and Ground Modification by: <ul style="list-style-type: none"> <li>• Compaction,</li> <li>• Vibroflotation.</li> <li>• Precompression.</li> <li>• Sand drains.</li> <li>• Wick drains,</li> <li>• Stabilization by admixtures.</li> <li>• Jet grouting.</li> <li>• Deep mixing,</li> <li>• Stone columns.</li> <li>• Sand Compaction Piles in Weak Clay to construct foundations.</li> </ul>	3	9
Number of Weeks /and Units Per Semester				14	42

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### B – Tutorial Aspect:

Order	Tasks/ Experiments	Number of Weeks	contact hours	Learning Outcomes
1	Estimate the bearing capacity of piles.	3	6	a1- a2- b1- b2- b3-c1-c2
2	Calculation of skin friction resistance.	2	4	a1- a2- b1- b2- b3-c1-c2
3	Calculation the Group piles Efficiency.	2	4	a2- b1- b2-b3-c1- c2
4	Calculate the Factors of safety of retaining walls.	2	4	a2- b1- b2-b3-c1- c2
5	Draw pressure diagram of Sheet Pile Walls	2	4	a2- b1- b2-b3-c1- c2
6	Design of Various Components of a Braced Cut	3	6	a2- b1- b2-b3-c1- c2
Number of Weeks /and Units Per Semester		14	28	

### V. Teaching strategies of the course:

Lecture  
Multimedia Presentations  
Presentations  
Tutorial  
Reading  
Small group working  
Independent study  
Case study

### VI. Assignments:

No	Assignments	Aligned CILOs(symbols)	Week Due	Mark
1	Calculation of bearing capacity of piles by different theories	a1-a2-b1-bc2-b3-b4	3	1.5
2	Calculation of bearing capacity of piles from SPT test.	a1-b1-b2-b3-c1-c2	5	1.5
3	Calculation the Group piles Efficiency.	a1-b1-b2-b3-c1-c2	8	1.5
4	Calculate the Factors of safety of retaining walls.	a1-b1-b2-b3-c1-c2	9	1.5
5	Draw pressure diagram of Sheet Pile Walls	a1-b1-b2-b3-c1-c2	12	1.5

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6	Design of a Braced Cut	a1-b1-b2-b3-c1-c2	13	1
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## 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	3, 5, 8, 9, 12,13	10	5	a1-a2-b1-b2-b3-c1-c3
2	Quizzes.	two time randomly	10	5	b3-c1
3	Mid-term exam.	7th	40	20	a1-a2-b1-b2-b3-c1-c3
4	Final-exam.	15th	120	60	a1-a2-b1-b2-b3-c1-c3
5	Project	14th	20	10	b1-b2-b3-b4-c1-c2-c3-d1
	<b>Sum</b>		<b>200</b>	<b>100%</b>	

## 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. Joseph Bowles, (2002), Foundation Analysis and Design, Fifth edition.
2. Braja Das, (2011), Principals of Foundation Engineering, Seventh edition.

### 2- Essential References.

- Foundation Analysis and Design, Kumar

### 3- Electronic Materials and Web Sites etc.

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<b>IX. Course Policies:</b>	
<b>1</b>	<b>Class Attendance:</b> The students should have more than 75 % of attendance according to rules and regulations of the faculty.
<b>2</b>	<b>Tardy:</b> The students should respect the timing of attending the lectures. They should attend within 1 minutes from starting of the lecture.
<b>3</b>	<b>Exam Attendance/Punctuality:</b> 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.
<b>4</b>	<b>Assignments &amp; Projects:</b> The assignment is given to the students after each chapter, the student has to submit all the assignments for checking on time.
<b>5</b>	<b>Cheating:</b> If any cheating occurred during the examination, the student is not allowed to continue and he/she has to face the examination committee for <b>enquiries</b> .
<b>6</b>	<b>Plagiarism:</b> 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.
<b>7</b>	<b>Other policies:</b> - 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.

<b>Reviewed By</b>	<b><u>Vice Dean for Academic Affairs and Post Graduate Studies</u></b> <b><u>Dr. Tarek A. Barakat</u></b> <b><u>Dr. Mohammad Algorafi</u></b>
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## Template for Course Plan (Syllabus) of Foundation Engineering 2

I. - Information about Faculty Member Responsible for the Course:							
Name of Faculty Member	Dr. ZIYAD ALGBOBY &Eng. SADDAM ALHADAMA	Office Hours					
Location& Telephone No.		SAT	SUN	MON	TUE	WED	THU
E-mail				8-10			

II. Course Identification and General Information:						
1-	Course Title:	Foundation Engineering 2				
2-	Course Number & Code:	CE 401				
3-	Credit hours:	C.H				Credit Hours
		Th.	Tu.	Pr.	Tr.	
		3	2			4
4-	Study level/year at which this course is offered:	5th Level/ first semester				
5-	Pre –requisite (if any):	Foundation Engineering 1				
6-	Co –requisite (if any):	-----				
7-	Program (s) in which the course is offered	Civil <b>Engineering</b>				
8-	Language of teaching the course:	English+ Arabic				
9-	System of Study:	Regular				
10-	Mode of delivery:	Lecture				
11-	Location of teaching the course:	Class				

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### III. Course Description:

This course deals with advanced topics in civil engineering **specially** in structure related to the deep foundations, Retaining Walls, Sheet Pile Walls, and, Soil Improvement and Ground Modification. In addition, this course provides the **students with knowledge** of the available depending on the piles type, load carried, estimating pile capacity and, Calculating pile capacity with SPT results. Also, **it** deals with Frictional Resistance, Point Bearing Capacity, Pile Load Tests, Settlement of Piles, Group Piles. Moreover, this course is **concerned** with Gravity and Cantilever Retaining Walls, Application of Lateral Earth Pressure Theories to Design, Stability of Retaining Walls, Overturning, Sliding along the Base, Bearing Capacity Failure. **Besides, it addresses topics such as** Sheet Pile Walls, Cantilever Sheet Pile Walls, Anchored Sheet-Pile Walls, Braced-Cut Design, and Pressure Envelope for Cuts in Layered Soil, and Design of Various Components of a Braced Cut. Finally, this course discusses Soil Improvement and Ground Modification.

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

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

- a.1 Determine** the basics of analysis and design of Pile Foundations, Retaining Walls, Sheet Pile Walls, and methods of Soil Improvement. A1
- a.2** Identify how analyses, and design the Pile Foundations, Retaining Walls, and Sheet Pile Walls. A3
- a.3** Show the impact of environmental, and safety in determine and design the Pile Foundations, Retaining Walls, Sheet Pile Walls also in soil improvement. A4
- b.1 Analyze** the Pile Foundations, Retaining Walls, and Sheet Pile Walls and explain the results of the analysis. B1
- b.2** Develop appropriate mathematical equations for analyzing and design the Pile Foundations, Retaining Walls, and Sheet Pile Walls. B2
- b.3** Demonstrate proficiency in the integration of information and processes in design Pile Foundations, Retaining Walls, and Sheet Pile Walls. B3
- b.4** Consider the economic, social, and environmental issues in Pile Foundations, Retaining Walls, and Sheet Pile Walls design. B4
- c.1** Design the Pile Foundations, Retaining Walls, and Sheet Pile Walls using code of practice considering all design criteria. C2
- c.2** Use techniques to analyze and design of Pile Foundations, Retaining Walls, and Sheet Pile Walls. C3
- c.3** Perform feasibility studies for deciding Pile Foundations, Retaining Walls, and Sheet Pile Walls. C4
- d.1** Write project report including calculation and drawing. D1

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## 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	Pile Foundations	<ul style="list-style-type: none"> <li>• Introduction.</li> <li>• Piles type.</li> <li>• Load carried.</li> <li>• Subsoil conditions.</li> <li>• Location of the water table.</li> <li>• Calculation of allowable loads on piles</li> <li>• Deformation behavior,</li> <li>• Load Transfer.</li> <li>• Estimating pile capacity.</li> <li>• Calculating pile capacity with SPT results.</li> <li>• Pile-driving and vibrating formulas.</li> <li>• Frictional Resistance.</li> <li>• Point Bearing Capacity</li> <li>• Pile Load Tests.</li> <li>• Settlement of Piles.</li> <li>• Group Piles.</li> <li>• Group Efficiency Mechanism.</li> <li>• Ultimate Capacity of Group Piles</li> </ul>	1,2,3,4,5,6	18
2	Retaining Walls	<ul style="list-style-type: none"> <li>• Introduction.</li> <li>• Gravity and Cantilever Walls.</li> <li>• Application of Lateral Earth Pressure.</li> <li>• Theories to Design.</li> <li>• Stability of Retaining Walls.</li> <li>• Check for Overturning.</li> <li>• Check for Sliding along the Base.</li> <li>• Check for Bearing Capacity Failure.</li> </ul>	7	3
3	Midterm Exam		8	3
4	Retaining Walls	<ul style="list-style-type: none"> <li>• Introduction.</li> <li>• Gravity and Cantilever Walls.</li> </ul>	9,10	6

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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
		<ul style="list-style-type: none"><li>• Application of Lateral Earth Pressure.</li><li>• Theories to Design.</li><li>• Stability of Retaining Walls.</li><li>• Check for Overturning.</li><li>• Check for Sliding along the Base.</li><li>• Check for Bearing Capacity Failure.</li></ul>		
5	Sheet Pile Walls	<ul style="list-style-type: none"><li>• Introduction.</li><li>•Sheet Pile Walls.</li><li>• Cantilever Sheet Pile Walls.</li><li>• Anchored Sheet-Pile Walls,</li><li>• Braced-Cut Design.</li><li>• Pressure Envelope for Cuts in Layered Soil,</li><li>• Design of Various Components of a Braced Cut.</li></ul>	11,12	6
6	Soil Improvement and Ground Modification	Soil Improvement and Ground Modification by <ul style="list-style-type: none"><li>• Compaction,</li><li>• Vibroflotation.</li><li>• Precompression.</li><li>• Sand drains.</li><li>• Wick drains,</li><li>• Stabilization by admixtures.</li><li>• Jet grouting.</li><li>• Deep mixing,</li><li>• Stone columns.</li><li>• Sand Compaction Piles In Weak Clay to construct foundations.</li></ul>	13,14,15	9
7	Final Exam		16	3
Number of Weeks /and Units Per Semester			16	48

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<b>B – Tutorial Aspect:</b>			
<b>Order</b>	<b>Topics List</b>	<b>Week Due</b>	<b>Contact Hours</b>
1	Estimate the bearing capacity of piles.	1,2,3	6
2	Calculation of skin friction resistance.	4,5	4
3	Calculation the Group piles Efficiency.	6,7	4
4	Calculate the Factors of safety of retaining walls.	8,9	4
5	Draw pressure diagram of Sheet Pile Walls	10,11	4
6	Design of Various Components of a Braced Cut	12,13,14	6
<b>Number of Weeks /and Units Per Semester</b>		<b>14</b>	<b>28</b>

<b>VI. Teaching strategies of the course:</b>
Lecture Multimedia Presentations Presentations Tutorial Reading Small group working Independent study Case study

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## VII. Assignments:

No	Assignments	Aligned CILOs(symbols)	Week Due	Mar k
1	Calculation of bearing capacity of piles by different theories.	a1-a2-b1-bc2-b3-b4	3	1.5
2	Calculation of bearing capacity of piles from SPT test.	a1-b1-b2-b3-c1-c2	5	1.5
3	Calculation the Group piles Efficiency.	a1-b1-b2-b3-c1-c2	8	1.5
4	Calculate the Factors of safety of retaining walls.	a1-b1-b2-b3-c1-c2	9	1.5
5	Draw pressure diagram of Sheet Pile Walls	a1-b1-b2-b3-c1-c2	12	1.5
6	Design of a Braced Cut	a1-b1-b2-b3-c1-c2	13	1

## 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	3, 5, 8, 9, 12,13	10	5
2	Quizzes.	two time randomly	10	5
3	Mid-term exam.	7th	40	20
4	Final-exam.	15th	120	60
5	Project	14th	20	10

## 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- Joseph Bowles, (2002), Foundation Analysis and Design, Fifth edition.
- 2- Braja Das, (2011), Principals of Foundation Engineering, Seventh edition.

### 2- Essential References.

- Foundation Analysis and Design, Kumar

### 3- Electronic Materials and Web Sites etc.

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## X. Course Policies:

Unless otherwise stated, the normal course administration policies and rules of the Faculty of Engineering apply. For the policy, see: -----

<b>1</b>	<b>Class Attendance:</b> The students should have more than 75 % of attendance according to rules and regulations of the faculty.
<b>2</b>	<b>Tardy:</b> The students should respect the timing of attending the lectures. They should attend within 1 minutes from starting of the lecture.
<b>3</b>	<b>Exam Attendance/Punctuality:</b> 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.
<b>4</b>	<b>Assignments &amp; Projects:</b> The assignment is given to the students after each chapter, the student has to submit all the assignments for checking on time.
<b>5</b>	<b>Cheating:</b> If any cheating occurred during the examination, the student is not allowed to continue and he/she has to face the examination committee for <b>enquiries</b> .
<b>6</b>	<b>Plagiarism:</b> 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.
<b>7</b>	<b>Other policies:</b> -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.

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