

54. Course Specification of Introduction to Industrial Engineering

]	. Course Identification and	Gen	eral Inforn	natio	n:	
1.	Course Title:	Introduction to Industrial Engineering.			ering.	
2.	Course Code & Number:	ME361.				
					TOTAL	
3.	Credit hours:	I In. I Seminar/III I Pr I Ir. I		CR. HRS.		
		2	2	ı	-	3
4.	Study level/ semester at which this course is offered:	Fourth Year-Second Semester.				
5.	Pre –requisite (if any):	Technical Writing.				
6.	Co –requisite (if any):	Engineering Project Management (ME372)		(ME372).		
7.	Program (s) in which the course is offered:	Mechanical Engineering Program.				
8.	Language of teaching the course:	English Language.				
9.	Location of teaching the course:	Mecl	nanical Enginee	ring D	epartm	ent.
10	Prepared By:	Asso	c. Prof. Dr. Am	in Alk	thulaidi	į
11	Date of Approval:					

II. Course Description:

This course will be an introduction to Industrial Engineering covering some topics for the fourth year of Mechanical Engineering students. This course will offer the opportunity to understand some techniques on plant layout for different manufacturing systems types, assembly line balancing, flow analysis, production planning, scheduling, project management and industrial cost analysis. The students will gain some skills to design, improve and install of integrated systems of people, materials and equipment for industrial enterprise.









Ш	. Alignment course intended learning outcomes (CILOs)	Referenced PILOs
a1	Recall the mathematical background required in plant site selection, productivity measurement, production flow line analysis and plant layout.	
a2	Recognize techniques used in product and process design and plant layout.	A1
b1	Explore manufacturing systems through the application of mathematical models.	B1
b2	Investigate the suitable product and process planning and design for given products.	B2
c1	Choose plant layout and material flow equipment.	
c2	Demonstrate an ability to select methods and tools used in manufacturing systems.	C1
d1	Assesses effective cooperation as a part of a team in discussion group for a real case study.	D1
d2	Deliver and present reports for a rea- case study in relevant to the manufacturing systems.	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-	Recall the mathematical background required in plant site selection, productivity measurement, production flow line analysis and plant layout.	Lectures, Tutorials, Case Study	Homework, Quizzes, Written Exams	
a2-	Recognize techniques used in product and process design and plant layout.		Case Study Presentation & Report	

(B) Alignment Course Intended Learning Strategies and Assessment Strategies:	Outcomes of Intellect	tual Skills to Teaching
Course Intended Learning Outcomes	Teaching strategies	Assessment Strategies

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b1- Explore manufacturing systems		
through the application of mathematical models.	Lectures, Tutorials	Homework, Quizzes, Written Exams
b2- Investigate the suitable product and process planning and design for given products.	Case Study	Case Study Presentation & Report

© Alignment Course Intended Learning Oute to Teaching Strategies and Assessment Strate		al and Practical Skills
Course Intended Learning Outcomes	Teaching strategies	Assessment Strategies
c1- Choose plant layout and material flow equipment	Lectures,	Homework, Quizzes, Written Exams
c2- Demonstrate an ability to select methods and tools used in manufacturing systems.	Tutorials, Case Study	Case Study Presentation & Report

` /	(D) Alignment Course Intended Learning Outcomes of Transferable Skills to Teaching Strategies and Assessment Strategies:				
Co	ourse Intended Learning Outcomes	Teaching strategies	Assessment Strategies		
d1- part real	Assesses effective cooperation as a of a team in discussion group for a case study.	Lectures,	Homework, Quizzes Written Exams Case Study		
d2- rea-	Deliver and present reports for a case study in relevant to the manufacturing systems.	Tutorials, Case Study	Presentation & Report		

IV.	Course C	ontent:			
A –	Theoretical A	spect:			
Order	Units / Topic List	Learning Outcomes	Sub Topics List	Numbe r of Weeks	Contact hours
1.	Introduction to Industrial	b2	- Classification of Industry,	1	2

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	Engineering Role.		 The Different Between Service and Manufacturing Industry. Different Between Production and Productivity and Their 		
2.	Industrial Facility Location and Plant Building	a1,b1	Measurements. - Factors Influencing Plant Location/Facility Location - General and Specific Locational Factors for Manufacturing Plant. - Location Models: - Factor Rating Method, - Weighted Factor Rating Method, - Load-Distance Method, - Centre of Gravity and Break- Even Analysis.	1	2
3.	Modes of Production	a1,a2,b2	 Fundamentals of Production System Types (Process, Product, Batch and Assembly Production Lines) Differences and Their Features. 	1	2
4.	Production Planning and Design	a2,b2	 Product Planning, The Steps Required for Producing New Products Including the Material Quantity and Sources, Degree of Equipment Technology and Production Sequence Using International Symbols. Practical Case Study for Producing Engineering 	1	2

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5.	Plant Layout Planning and Design	a1,a2,b1,b 2,c1,c2,d1, d2	Drawing Wood Ruler Using the Above Methodology. - Scope and Problems of Layout Planning for Different Production Modes. - Types and the Different of Plant Layouts Focusing on Process, Product and Cellular Production Layout. - Production Flow Analysis - Process Layout Flow Analysis, Traffic and Distance Matrix Using From/To Chart, Column Diagram and String Diagram. - Assignment Modeling Application for Plant Layout to Select the Optimum Location for a New Machine/Line on Candidate Positions for an Existing Production Line. - Optimum Routing Analysis and Selection. - Assembly Line Balancing Process Design Using Trails/Error and Weight Techniques. - Design Material/Product Handling for Assembly	3	6
6.	Mid-Term Exam	a1,a2,b1,b 2,c1,c2,d1, d2	 Design Material/Product Handling for Assembly Production Line All Previous Topics 	1	2

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7.	Plant Layout Planning and Design	a1,a2,b1,b 2,c1,c2,d1, d2	 Scope and Problems of Layout Planning for Different Production Modes. Types and the Different of Plant Layouts Focusing on Process, Product and Cellular Production Layout. Production Flow Analysis Process Layout Flow Analysis, Traffic and Distance Matrix Using From/To Chart, Column Diagram and String Diagram. Assignment Modeling Application for Plant Layout to Select the Optimum Location for a New Machine/Line on Candidate Positions for an Existing Production Line. Optimum Routing Analysis and Selection. Assembly Line Balancing Process Design Using Trails/Error and Weight Techniques. Design Material/Product Handling for Assembly Production Line 	1	2
8.	Production, Scheduling, Planning and Control	b1,b2,c2,d 1,d2	Scope of ProductionSchedulingProcess Scheduling,Sequencing Using JohnsonRole.	3	6

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			- Process Scheduling: Dispatching Using Several		
			Roles FIFO, LIFO, Etc		
			- Batch Production Scheduling,		
			- The Economic Batch Quantity		
			EBQ and the Production		
			Range.		
			- Inventory Control		
			- Production Capacity, Plant		
			Loading		
	Engineering				
	Management		- Critical Path Analysis CPA,		
9.	Application	b1,c2	- Activities and Project Time	1	2
	for Plant		- Pert and Resource Allocation		
	Extension				
			- Types of Production Cost		
10.	Indusial Cost	b1	- Break-Even Point Analysis	1	2
	Analysis		- Wages and Incentives		
		1 0111	- Deprecation		
11	Davian	a1,a2,b1,b	All Topics	1	
11.	Review	2,c1,c2,d1,	- All Topics	1	2
		d2			
10	E:1 E	a1,a2,b1,b	All Tagina	1	2
12.	Final Exam	2,c1,c2,d1, d2	- All Topics	1	2
	Number		Units Dar Samastan	16	32
	Number of Weeks /and Units Per Semester				34

B - Tutorial Aspect:					
Order	Weeks hours		Learning Outcomes		
1.	Introduction to Industrial Engineering Role.	2	4	b2	
2.	Industrial Facility Location and Plant Building	1	2	a1,b1	

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4. Production Planning and Design		1	8	a2,b2
5.	Plant Layout Planning and Design	4	0	a1,a2,b1,b2,c1,c2,d1,d2
6.	Production, Scheduling, Planning and Control	3	6	b1,b2,c2,d1,d2
7. Engineering Management Application for Plant Extension		1	2	b1,c2
	Application for Plant Extension			,
8.	Application for Plant Extension Indusial Cost Analysis	1	2	b1

V. Teaching strategies of the course:

- Lectures
- Tutorials
- Case Studies

7	VI. Assignments:			
No	Assignments	Aligned CILOs(symbols)	Week Due	Mark
1	 Facility Layout Extensions using: 1. From/To Chart, 2. String and Column Diagrams, 3. Travel and Distance Matrixes 	a1,a2,b1,b2	2 nd and 3 rd weeks	3
2	• Flow Analysis Techniques Applications on Selecting the Suitable Plant Layout	a1,a2,b1,b2,c1,c2,d1,d2	4 th and 5 th weeks	3
3	 Assembly Line Design/Balancing Trail and Errors and Weight Techniques 	a1,a2,b1,b2,c1,c2,d1,d2	6 th week	3
4	 Production Planning and Control: Production Capacity, Pant Loading, Sequencing, Dispatching, 	b1,b2,c2,d1,d2	7 th and 8 th weeks	2

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	 Economic Batch Quantity (EBQ), Inventory Control, Productivity Measurement 			
5	 Engineering Management: Critical Path Analysis CPA, Pert And Resource	b1,c2	9 th week	2
6	 Industrial Cost Analysis: Production Cost Break- Even Analysis, Depreciations, Wages and Incentives 	b1	10 th week	2
	Total			15

V	VII.Schedule of Assessment Tasks for Students During the Semester:						
No.	Assessment Method	Week Due	Mar k	Proportio n of Final Assessme nt	Aligned Course Learning Outcomes		
1	Six Writing Assignments	3 rd ,6 th ,9 th and 10 th weeks	15	10 %	a1,a2,b1,b2,c1,c2,d1,d 2		
2	Quizzes (3)	4 th ,7 th and 11 th	10	6.67 %	a1,a2,b1,b2,c1,c2,d1,d 2		
3	Attendance and Course Works	Weekly	15	10 %	a1,a2,b1,b2,c1,c2,d1,d 2		
4	Mid-Term Written Test	8 th week	20	13.33 %	a1,a2, b1,b2,c1,c2		
5	Final Exam (Theoretical)	16 th week	90	60 %	a1,a2,b1,b2,c1,c2		
	Total		150	100 %			

VIII. Learning Resources:

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

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

- 1. Shankar R., (2004). "Industrial Engineering and Management" First Edition, Galgotia Publication Pvt. Ltd, Ansari Road, Daryagani, New Delhi,
- 2. S. ANIL KUMAR and N. SURESH, 2008, "Production and Operation Management with Skill Development", Caselets and Cases, Second Edition". New Age International (P) Limited Publishers, New Delhi India,.

2- Essential References.

- 1. Fred E. Meyers "Manufacturing Facility Design and Material Handling 2nd Edition" (Prentice Hall, 2000) ISBN: 0-13-674821-X.
- 2. Katsundo Hitomi: 2008 "Introduction to Manufacturing Systems Engineering (5th Ed.)" (Kyoritsu Publishing, ISBN 978-4-320-08172-7, in Japanese.

3- Electronic Materials and Web Sites etc.

Web sites free download software related to Industrial Engineering topics:

- 1. Pant layout and assembly line balancing
- 2. Production planning and control, sequencing, Inventory control, EBQ
- 3. Project management CPA

Engineering cost analysis

I. Course Policies:

Class Attendance:

- The student should be attending not less than 75% of total contact hours of the subject, otherwise he will not able to take exam and be considerd as an exam failure. If the student is absent due to illness, he/she should bring an approved statement from university Clinic.

Tardy:

2 - For lateness in attending the class, the student will be initially notified. If he repeates late in attending class he will be considered absent.

Exam Attendance/Punctuality:

The student should attend the exam on time. He is permitted to attend the exam half one hour from exam beginning, after that he/she will not be permitted to take exam and he/she is considered absent in the exam.

Assignments & Projects:

- In general one assignment is given after each chapter of a course. The student should submit the assignment on time, mostly one week after giving the assignment

Cheating:

- For cheating in exam, the student is considered as failure. In case the cheating is repeated three times during study the student will be disengaged from the Faculty

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Plagiarism: Plagiarism is the attending of the student the exam of a course instead of other 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 Affair Council of the university. Other policies: The mobile phone is not allowable to be used during class lecture. It must be switched off, otherwise the student will be ordered to leave the lecture room. The mobile phone is not allowed to be taken during the examination time. Lecture notes and assignments may be given directly to students using soft or hard copy.

Reviewed	Vice Dean for Academic Affairs and Post Graduate Studies: Asst. Prof. Dr. Tarek A.				
By	<u>Barakat</u>				
	President of Quality Assurance Unit: Assoc. Prof. Dr. Mohammed Algorafi				
	Name of Reviewer from the Department: Assoc.Prof. Dr. Khalil Al-Hatab				
	Deputy Rector for Academic Affairs Asst. Prof. Dr. Ibrahim AlMutaa				
	Assoc. Prof. Dr. Ahmed Mujahed				
	Asst. Prof. Dr. Munasar Alsubri				



Course Plan of Introduction to Industrial Engineering

I. Information about Faculty Member Responsible for the Course:)
Name of Faculty Member	Ass. Prof. Dr. Amin Alkhulaidi	min Office Hours					
Location& Telephone No.		SAT	SUN	MON	TUE	WED	THU
E-mail							

II.	Course Identification and General Information:						
1.	Course Title:	Introd	uction to Indus	strial En	ginee	ering.	
2.	Course Code & Number:	ME36	1.				
			С.Н			TOTAL	
3.	Credit hours:	Th.	Seminar/Tu	Pr	Tr.	CR. HRS.	
		2	2	-	-	3	
4.	Study level/ semester at which this course is offered:	Fourth Year-Second Semester.					
5.	Pre –requisite (if any):	Technical Writing.					
6.	Co –requisite (if any):	Engineering Project Management (ME372).					
7.	Program (s) in which the course is offered:	Mechanical Engineering Program.					
8.	Language of teaching the course:	English Language.					
9.	System of Study:	Semesters.					
10.	Mode of delivery:	Lectures and Tutorials.					
11.	Location of teaching the course:	Mecha	anical Enginee	ring De	partm	ent.	

III. Course Description:

This course will be an introduction to Industrial Engineering covering some topics for the fourth year of Mechanical Engineering students. This course will offer the opportunity to

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understand some techniques on plant layout for different manufacturing systems types, assembly line balancing, flow analysis, production planning, scheduling, project management and industrial cost analysis. The students will gain some skills to design, improve and install of integrated systems of people, materials and equipment for industrial enterprise.

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

- Brief summary of the knowledge or skill the course is intended to develop:
 - 1. Recall the mathematical background required in plant site selection, productivity measurement, production flow line analysis and plant layout.
 - 2. Recognize techniques used in product and process design and plant layout.
 - **3.** Explore manufacturing systems through the application of mathematical models.
 - **4.** Investigate the suitable product and process planning and design for given products.
 - **5.** Choose plant layout and material flow equipment.
 - **6.** Demonstrate an ability to select methods and tools used in manufacturing systems.
 - **7.** Assesses effective cooperation as a part of a team in discussion group for a real case study.
 - **8.** Deliver and present reports for a rea- case study in relevant to the manufacturing systems.









V. Course Content:

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

A –	Theore	tical	Aspect:
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A – Theoretical Aspect:					
Order	Topics List	Sub Topics List	Week Due	Contact Hours	
1.	Introduction to Industrial Engineering Role.	 Classification of Industry, The Different Between Service and Manufacturing Industry. Different Between Production and Productivity and Their Measurements. 	1 st week	2	
2.	Industrial Facility Location and Plant Building	 Factors Influencing Plant Location/Facility Location General and Specific Locational Factors for Manufacturing Plant. Location Models: Factor Rating Method, Weighted Factor Rating Method, Load-Distance Method, Centre of Gravity And Break Even Analysis. 	2 nd week	2	
3.	Modes of Production	 Fundamentals of Production System Types (Process, Product, Batch and Assembly Production Lines) Differences and Their Features. 	3 rd week	2	
4.	Production Planning and Design	 Product Planning, The Steps Required for Producing New Products Including the Material Quantity and Sources, Degree of Equipment Technology and Production Sequence Using International Symbols. Practical Case Study for Producing Engineering Drawing Wood Ruler Using the Above Methodology. 	4 th week	2	

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5.	Plant Layout Planning and Design	 Scope and Problems of Layout Planning for Different Production Modes. Types and the Different of Plant Layouts Focusing on Process, Product and Cellular Production Layout. Production Flow Analysis Process Layout Flow Analysis, Traffic and Distance Matrix Using From/To Chart, Column Diagram and String Diagram. Assignment Modeling Application for Plant Layout to Select the Optimum Location for a New Machine/Line on Candidate Positions for an Existing Production Line. Optimum Routing Analysis and Selection. Assembly Line Balancing Process Design Using Trails/Error and Weight Techniques. Design Material/Product Handling for Assembly Production Line 	5 th to 7 th weeks	6
6.	Mid-Term Exam	- All Previous Topics	8 th week	2
7.	Plant Layout Planning and Design	 Scope and Problems of Layout Planning for Different Production Modes. Types and the Different of Plant Layouts Focusing on Process, Product and Cellular Production Layout. Production Flow Analysis Process Layout Flow Analysis, Traffic and Distance Matrix Using From/To Chart, Column Diagram and String Diagram. Assignment Modeling Application for Plant Layout to Select the Optimum Location for a New Machine/Line on Candidate Positions for an Existing Production Line. 	9 th week	2

Algorafi	

Quality Assurance

Unit

Assoc. Prof. Dr.

Mohammad

Head of

Department

Asst. Prof. Dr.

Adel Ahmed

Al-Shakiri

Dean of the Faculty

Prof. Dr. Mohammed

AL-Bukhaiti

Academic

Development

Center & Quality

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Assoc. Prof. Dr. Huda Al-Emad Rector of Sana'a

University

Prof. Dr. Al-Qassim

Mohammed Abbas









		- Optimum Routing Analysis and		
		Selection.		
		- Assembly Line Balancing Process		
		Design Using Trails/Error and Weight Techniques.		
		- Design Material/Product Handling for		
		Assembly Production Line		
8.	Production, Scheduling, Planning and Control	 Scope of Production Scheduling Process Scheduling, Sequencing Using Johnson Role. Process Scheduling: Dispatching Using Several Roles FIFO, LIFO, Etc Batch Production Scheduling, The Economic Batch Quantity EBQ and the Production Range. Inventory Control 	10 th to 12 th weeks	6
9.	Engineering Management Application for Plant Extension	 Production Capacity, Plant Loading Critical Path Analysis CPA, Activities and Project Time Pert and Resource Allocation 	13 th week	2
10.	Indusial Cost Analysis	Types of Production CostBreak-Even Point AnalysisWages and IncentivesDeprecation	14 th weeks	2
11.	Review	- All Topics	15 th week	2
12.	Final Exam	- All Topics	16 th week	2
	Number of W	eeks /and Units Per Semester	16	32

B – Tutorials Aspect:						
Order	Topics List	Week Due	Contact Hours			
1	Introduction to Industrial Engineering Role.	1 st , 2 nd week	4			
2	Industrial Facility Location and Plant Building	3 rd week	2			
3	Modes of Production	4 th week	2			
4	Production Planning and Design	5 th	2			
5	Plant Layout Planning and Design	6 th to 9 th	8			

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6	Production, Scheduling, Planning and Control	10 th to 12 th weeks	6
7	Engineering Management Application for Plant Extension	13 th week	2
8	Indusial Cost Analysis	14 th weeks	2
Nu	mber of Weeks /and Units Per Semester	14	28

VI. Teaching strategies of the course:

- Lectures,
- Tutorials,
- Case Studies.

VII.Assignments:							
No	Assignments	Aligned CILOs(symbols)	Week Due	Mark			
1	 Facility Layout Extensions using: 4. From/To Chart, 5. String and Column Diagrams, 6. Travel and Distance Matrixes 	a1,a2,b1,b2	2 nd and 3 rd weeks	3			
2	• Flow Analysis Techniques Applications on Selecting the Suitable Plant Layout	a1,a2,b1,b2,c1,c2,d1,d2	4 th and 5 th weeks	3			
3	• Assembly Line Design/Balancing – Trail and Errors and Weight Techniques	a1,a2,b1,b2,c1,c2,d1,d2	6 th week	3			
4	 Production Planning and Control: Production Capacity, Pant Loading, Sequencing, Dispatching, Economic Batch Quantity (EBQ), Inventory Control, Productivity Measurement 	b1,b2,c2,d1,d2	7 th and 8 th weeks	2			
5	 Engineering Management: Critical Path Analysis CPA, Pert And Resource Allocation For Plant Extension 	b1,c2	9 th week	2			

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6	 Industrial Cost Analysis: Production Cost Break-Even Analysis, Depreciations, Wages and Incentives 	b1	10 th week	2
	Total			15

VIII. Schedule of Assessment Tasks for Students During the Semester:							
No.	Type of Assessment Tasks	Week Due	Mark	Proportion of Final Assessment			
1	Six Writing Assignments	3 rd ,6 th ,9 th and 10 th weeks	15	10 %			
2	Quizzes (3)	4 th ,7 th and 11 th weeks	10	6.67 %			
3	Attendance and Course Works	Weekly	15	10 %			
4	Mid-Term Written Test	9 th week	20	13.33 %			
5	Final Exam (Theoretical)	16 th week	90	60 %			
	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).

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- 2. S. ANIL KUMAR and N. SURESH, 2008, "Production and Operation Management (with skill development, caselets and cases) Second Edition". New Age International (P) Limited Publishers, New Delhi India.

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- 1. Pant layout and assembly line balancing
- 2. Production planning and control, sequencing, Inventory control, EBQ
- 3. Project management CPA
- 4. Engineering cost analysis

II. Course Policies:

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2 - For lateness in attending the class, the student will be initially notified. If he repeates late in attending class he will be considered absent.

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Other policies:

- 7 The mobile phone is not allowable to be used during class lecture. It must be switched off, otherwise the student will be ordered to leave the lecture room.
 - The mobile phone is not allowed to be taken during the examination time.

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- Lecture notes and assignments may be given directly to students using soft or hard copy.