Sana'a University
Faculty of Engineering
Mechanical Engineering Department
Mechanical Engineering Program

Course Specification of Research Methodology

I. Course Identification and General Information:

1.	Course Title:	Research Methodology.				
2.	Course Code & Number:	ME378.				
3.	Credit Hours:	C.H				TOTAL CR. HRS.
		Th.	Seminar/Tu.	Pr	Tr.	
		2	-	-	-	2
4.	Study level/ semester at which this course is offered:	Fourth Year - Second Semester.				
5.	Pre –requisite (if any):	Basic Mathematics.				
6.	Co –requisite (if any):	None.				
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:	Mechanical Engineering Department.				
10.	Prepared By:	Asst. Prof. Dr. Tarek A. Barakat.				
11.	Date of Approval:					

II. Course Description:

This course provides problem solving skills essential for engineers. The course is designed to apply the engineering research process and methods of inquiry to solve problems. It will introduce students to quantitative and qualitative methods for conducting meaningful inquiry and research. They will gain an overview of research intent and design, methodology and technique, format and presentation, and data management and analysis, it will examine the procedures and principles involved with experimental, quasi-experimental, correlational, and another research. Problem formulation, literature review, measurement issues, sampling, research design, data analysis, and report writing will be addressed.

Prepared by	Head of Department	Quality Assurance Unit	Dean of the Faculty	Academic Development Center & Quality Assurance
Asst. Prof. Dr. Tarek Barakat	Asst. Prof. Dr. Eng. Hamoud Al-Nahari	Assoc. Prof. Dr. Mohammad Algorafi	Prof. Dr. Mohammed AL-Bukhaiti	Assoc. Prof. Dr. Huda Al-Emad

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III. Alignments of the Course Intended learning outcomes (CILOs)		Referenced PILOs
a1	Recognize types and particular properties of quantitative and qualitative research and methodologies.	A4
a2	Express how to write a good research question, hypothesis and aims.	A4
b1	Propose an alternative research methodologies and analytical techniques for a chosen mechanical engineering research problem.	B1
b2	Analyze data that relate to complex theoretical and technical mechanical engineering problems.	B2
c1	Apply an appropriate research design, methodologies and analytical techniques for a chosen mechanical engineering research problem.	C1
c2	Prescribe accurately data from research for presentation of results.	C2
d1	Assess complex research results to specialist audiences.	D5
d2	Cooperate professionally, autonomously and in teams to produce a professional product.	D1
d3	Review literature from databases and other sources.	D4

(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 types and particular properties of quantitative and qualitative research and methodologies.	Lecture Presentations Discussion	Participation Written exam Written assignment
a2- Express how to write a good research question, hypothesis and aims.	Lecture Presentations Discussion	Participation Written exam Written assignment

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(B) Alignment Course Intended Learning Outcomes of Intellectual Skills to Teaching Strategies and Assessment Strategies:			
	Course Intended Learning Outcomes	Teaching strategies	Assessment Strategies
b1-	Propose an alternative research methodologies and analytical techniques for a chosen mechanical engineering research problem.	Lecture. Presentations. Discussion.	Participation. Written Exam. Written Assignment.
b2-	Analyze data that relate to complex theoretical and technical mechanical engineering problems.	Lecture. Presentations. Discussion.	Participation. Written Exam. Written Assignment.

© 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 an appropriate research design, methodologies and analytical techniques for a chosen mechanical engineering research problem.	Lecture. Presentations. Discussion.	Participation. Written Exam. Written Assignment.
c2-	Prescribe accurately data from research for presentation of results.	Lecture. Presentations. Discussion.	Participation. Written Exam. Written Assignment.

(D) Alignment Course Intended Learning Outcomes of Transferable Skills to Teaching Strategies and Assessment Strategies:			
	Course Intended Learning Outcomes	Teaching strategies	Assessment Strategies
d1-	Assess complex research results to specialist audiences**.**	Lecture. Presentations. Discussion.	Participation. Written Exam. Written Assignment.

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d2-	Cooperate professionally, autonomously and in teams to produce a professional product.	Lecture. Presentations. Discussion.	Participation. Written Exam. Written Assignment.
d3-	Review literature from databases and other sources.	Lecture. Presentations. Discussion.	Participation. Written Exam. Written Assignment.

IV. Course Content:

A – Theoretical Aspect:

Order	Units/Topics List	Learning Outcomes	Sub Topics List	Number of Weeks	Contact Hours
1.	Introduction to the Process of Conducting Research.	a1	• Meaning and Objective of Research. • Research Proposal or Synopsis. • Research Report Writing.	1	2
2.	Research Design Introduction.	a1, a2, c1, d3	• Steps in the Process of Research. • Identifying a Hypothesis and/or Research Problem, specifying a Purpose, Creating Research Questions. • Reviewing Literature. • Ethics of research and informed consent	1	2

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3.	Introduction to Qualitative Research.	a1, a2, b1, b2, c1, c2, d3	• Essence of Qualitative Data.
			• Sampling.
			• Collection Techniques:
			  ○ Biography.
			  ○ Phenomenology.
			  ○ Grounded Theory.
			  ○ Ethnography.
			  ○ Case Study.
				2	4

4.	Interpreting Qualitative Data.	a1, a2, c1, d3	• Qualitative Data Analysis Procedures. • Coding. • Thematic Development.	1	2
5.	Introduction to Quantitative Research.	a1, a2, b1, b2, c1, c2, d3	• Essence of Quantitative Data • Collection and Analysis Techniques.	2	4
6.	Mid-Term Exam.	a1, a2, b1, b2, c1, c2, d3	The First 5 Chapters.	1	2
7.	Sampling Concepts.	a1, b1, c1, c2	• Defining the Target Population. • Representative Sample. • Potential Consequences of Unrepresentative Sampling (Gaming the System). • Over Representative Subgroups / Weighting. • Design Effect.	1	2

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			• Sampling Methods (Cluster, Stratified, Simple Random).		
8.	Quantitative Data Collection Instruments.	a1, b1, c1, c2	• Choosing a Good Instrument. • Interval and Ratio Scales.	1	2
9.	Introduction to Applied Statistics.	a1, b1, c1, c2	• Identifying the Dependent and Independent Variables. • Confidence Levels. • Math that Manipulates Data.	1	2
10.	Descriptive Statistics.	a1, b1, c1, c2	• Summarizing and Describing a Collection of Data. • Univariate and Bivariate Analysis. • Mean, Mode and Standard Deviation. • Percentages and Ratios. • Histograms. • Identifying Randomness and Uncertainty in Data.	1	2
11.	Inferential Statistics.	a1, b1, c1, c2	• Drawing Inference from Data. • Modeling Assumptions. • Identifying Patterns. • Regression Analysis. • T-Test. • Analysis of Variance. • Correlations.	1	2

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			• Chi-Square.		
12.	Introduction to Mixed Methods Research.	a1, a2, b1, b2, c1, c2, d3	• Advantages. • Design Components. • Explanatory Mixed Methods. Framework. • Exploratory Mixed Methods Framework.	1	2
13.	Writing the Research.	a2, d1, d2, d3	• Procedures for Writing a Research. • Scientific Research.	1	2
14.	Final Exam.	a1, a2, b1, b2, c1, c2, d1, d2, d3	All the Chapters.	1	2
Number of Weeks /and Units Per Semester				**16**	**32**

V. Teaching strategies of the course:

- Lectures.
- Presentations.
- Discussion.

VI. Assignments:

No	Assignments	Aligned CILOs (symbols)	Week Due	Mark
1.	Writing Research Problem, Questions Hypotheses and Aims.	a1, a2, c1, d3	3	2
2.	Qualitative Research Collection Techniques.	a1, a2 ,b1,b2, c1 , c2 , d3	6	2
3.	Qualitative Data Analysis.	a1 ,a2, c1 ,d3	8	2

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4.	Quantitative Research Collection Techniques.	a1 , a2,b1,b2, c1, c2, d3	10	3
5.	Quantitative Data Analysis.	a1 ,a2, c1 , d3	12	2
6.	Sampling and Data Collection Techniques.	a1, b1, c1, c2	13	3
7.	Statistics.	a1, b1, c1, c2	14	2
8.	Mixed Methods Research and Writing Research Paper.	a1, a2, b1, b2, c1, c2, d1, d2, d3	15	4
Total				**20**

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.	Assignments.	1-15	20	20%	a1, a2, b1, b2, c1, c2, d1, d2, d3
2.	Mid-Term Exam.	8	20	20 %	a1, a2, b1, b2, c1, c2
3.	Final Exam.	16	60	60%	a1, a2, b1, b2, c1, c2
	Total:		**100**	**100 %**	

VIII. Learning Resources:

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

1. Thiel, D. V., 2014 - Research Methods for Engineering.
2. John Creswell, 2013, "Research Design: Qualitative, Quantitative, and Mixed Methods Approaches", SAGE Publications, Inc; Fourth Edition.

2- Essential References.

1. Shanti Bushan and Shashi Alok, 2017, "Hand Book of Research Methodology", Educreation Publishing, India.

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	2. C.R. Kothari, 2004, "Research Methodology: Methods and Techniques" Second Revised Edition, New Age International (P) Limited Publishers, India.
3- Electronic Materials and Web Sites *etc*.	
	1. www.educreation.in. 2. www.researchgate.net. 3. www.euacademic.org.

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.
6.	**Plagiarism**:

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	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. Abdul-Malik Momin**
	Deputy Rector for Academic Affairs Asst. Prof. Dr. Ibrahim AlMutaa **Assoc. Prof. Dr. Ahmed Mujahed** **Asst. Prof. Dr. Munasar Alsubri**

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Mechanical Engineering Department
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Template for Course Plan of Research Methodology

I. Information about Faculty Member Responsible for the Course:							
Name of Faculty Member	Asst. Prof. Dr Tarek A. Barakat	Office Hours					
Location & Telephone No.	777764744	SAT	SUN	MON	TUE	WED	THU
E-mail	barakatgroupyemen@gmail.com		2				

II. Course Identification and General Information:						
1.	Course Title:	Research Methodology.				
2.	Course Code & Number:	ME378.				
3.	Credit Hours:	C.H				TOTAL CR. HRS.
		Th.	Seminar/Tu.	Pr	Tr.	
		2	-	-	-	2
4.	Study level/ semester at which this course is offered:	Fourth Year-Second Semester.				
5.	Pre –requisite (if any):	Basic Mathematics.				
6.	Co –requisite (if any):	None.				
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:	Mechanical Engineering Department.				
10.	Prepared By:	Asst. Prof. Dr. Tarek A. Barakat.				
11.	Date of Approval:					

Prepared by	Head of Department	Quality Assurance Unit	Dean of the Faculty	Academic Development Center & Quality Assurance
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III. Course Description:

This course provides problem solving skills essential for engineers. The course is designed to apply the engineering research process and methods of inquiry to solve problems. It will introduce students to quantitative and qualitative methods for conducting meaningful inquiry and research. They will gain an overview of research intent and design, methodology and technique, format and presentation, and data management and analysis, it will examine the procedures and principles involved with experimental, quasi-experimental, correlational, and another research. Problem formulation, literature review, measurement issues, sampling, research design, data analysis, and report writing will be addressed.

IV. Course Intended learning outcomes (CILOs) of the course

1.	Recognize types and particular properties of quantitative and qualitative research and methodologies.
2.	Express how to write a good research question, hypothesis and aims.
3.	Propose an alternative research methodologies and analytical techniques for a chosen mechanical engineering research problem.
4.	Analyze data that relate to complex theoretical and technical mechanical engineering problems.
5.	Apply an appropriate research design, methodologies and analytical techniques for a chosen mechanical engineering research problem.
6.	Prescribe accurately data from research for presentation of results.
7.	Assess complex research results to specialist audiences.
8.	Cooperate professionally, autonomously and in teams to produce a professional product.
9.	Review literature from databases and other sources.

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V. Course Content:

A – Theoretical Aspect:

Order	Units/Topics List	Sub Topics List	Week Due	Contact Hours
1.	Introduction to the Process of Conducting Research.	• Meaning and Objective of Research. • Research Proposal or Synopsis. • Research Report Writing.	1st	2
2.	Research Design Introduction.	• Steps in the Process of Research. • Identifying a Hypothesis and/or Research Problem, specifying a Purpose, Creating Research Questions. • Reviewing Literature. • Ethics of research and informed consent	2nd	2
3.	Introduction to Qualitative Research.	• Essence of Qualitative Data. • Sampling. • Collection Techniques: ○ Biography. ○ Phenomenology. ○ Grounded Theory. ○ Ethnography. ○ Case Study.	3rd, 4th	4
4.	Interpreting Qualitative Data.	• Qualitative Data Analysis Procedures. • Coding. • Thematic Development.	5th	2

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5.	Introduction to Quantitative Research.	• Essence of Quantitative Data • Collection and Analysis Techniques.	6 th, 7 th	4
6.	Mid-Term Exam.	The First 5 Chapters.	8 th	2
7.	Sampling Concepts.	• Defining the Target Population. • Representative Sample. • Potential Consequences of Unrepresentative Sampling (Gaming the System). • Over Representative Subgroups / Weighting. • Design Effect. • Sampling Methods (Cluster, Stratified, Simple Random).	9th	2
8.	Quantitative Data Collection Instruments.	• Choosing a Good Instrument. • Interval and Ratio Scales.	10th	2
9.	Introduction to Applied Statistics.	• Identifying the Dependent and Independent Variables. • Confidence Levels. • Math that Manipulates Data.	11th	2
10.	Descriptive Statistics.	• Summarizing and Describing a Collection of Data. • Univariate and Bivariate Analysis. • Mean, Mode and Standard Deviation. • Percentages and Ratios. • Histograms. • Identifying Randomness and Uncertainty in Data.	12th	2

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11.	Inferential Statistics.	• Drawing Inference from Data. • Modeling Assumptions. • Identifying Patterns. • Regression Analysis. • T-Test. • Analysis of Variance. • Correlations. • Chi-Square.	13th	2
12.	Introduction to Mixed Methods Research.	• Advantages. • Design Components. • Explanatory Mixed Methods. Framework. • Exploratory Mixed Methods Framework.	14th	2
13.	Writing the Research.	• Procedures for Writing a Research. • Scientific Research.	15th	2
14.	Final Exam.	All the Chapters.	16th	2
Number of Weeks /and Units Per Semester			**16**	**32**

VI. Teaching strategies of the course:

- Lectures.
- Presentations.
- Discussion.

VII. Assignments:

No	Assignments	Aligned CILOs (symbols)	Week Due	Mark
1.	Writing Research Problem, Questions Hypotheses and Aims.	a1, a2, c1, d3	3	2

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2.	Qualitative Research Collection Techniques.	a1, a2 ,b1,b2, c1 , c2 , d3	6	2
3.	Qualitative Data Analysis.	a1 ,a2, c1 ,d3	8	2
4.	Quantitative Research Collection Techniques.	a1 , a2,b1,b2, c1, c2, d3	10	3
5.	Quantitative Data Analysis.	a1 ,a2, c1 , d3	12	2
6.	Sampling and Data Collection Techniques.	a1, b1, c1, c2	13	3
7.	Statistics.	a1, b1, c1, c2	14	2
8.	Mixed Methods Research and Writing Research Paper.	a1, a2, b1, b2, c1, c2, d1, d2, d3	15	4
Total				**20**

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.	Assignments.	1-15	20	20%	a1, a2, b1, b2, c1, c2, d1, d2, d3
2.	Mid-Term Exam.	8	20	20 %	a1, a2, b1, b2, c1, c2
3.	Final Exam.	16	60	60%	a1, a2, b1, b2, c1, c2
	Total:		**100**	**100 %**	

IX. Learning Resources:

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

1. Thiel, D. V., 2014 - Research Methods for Engineering.
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