Course Specifications

Course Title:	Functional Analysis
Course Code:	42041424
Program:	B. Sc in Mathematics
Department:	Department of Mathematics
College:	Faculty of Science and Arts in Qilawah
Institution:	AlBaha University

Table of Contents

A. Course Identification

1. Credit hours:
2. Course type **a.** University ☐ College ☐ Department ■ Others ☐ **b.** Required ■ Elective ☐
3. Level/year at which this course is offered: 8th Level / 4th year
4. Pre-requisites for this course (if any)**: Real analysis (2) (42041312)**
5. Co-requisites for this course (if any)**: None**

6. Mode of Instruction (mark all that apply)

No	Mode of Instruction	Contact Hours	Percentage
1	**Traditional classroom**	45	100 %
2	**Blended**		
3	**E-learning**		
4	**Correspondence**		
5	**Other**		

7. Actual Learning Hours (based on academic semester)

No	Activity	Learning Hours
Contact Hours		
1	**Lecture**	45
2	**Laboratory/Studio**	
3	**Tutorial**	
4	**Others** (specify)	
	Total	45
Other Learning Hours*		
1	**Study**	5
2	**Assignments**	5
3	**Library**	5
4	**Projects/Research Essays/Theses**	5
5	**Others** (specify)	
	Total	20

* The length of time that a learner takes to complete learning activities that lead to achievement of course learning outcomes, such as study time, homework assignments, projects, preparing presentations, library times

B. Course Objectives and Learning Outcomes

1. Course Description

This is a basic graduate level course that introduces the student to Functional Analysis and its applications. It starts with a review of the theory of metric spaces, the theory of Banach spaces and proceeds to develop some key theorems of functional analysis. Then continuous to linear operators in Banach and Hilbert spaces and to spectral theory of self-adjoint operators with applications to the theory of boundary value problems, and the theory of linear elliptic partial differential equations.

2. Course Main Objective

The objectives of this course are to: Study of main concepts of functional analysis as follows:

- Studying different types of spaces in analysis.
- Studying the spaces properties such as basic theorems.
- Solving some examples on these spaces which clarify its basic concepts.
- Have the knowledge of the inner and Hilbert spaces.
- Have the knowledge of Linear operators and functionals on these spaces
- Acquiring the analysis technique in solving different problems;

3. Course Learning Outcomes

CLOs		Aligned PLOs
1	**Knowledge:** At the end of the course, the student will be able to	
1.1	Define basic concept of functional analysis (Metric spaces , Normed spaces and Hilbert spaces)	K1
1.2	State the various conditions to solve problems	K2
1.3	forming the spaces properties such as basic theorems	K3
2	**Skills :** At the end of the course, the student will be able to	
2.1	Explain different types of spaces in functional analysis.	S1
2.2	Drive the relation between the spaces in functional analysis	S2
2.3	Solve different problems in the spaces	S3
3	**Competence:** At the end of the course, the student will be able to	
3.1	Take responsibility for own learning and professional development	C1
3.2	Work effectively in groups and exercise leadership when appropriate.	C3

C. Course Content

No	List of Topics	Contact Hours
1	Metric spaces (Definitions, examples, properties of metric spaces, topology in metric spaces, continuity in metric spaces)	6
2	Metric spaces (compactness and completeness in metric spaces) Introduction to normed spaces (definitions and examples)	6
3	Normed spaces (linear applications, sub-vector spaces and Banach spaces)	3
4	Spaces of continuous functions (continuity, uniform continuity, ordinary convergence, uniform convergence, equicontinuity, uniform equicontinuity)	6
5	Fundamental theorems in functional analysis (Baire theorem and Banach Steinhauss theorem, open mapping theorem and closed graph theorem, Hahn Banach theorem and applications)	9
6	Hilbert spaces (scalar product, hermitian product, Cauchy Schwartz inequality, orthogonality, Projection on a convex closed set)	6
7	Orthogonal systems and Hilbert bases, Bessel inequality, Parseval equality.	6
8	Application 2: Compact operators on Hilbert spaces Adjoint operators on Hilbert spaces	3
Total		45

D. Teaching and Assessment

1. Alignment of Course Learning Outcomes with Teaching Strategies and Assessment Methods

Code	Course Learning Outcomes	Teaching Strategies	Assessment Methods
1.0	**Knowledge**		
1.1	Define the fundamental notions in Functional Analysis such as: Definitions of different types of space and its properties-complete metric spaces	• Lectures • Discussion • Assignments	• Continuous evaluation through interaction, and presentation of research projects. • Presentation of summaries and reports during lectures. • Evaluation of assignments. • Quiz1 & Quiz2. • Midterm & Final written exams.
1.2	Outline the logical thinking.	• Lectures • PowerPoint presentation • Discussion. • Assignments.	• Continuous evaluation through interaction, and presentation of research projects. • Presentation of summaries and reports during lectures. • Evaluation of assignments. • Quiz1 & Quiz2. • Midterm & Final written exam.
1.3	State the physical problems by mathematical method.	• Lectures • Discussion. • Assignments.	Midterm & final written exam Quiz1 & Quiz2
2.0	**Skills**		
2.1	The students will explain and interpret a general knowledge of Functional Analysis.	• Lectures • Debate and discussion. • Assignments • Cooperative Learning • Working in small groups Individual & group research	• Continuous evaluation through interaction, and presentation of research projects. • Presentation of summaries and reports during lectures. • Evaluation of assignments. • Quiz1 & Quiz2. • Midterm & Final written exam.
2.2	Enable students to analyses the mathematical problems.	• Lectures • Debate and discussion. • Assignments • Cooperative Learning • Working in small groups Individual & group research	• Continuous evaluation through interaction, and presentation of research projects. • Presentation of summaries and reports during lectures. • Evaluation of assignments. • Quiz1 & Quiz2. • Midterm & Final written exam.
2.3	Student's ability to write analytical equations in a correct mathematical way.	• Lectures • Debate and discussion. • Assignments • Cooperative Learning • Working in small groups Individual & group research	• Continuous evaluation through interaction, and presentation of research projects. • Presentation of summaries and reports during lectures. • Evaluation of assignments.

Code	Course Learning Outcomes	Teaching Strategies	Assessment Methods
			• Quiz1 & Quiz2. • Midterm & Final written exam.
3.0	**Competence**		
3.1	The student should illustrate how take up responsibility.	• Team work- presentation- reporting • Co-operative & Individual assignments. • Cooperative Learning.	• Evaluation of Individual & group works. • Observation
3.2	Must be shown the ability of working independently and with groups.	• Working in small groups • Group research	• Evaluation of group works. • Observation

2. Assessment Tasks for Students

#	Assessment task*	Week Due	Percentage of Total Assessment Score
1	Periodic test 1	5	10%
2	Midterm	7	20%
3	Periodic test 2	10	10%
4	Home works	Every two weeks	10%
5	Final Exam	16	50%

***Assessment task** (i.e., written test, oral test, oral presentation, group, etc.)

E. Student Academic Counseling and Support

Arrangements for availability of faculty and teaching staff for individual student consultations and academic advice :

- The presence of faculty members to provide advice, academic advice and academic guidance to the student in need within the six hours a week available to all students.

F. Learning Resources and Facilities

1.Learning Resources

Required Textbooks	Introductory Functional Analysis with Applications, Erwin Kreyszig: John Willy and Sons, 1978.
Essential References Materials	Elements of Functional Analysis with Applications by: I.J. Maddox.
Electronic Materials	
Other Learning Materials	

2. Facilities Required

Item	Resources
Accommodation (Classrooms, laboratories, demonstration rooms/labs, etc.)	Classrooms

Item	Resources
Technology Resources (AV, data show, Smart Board, software, etc.)	Data show
Other Resources (Specify, e.g. if specific laboratory equipment is required, list requirements or attach a list)	None

G. Course Quality Evaluation

Evaluation Areas/Issues	Evaluators	Evaluation Methods
Effectiveness of teaching and assessment	Students	Direct
Quality of learning resources	Students, faculty and staff	Direct
Achievement of course learning outcomes	Staff and program leaders	Indirect

Evaluation areas (e.g., Effectiveness of teaching and assessment, Extent of achievement of course learning outcomes, Quality of learning resources, etc.)
Evaluators (Students, Faculty, Program Leaders, Peer Reviewer, Others (specify)
Assessment Methods (Direct, Indirect)

H. Specification Approval Data

Council / Committee	1. Dr. Ali Hassan Abkar. 2. Dr . Mohammed Al-modeer Mohammed. 3. Dr. Al-Hadi Al-nour Alneel. 4. Dr.Asia Abdualzeez Abdurahman.
Reference No.	
Date	

Course Specifications

Course Title:	Statistical inference(Elective Course (2))
Course Code:	42041432
Program:	B. Sc in Mathematics
Department:	Department of Mathematics
College:	Faculty of Science and Arts in Qilawah
Institution:	AlBaha University

Table of Contents

A. Course Identification

1. Credit hours: 3 hours (lecture)
2. Course type **a.** University ☐ College ☐ Department ☑ Others ☐ **b.** Required ☑ Elective ☐
3. Level/year at which this course is offered: Level: 8/ year: 4 (optional course)
4. Pre-requisites for this course (if any)**:** **Introduction to mathematical statistics (42041218)**
5. Co-requisites for this course (if any)**:** Non

6. Mode of Instruction (mark all that apply)

No	Mode of Instruction	Contact Hours	Percentage
1	**Traditional classroom**	√	80%
2	**Blended**	√	10%
3	**E-learning**	√	10%
4	**Correspondence**		
5	**Other**		

7. Actual Learning Hours (based on academic semester)

No	Activity	Learning Hours
Contact Hours		
1	**Lecture**	45
2	**Laboratory/Studio**	
3	**Tutorial**	
4	**Others** (specify)	
	Total	45
Other Learning Hours*		
1	**Study**	45
2	**Assignments**	30
3	**Library**	25
4	**Projects/Research Essays/Theses**	
5	**Others**(specify)	
	Total	100

***The length of time that a learner takes to complete learning activities that lead to achievement of course learning outcomes, such as study time, homework assignments, projects, preparing presentations, library times

B. Course Objectives and Learning Outcomes

1. Course Description

This course is designed to give overview of Statistical inference. Topics covered include the Point & Interval estimations (Two populations), Hypothesis tests (Two populations), Nonparametric methods, Analysis of variance and Decision theory.

2. Course Main Objective

The main purpose of this course is to introduce the basic concepts of Statistical Inference concerning techniques and tools used in the estimation theory, testing of hypotheses, nonparametric methods, analysis of variance and decision theory.

3. Course Learning Outcomes

	CLOs	Aligned PLOs
1	**Knowledge:**	
1.1	Define the principal concepts about of estimation.	K1
1.2	Recognize the basic principles of statistical inference, including laws for various methods of the hypothesis tests and their characteristics.	K2
1.3	State various concepts related to the analysis of variance, correlation and regression.	K3
2	**Skills :**	
2.1	Solve the problems related to point and interval estimations and testing of hypotheses.	S3
2.2	Explain the concepts of nonparametric methods.	S1
2.3	Calculate the problems related to analysis of variance, correlation and regression.	S3
3	**Competence:**	
3.1	Communicates effectively in oral and written form in educational situations related to the subjects of the course.	C1
3.2	Take responsibility for own learning and professional development	C2
3.3	Work effectively in groups and exercise leadership when appropriate.	C3
3.4	Present information clearly in both written and oral form.	

C. Course Content

No	List of Topics	Contact Hours
1	**Introduction to statistical inferences:** Basic concepts; Useful distributions in statistical inference; Types of inference (Point estimation, Interval estimation, Hypothesis testing).	3
2	**Point Estimate and Interval Estimate:** Confidence Interval for the difference between two population means; Confidence Interval for the Difference Between Two population proportions. Confidence Intervals for Two Variances: Variance confidence intervals-Confidence intervals for ratio of variances.	6
3	**Hypothesis Tests (Two populations):** Hypothesis Tests two population means (Independent populations); Hypothesis Tests for two population proportions; Hypothesis Tests for Two Variances. Uniformly most powerful unbiased test-Likelihood Ratio test- Bartlet's test - Chi-Square tests- Goodness of fit test.	9
4	**Nonparametric Methods:** Order statistics (Median, Range and midrange, Sample cumulative distribution function, Coverage's); Point and interval estimation; Tolerance limits for distributions; One sample location tests(Sign test, Signed rank test, Wilcoxon test, Kolmogorov-Smirnov test); Two samples location tests; Kruskal-Wallis test; Test of independence.	12
5	**Analysis of variance:** Introduction and basic concepts/One way ANOVA/Two way ANOVA/Applications/Use of statistical package for ANOVA	9
6	Correlation and regression	6
	Total	**45**

D. Teaching and Assessment

1. Alignment of Course Learning Outcomes with Teaching Strategies and Assessment Methods

Code	Course Learning Outcomes	Teaching Strategies	Assessment Methods
1.0	**Knowledge**		
1.1	Define the principal concepts about statistical inference.	• Lectures • Self-Learning • Free discussion	• Quizzes • Assignments • Midterm exams • Final exam
1.2	Recognize the basic principles of statistical inference including the laws for various methods of estimates and their characteristics.	• Lectures • PowerPoint presentation • Debate and discussion. • Assignments (Co-operative & Individual assignments). • Cooperative Learning • Working in small groups • Individual & group research	• Quizzes • Assignments • Midterm exams • Final exam
1.3	State various concepts related to the testing of hypothesis.	• Lectures • PowerPoint presentation • Debate and discussion. • Assignments (Co-operative & Individual assignments). • Cooperative Learning • Working in small groups • Individual & group research	• Quizzes • Assignments • Midterm exams • Final exam
2.0	**Skills**		
2.1	Solve different problems related to point and interval estimations and testing of hypotheses.	• Lectures. • Debate and discussion. • Assignments (Co-operative & Individual assignments). • Cooperative Learning. • Working in small groups. • Individual & group research.	• Quizzes • Assignments • Midterm exams • Final exam
2.2	Explain the concepts of nonparametric methods.	• Lectures. • Debate and discussion. • Assignments (Co-operative & Individual assignments). • Cooperative Learning. • Working in small groups. Individual & group research.	• Quizzes • Assignments • Midterm exams • Final exam

Code	Course Learning Outcomes	Teaching Strategies	Assessment Methods
2.3	Calculate the problems related to analysis of variance, correlation and regression.	• Lectures. • Debate and discussion. • Assignments (Co-operative & Individual assignments). • Cooperative Learning. • Working in small groups. Individual & group research.	• Assignments • Midterm exams • Final exam
3.0	**Competence**		
3.1	Take responsibility for own learning and professional development	• Team work. • Assignments-student. • presentation-reporting-Scientific media • Co-operative & Individual assignments. • Cooperative Learning. • Role playing	• Evaluation of individual & group works. Observation Card
3.2	Work effectively in groups and exercise leadership when appropriate.	• Working in small groups • Group research	Evaluation of individual & group works.
3.3	Present information clearly in both written and oral form.	• Team work • Small groups and the distribution of roles. • PowerPoint presentation. Writing reports	Oral discussion Report evaluation
	Communicates effectively in oral and written form in educational situations related to the subjects of the course.	• Small groups and the distribution of roles. • PowerPoint presentation. • Writing reports	Oral discussion Report evaluation

2. Assessment Tasks for Students

#	Assessment task*	Week Due	Percentage of Total Assessment Score
1	Quiz 1	5	10
2	Midterm Written Theoretical Exam	9	20
3	Quiz2	13	10
4	Assignments, Activities & Attendance	During Semester	10
5	Final Written Theoretical Exam	16	50

***Assessment task** (i.e., written test, oral test, oral presentation, group project, essay, etc.)

E. Student Academic Counseling and Support

Arrangements for availability of faculty and teaching staff for individual student consultations and academic advice :

Office hours (at least 14 hour per week).

- Arrange extra hours gifted students or Program for students who default in scholastic achievement.

F. Learning Resources and Facilities

1.Learning Resources

Required Textbooks	
Essential References Materials	1. Hogg, R. V. and Tanis, E. A. (2010). Probability and statistical inference. (8 th ed.), Prentice Hall. 2. Roussas, G. G. (2003). Introduction to probability and statistical inference, Academic Press. 3. Stapleton, J. H. (2008). Models for probability and statistical inference: theory and applications. Wiley-Interscience.
Electronic Materials	• https://www.academia.edu/36214906/Introductory_Statistics_9th_Edition_Neill_A_Weiss • http://psychstat3.missouristate.edu/Documents/IntroBook3/sbk.htm • https://bolt.mph.ufl.edu/6050-6052/unit-4b/
Other Learning Materials	SPSS, Minitab and R.

2. Facilities Required

Item	Resources
Accommodation (Classrooms, laboratories, demonstration rooms/labs, etc.)	Class room, capacity equal 30 students.
Technology Resources (AV, data show, Smart Board, software, etc.)	Data show device.
Other Resources (Specify, e.g. if specific laboratory equipment is required, list requirements or attach a list)	----------

G. Course Quality Evaluation

Evaluation Areas/Issues	Evaluators	Evaluation Methods
Review of the course	The committee plans in department	• Periodic review of the course by the committee plans in department • Course Evaluation questionnaire at the end of the semester • Consult with colleagues who are studying the same course. • Taking the recommendations of the results of internal and external audits.
Extent of achievement of	The teacher	An excel program that

Evaluation Areas/Issues	Evaluators	Evaluation Methods
course learning outcomes		measure CLO's
Quality of learning resources	Students and Program Leaders	Direct

Evaluation areas (e.g., Effectiveness of teaching and assessment, Extent of achievement of course learning outcomes,Quality oflearning resources, etc.)
Evaluators (Students,Faculty, Program Leaders,Peer Reviewer, Others (specify)
Assessment Methods(Direct, Indirect)

H. Specification Approval Data

Council / Committee	1- Dr. Mohammed Sayed Ahmed Mohammed 2- Prof. Ahmed Hamed AbdulIlah 3- Dr. Fath Al -Rahman 4- Dr. Walaa Awad
Reference No.	
Date	

Course Specifications

Course Title:	Special relativity (Elective Course (2))
Course Code:	42041430
Program:	B. Sc in Mathematics
Department:	Department of Mathematics
College:	Faculty of Science and Arts in Qilawah
Institution:	AlBaha University

A. Course Identification

1. Credit hours: 3 hours								
2. Course type								
a. University		College		Department	√	Others		
b. Required		Elective						
3. Level/year at which this course is offered: eighth Level, Forth Year								
4. Pre-requisites for this course (if any)**: Continuum Mechanics (42041314)**								
5. Co-requisites for this course (if any)**: N/A**								

6. Mode of Instruction (mark all that apply)

No	Mode of Instruction	Contact Hours	Percentage
1	**Traditional classroom (√)**	4 hours	95
2	**Blended**		
3	**E-learning**		
4	**Correspondence**		
5	**Other** (Exercises) **(√)**		5

7. Actual Learning Hours (based on academic semester)

No	Activity	Learning Hours
Contact Hours		
1	**Lecture**	45
2	**Laboratory/Studio**	
3	**Tutorial**	
4	**Others** (specify)	
	Total	45
Other Learning Hours*		
1	**Study**	3
2	**Assignments**	
3	**Library**	
4	**Projects/Research Essays/Theses**	
5	**Others** (specify)	
	Total	3

***** The length of time that a learner takes to complete learning activities that lead to achievement of course learning outcomes, such as study time, homework assignments, projects, preparing presentations, library times

B. Course Objectives and Learning Outcomes

1. Course Description Course Description: (Note: General description in the form used in Bulletin or handbook).

2. Course Main Objective

1. What is the main purpose for this course?

The objectives of this course are to:

- introduce students to the basic concepts of special theory of relativity;
- expose students to the knowledge of Galilean transformation;
- give students a broad perception of the Lorentz transformation; the equivalence principle; transformation of forces, energy and momentum transformation

Outcomes:

After studying this course, the student is expected to be able to know the basic the Inertial frame, the Galilean transformation, the speed of light, the relationship between simultaneity and time sequence, , time dilation, and Lorentz contraction, as well as student knowledge conservation of linear momentum, center of mass (nonrelativistic), transformation of momentum and energy transformations

Learning outcomes for this course: It is expected that after studying this course, the student will be able to:

- Define, understand and explain the concept of special theory of relativity
- Understand and explain the Galilean transformation.
- Recognize the exact definitive for the Lorentz transformation
- Classify transformations according their mathematics characteristics.
- Describe in details the Newton's second law, the equivalence principle, and transformation of Forces.
- Define the energy and momentum involved in the Newton's second law.
- Recall the relationship of this relativity and electro-magnetic, moving, transformation of acceleration.

- Choosing new subjects, new books and latest papers.

3. Course Learning Outcomes

CLOs		Aligned PLOs
1.0	**Knowledge:**	
K1	Calculate the main concepts of the **Special relativity** and their operations.	
K2	State the principles of calculus in Special relativity such as gradient The Galilean Transformation, The Inertial Frame, 9; The Galilean Transformation, The Speed of Light, The Special Theory of Relativity, The Rod Clock..	
K3	**Recognize Special relativity and Algorithms.**	
S0	**Skills :**	
S1	The Lorentz Transformation, Simultaneity and Time Sequence, Time Dilation, Lorentz Contraction, Velocity Transformations, Visual Appearance of Rapidly Moving Objects, Transformation of Acceleration.	
S2	Students should be able Force and Motion, Introduction, Newton's Second Law, The Equivalence Principle, Transformation of Forces..	
S3	Students should be able Force and Motion, Introduction, Newton's Second Law, The Equivalence Principle, Transformation of Forces.	
3	**Competence:**	
C1	Students should be able to use information and communication technologies to collect, interpret and analyze information in both verbal	

CLOs		Aligned PLOs
	and written forms.	
C2	Students should be able to Relativity and Electromagnetism, Introduction, The Lorentz Force, Magnetization and Polarization, Transformations of Fields and Flux	
C3	Students should be able to Electromagnetic Induction, Field of a Moving Charge, Transformation of Polarization and Magnetization, The Unipolar Generator, Postscript.	
C4	Students should be able to demonstrate the work either independently or being a part of a team.	

C. Course Content

No	List of Topics	Contact Hours
1	The Galilean Transformation, The Inertial Frame, 9; The Galilean Transformation, The Speed of Light, The Special Theory of Relativity, The Rod Clock.	9
2	Time Dilation, Lorentz Contraction, Velocity Transformations, Visual Appearance of Rapidly Moving Objects, Transformation of Acceleration.	9
3	Force and Motion, Introduction, Newton's Second Law, The Equivalence Principle, Transformation of Forces.	9
4	Energy and Momentum, Work, Kinetic Energy (Nonrelativistic), Kinetic Energy (Relativistic), Conservation of Linear Momentum, Center of Mass (Nonrelativistic), Transformation of Momentum and Energy (Relativistic). Center of Mass (Relativistic).	9
5	Tensor algebra and analysis Relativity and Electromagnetism, Introduction, The Lorentz Force, Magnetization and Polarization, Transformations of Fields and Flux Densities, Electromagnetic Induction, Field of a Moving Charge, Transformation of Polarization and .Magnetization, The Unipolar Generator, Postscript	9
Total		45

D. Teaching and Assessment

1. Alignment of Course Learning Outcomes with Teaching Strategies and Assessment Methods

Code	Course Learning Outcomes	Teaching Strategies	Assessment Methods
1.0	**Knowledge**		
1.1	Define, understand and explain the concept of special theory of relativity	Developing basic communicative ability through: • Lectures • Team work • Oral discussion • Scientific discussion. • Open discussion.	• Homework. • Periodic tests • Web search • Class Participation • Midterm tests Final exams
1.2	State the explain the Galilean transformation.		
1.3	Recognize the exact definitive and intermediate hosts for the Lorentz transformation		
2.0	**Skills**		
2.1	Define the energy and momentum involved in the infection.	• Lectures • Exercises • Case studies	• Class Participation • Essay Question • Presentation

Code	Course Learning Outcomes	Teaching Strategies	Assessment Methods
2.2	Recall the relationship of this relativity and electro-magnetic, moving objects, transformation of acceleration	• Individual • Presentations Brainstorming.	Research
2.3	Propose t methods for Energy and Momentum.		
	Explain the methods Work, Kinetic Energy (Nonrelativistic), Kinetic Energy (Relativistic), Conservation of Linear Momentum, Center of Mass (Nonrelativistic), Transformation of Momentum and Energy (Relativistic). Center of Mass (Relativistic).		
3.0	**Competence**		
3.1	Take responsibility for own learning and professional development	• Small group discussion • Whole group discussion • Brainstorming Presentation.	• Written Exam • Web search and writing reports. • Class Activities • Periodic tests
3.2	Work effectively in groups and exercise leadership when appropriate.		
3.3	Present information clearly in both written and oral form.		
3.4	Communicates effectively in oral and written form in educational situations related to the subjects of the course.		

2. Assessment Tasks for Students

#	Assessment task*	Week Due	Percentage of Total Assessment Score
1	Quiz 1 (Periodic test 1)	5	10%
2	Midterm Exam	9	20%
3	Quiz 2 (Periodic test 2)	13	10%
4	Homework & participation	During the term	10%
5	Final theoretical exam	16	50%

***Assessment task** (i.e., written test, oral test, oral presentation, group project, essay, etc.)

E. Student Academic Counseling and Support

Arrangements for availability of faculty and teaching staff for individual student consultations and academic advice :

(include amount of time faculty are available each week)

- Follow-up by the head of the department.
- Define 8 office hours per week for each member of the faculty who resides in his office.
- Define 2 hours weekly as Academic guidance for each faculty member for guiding a group of students academically.
- Give guidance so encouraging in assessing the performance of a teacher.
- Creating the means to make the teacher benefit of his time during his stay in office.

Non-scientific services to assist the teacher to attend office hours**.**

F. Learning Resources and Facilities

1.Learning Resources

1.Required Textbooks	**1. Required Text(s)** • Course notes • Chapters from different text books

2. Essential References

[1] M. R. Spiegel, Vector Analysis, Schaum's Outline Series, McGraw-Hill Book Company, 2009.

3- Recommended Books and Reference Material (Journals, Reports, etc) (Attach List)

[1] H. Anton, I. Bivens, and S. Davis. Calculus, 8th Edition. John Wiley and Sons, 2005.
[2] James Stewart. Calculus Early Transcendentals, 5th edition. Thomson, 2003.
[3] R. Larson, R. Hostetler, and B. Edwards. Calculus, 7th edition . Houghton Mifflin Company, 2002.
[4] H. Anton. Calculus, 7th Edition. John Wiley and Sons, 2002.
[5] E. Swokowski, M. Olinic, and D. Pence Calculus, 6th Edition. PWS Publishing Company,1994.
[6] M. R. Spiegel Vector Analysis, Schaum's Outline Series, McGraw-Hill Book Company, 2009.

4-.Electronic Materials, Web Sites etc

http://www.google.com.

2. Facilities Required

Item	Resources
Accommodation (Classrooms, laboratories, demonstration rooms/labs, etc.)	Teaching classes equipped with white board and display screen for (30) students
Technology Resources (AV, data show, Smart Board, software, etc.)	**- Provision of computers for students training to be used in research on scientific topics that serve the course.**
Other Resources (Specify, e.g. if specific laboratory equipment is required, list requirements or attach a list)	

G. Course Quality Evaluation

Evaluation Areas/Issues	Evaluators	Evaluation Methods
Effectiveness of teaching and assessment, Extent of achievement of course learning outcomes, Quality of learning resources, et	Students, Faculty, Program Leaders, Peer Reviewer	

Evaluation areas (e.g., Effectiveness of teaching and assessment, Extent of achievement of course learning outcomes, Quality of learning resources, etc.)
Evaluators (Students, Faculty, Program Leaders, Peer Reviewer, Others (specify)
Assessment Methods (Direct, Indirect)

H. Specification Approval Data

Council / Committee	
Reference No.	
Date	

Course Specifications

Course Title:	Operations Research
Course Code:	42041422
Program:	B. Sc in Mathematics
Department:	Department of Mathematics
College:	Faculty of Science and Arts in Qilawah
Institution:	Al Baha University

Table of Contents

A. Course Identification

1. Credit hours: 3 hours (lecture)
2. Course type **a.** University ☐ College ☐ Department ☑ Others ☐ **b.** Required ☑ Elective ☐
3. Level/year at which this course is offered: Level: 8 / year: 4
4. Pre-requisites for this course (if any)**:** **Introduction to mathematical statistics (42041218)**
5. Co-requisites for this course (if any)**:** Non

6. Mode of Instruction (mark all that apply)

No	Mode of Instruction	Contact Hours	Percentage
1	**Traditional classroom**	√	80%
2	**Blended**	√	10%
3	**E-learning**	√	10%
4	**Correspondence**		
5	**Other**		

7. Actual Learning Hours (based on academic semester)

No	Activity	Learning Hours
Contact Hours		
1	**Lecture**	45
2	**Laboratory/Studio**	
3	**Tutorial**	
4	**Others** (specify)	
	Total	45
Other Learning Hours*		
1	**Study**	45
2	**Assignments**	30
3	**Library**	25
4	**Projects/Research Essays/Theses**	
5	**Others**(specify)	
	Total	100

***The length of time that a learner takes to complete learning activities that lead to achievement of course learning outcomes, such as study time, homework assignments, projects, preparing presentations, library times

B. Course Objectives and Learning Outcomes

1. Course Description This course is designed to give overview of operations research. Topics covered include the Linear Programming and Transportation problem and Decision Theory
2. Course Main Objective The main purpose of this course is to introduce the basic concepts of Operations Research concerning Types of model of linear programming and the method of solving these models and also study the model of transportation problem and decision theory

3. Course Learning Outcomes

CLOs		Aligned PLOs
1	**Knowledge:**	
1.1	Define the principal concepts of operations research.	K1
1.2	Recognize the basic principles of operation Research models, including general model and standard one and various methods of solving these models	K2
1.3	State various methods related to the Graphical ,algebraic and Simplex	K3
2	**Skills :**	
2.1	Solve the problems related to operations research in general	S3
2.2	Explain the concepts of all methods of solving operations research problems.	S1
2.3	Calculate the problems related to linear programming, transportation problems and Decision theory.	S3
3	**Competence:**	
3.1	Communicates effectively in oral and written form in educational situations related to the subjects of the course.	C1
3.2	Take responsibility for own learning and professional development	C2
3.3	Work effectively in groups and exercise leadership when appropriate.	C3
3.4	Present information clearly in both written and oral form.	

C. Course Content

No	List of Topics	Contact Hours
1	**Introduction to Operations Research:** Basic concepts , origin , definitions and essential features of the operations research	6
2	**Linear programming**: Expressing maximization and minimization concepts	6
3	**Method of Solving Linear Programming:** Graphical, Algebraic and Simplex Methods	18
4	**Transportation Problem and Method of Solutions :**. North West Corner and Least Cost Methods	9
5	**Assignment Problem**	3
6	**Decision Theory**	3
Total		**45**

D. Teaching and Assessment

1. Alignment of Course Learning Outcomes with Teaching Strategies and Assessment Methods

Code	Course Learning Outcomes	Teaching Strategies	Assessment Methods
1.0	**Knowledge**		
1.1	Define the principal concepts about Operations research.	• Lectures • Self-Learning • Free discussion	• Quizzes • Assignments • Midterm exams • Final exam
1.2	Recognize the basic principles of operation Research models,	• Lectures • Discussion.	• Quizzes • Assignments

Code	Course Learning Outcomes	Teaching Strategies	Assessment Methods
	including general model and standard one and various methods of solving these models	• Assignments (Co-operative & Individual assignments). • Cooperative Learning • Working in small groups • Individual & group research	• Midterm exams • Final exam
1.3	State various methods related to the Graphical, algebraic and Simplex.	• Lectures • Discussion. • Assignments (Co-operative & Individual assignments). • Cooperative Learning • Working in small groups • Individual & group research	• Quizzes • Assignments • Midterm exams • Final exam
2.0	**Skills**		
2.1	Solve different problems related to operations research in general.	• Lectures. • Debate and discussion. • Assignments (Co-operative & Individual assignments). • Cooperative Learning. • Working in small groups. • Individual & group research.	• Quizzes • Assignments • Midterm exams • Final exam
2.2	Explain the concepts of all methods of solving operations research problems.	• Lectures. • Debate and discussion. • Assignments (Co-operative & Individual assignments). • Cooperative Learning. • Working in small groups. Individual & group research.	• Quizzes • Assignments • Midterm exams • Final exam
2.3	Calculate the problems related to linear programming, transportation problems and Decision theory.	• Lectures. • Debate and discussion. • Assignments (Co-operative & Individual assignments). • Cooperative Learning. • Working in small groups. Individual & group research.	• Assignments • Midterm exams • Final exam
3.0	**Competence**		
3.1	Take responsibility for own learning and professional development	• Team work. • Assignments-student.	• **Evaluation of individual & group works.**

Code	Course Learning Outcomes	Teaching Strategies	Assessment Methods
		• presentation-reporting-Scientific media • Co-operative & Individual assignments. • Cooperative Learning. • Role playing	**Observation Card**
3.2	Work effectively in groups and exercise leadership when appropriate.	• **Working in small groups** • **Group research**	**Evaluation of individual & group works.**
3.3	Present information clearly in both written and oral form.	• **Team work** • **Small groups and the distribution of roles.**	**Oral discussion Report evaluation**
3.4	Communicates effectively in oral and written form in educational situations related to the course.	• **Small groups and the distribution of roles.** • **Writing reports**	**Oral discussion Report evaluation**

2. Assessment Tasks for Students

#	Assessment task*	Week Due	Percentage of Total Assessment Score
1	Quiz 1	5	10
2	Midterm Written Theoretical Exam	9	20
3	Quiz2	13	10
4	Assignments, Activities & Attendance	During Semester	10
5	Final Written Theoretical Exam	16	50

***Assessment task** (i.e., written test, oral test, oral presentation, group project, essay, etc.)

E. Student Academic Counseling and Support

Arrangements for availability of faculty and teaching staff for individual student consultations and academic advice :

- Office hours (at least 14 hour per week).
- Arrange extra hours gifted students or Program for students who default in scholastic achievement.

F. Learning Resources and Facilities

1.Learning Resources

Required Textbooks	
Essential References Materials	• Introduction to Operations Research, Hillier and Lieberman (7th edition), McGraw Hill, Singapore, 2001. • Operations Research an introduction by Hamdy A. Taha (8th edition), PEARSON-Hall, 2007 . • Linear Programming and Network Flows, Bazaraa & Gravis Sherali. • مقدمة في البرمجة الخطية. تأليف د. إبراهيم بن صالح العليان

Electronic Materials	• Any electronic materials in the internet
Other Learning Materials	

2. Facilities Required

Item	Resources
Accommodation (Classrooms, laboratories, demonstration rooms/labs, etc.)	Class room, capacity equal 30 students.
Technology Resources (AV, data show, Smart Board, software, etc.)	Data show device.
Other Resources (Specify, e.g. if specific laboratory equipment is required, list requirements or attach a list)	----------

G. Course Quality Evaluation

Evaluation Areas/Issues	Evaluators	Evaluation Methods
Review of the course	The committee plans in department	• Periodic review of the course by the committee plans in department • Course Evaluation questionnaire at the end of the semester • Consult with colleagues who are studying the same course. • Taking the recommendations of the results of internal and external audits.
Extent of achievement of course learning outcomes	The teacher	An excel program that measure CLO's
Quality of learning resources	Students and Program Leaders	Direct

Evaluation areas (e.g., Effectiveness of teaching and assessment, Extent of achievement of course learning outcomes,Qualityoflearning resources, etc.)
Evaluators (Students,Faculty, Program Leaders,PeerReviewer, Others (specify)
Assessment Methods(Direct, Indirect)

H. Specification Approval Data

Council / Committee	
Reference No.	
Date	

Course Specifications

Course Title:	Quantum Theory
Course Code:	42041420
Program:	B. Sc in Mathematics
Department:	Department of Mathematics
College:	Faculty of Science and Arts in Qilawah
Institution:	AlBaha University

Table of Contents

A. Course Identification

1. Credit hours:	**3 hours**
2. Course type	
a.	University ☐ College ☐ Department ☑ Others ☐
b.	Required ☐ Elective ☑
3. Level/year at which this course is offered:	**Level : 8 / year: 4**
4. Pre-requisites for this course (if any)**:**	**Analytical Mechanics (42041419)**
5. Co-requisites for this course (if any)**:**	**Non**

6. Mode of Instruction (mark all that apply)

No	Mode of Instruction	Contact Hours	Percentage
1	Traditional classroom	√	80%
2	Blended		
3	E-learning		
4	Correspondence		
5	Other	√	20%

7. Actual Learning Hours (based on academic semester)

No	Activity	Learning Hours
Contact Hours		
1	Lecture	45
2	Laboratory/Studio	
3	Tutorial	
4	Others (specify)	
	Total	45
Other Learning Hours*		
1	Study	90
2	Assignments	45
3	Library	45
4	Projects/Research Essays/Theses	--------
5	Others (specify)	--------
	Total	180

* The length of time that a learner takes to complete learning activities that lead to achievement of course learning outcomes, such as study time, homework assignments, projects, preparing presentations, library times

B. Course Objectives and Learning Outcomes

1. Course Description:

This course has been designed as an introduction to quantum mechanics. The student enrolled in this course should have a back-ground in analytical mechanics and classical mechanics. This course covers basic points in quantum mechanics:

- Introduce students to the basic concepts of quantum mechanics;.
- expose students to the knowledge of how build the quantum theory and development it.
- A broad and deep knowledge of quantum mechanics with mathematical analysis which forms the background for much theoretical physics.

2. Course Main Objective:

After studying this course, the student should be able to:

- Students will be able to use perturbation method for solving some problem in quantum mechanics.
- Students will be able to apply collision theory in quantum mechanics.
- Students will be able to apply quantum mechanics techniques to a variety of applied problems.
- Students will be able to organize independent study of quantum mechanics and ask for appropriate clarification.

3. Course Learning Outcomes

CLOs		Aligned PLOs
1	**Knowledge:**	
1.1	Students should be able to define the basic concepts of Quantum mechanics.	**K1**
1.2	Students should be able to state the Schrödinger equation (SE) and Heisenberg uncertainty principle.	**K2**
1.3	Students should be able to recognize formulation to the quantum theory, Eigen-value and Eigen function of the operators, operator's method, angular momentum operators and its applications.	**K3**
2	**Skills :**	
2.1	Students should be able to derive solution of the Schrödinger equation (SE).	**S3**
2.2	Students should be able to derive the formulation to the quantum theory, Eigen-value and Eigen-function of the operators, Operator's Method, Schrödinger Equation.	**S2**
2.3	Students should be able to explain the commutation relations between operators of position, momentum and angular momentum.	**S1**
2. 4	Students should be able to explain applications of the eigen-value problems and the Schrödinger equation in one dimension, as well as in three dimensions.	**S4**
3	**Competence:**	
3.1	Students should be able to use information and communication technologies to gather, interpret and communicate information and ideas.	**C1**
3.2	Students should be able to develop their self-learning skills.	**C2**
3.3	Students should be able to demonstrate the work either independently or being a part of a team.	**C4**

C. Course Content

No	List of Topics	Contact Hours
1	The old quantum theory, the base of Wilson - Summerfield and its applications, Particle duality property, the wave packet	6
2	The Schrödinger equation dependent on time and not dependent on time, measure the dynamic variable and the mean values	6
3	Applications to solve the Schrödinger equation in one dimension, as well as in three dimensions	9
4	Formulation to the quantum theory, Operator's Method, Schrödinger Equation	9
5	Angular momentum operators, and its applications	9
6	Introduction in quantum computer	6
Total		

D. Teaching and Assessment

1. Alignment of Course Learning Outcomes with Teaching Strategies and Assessment Methods

Code	Course Learning Outcomes	Teaching Strategies	Assessment Methods
1.0	**Knowledge**		
1.1	Students should be able to define the basic concepts of Quantum mechanics.	• Formal Lectures • Debate and discussion • Assignments (Co-operative & Individual assignments). Working in small groups	• Continuous evaluation through interaction, and presentation of research projects. • presentation of summaries and reports during lectures. • Evaluation of assignments. • Quiz1 & Quiz2. • Midterm exam. Final written exams.
1.2	Students should be able to state the Schrödinger equation (SE) and Heisenberg uncertainty principle.	• Formal Lectures • Debate and discussion. • Assignments (Co-operative & Individual assignments). • Working in small groups	• Continuous evaluation through interaction, and presentation of research projects. • presentation of summaries and reports during lectures. • Evaluation of assignments. • Quiz1 & Quiz2. • Midterm exam. Final written theoretical exam.
1.3	Students should be able to recognize formulation to the quantum theory, Eigen-value and Eigen function of the operators, operator's method, angular momentum operators and its applications.	• Formal Lectures • Debate and discussion. • Assignments (Co-operative & Individual assignments). • Cooperative Learning • Working in small groups Individual & group	• Continuous evaluation through interaction, and presentation of summaries and reports during lectures. • Evaluation of assignments. • Quiz1 & Quiz2.

Code	Course Learning Outcomes	Teaching Strategies	Assessment Methods
		research	• Midterm exam. Final written exams.
2.0	**Skills**		
2.1	Students should be able to derive solution of the Schrödinger equation (SE).	• Formal lectures • Debate and discussion. • Assignments (Co-operative & Individual assignments). • Cooperative Learning • Working in small groups Individual & group research	• Continuous evaluation through interaction, and presentation of research projects. • presentation of summaries and reports during lectures. • Quiz1 & Quiz2. • Midterm exam. • Final written theoretical exam. Evaluation of assignments
2.2	Students should be able to derive the formulation to the quantum theory, Eigen-value and Eigen-function of the operators, Operator's Method, Schrödinger Equation.	• Formal lectures • Debate and discussion. • Assignments (Co-operative & Individual assignments). • Cooperative Learning • Working in small groups	• Continuous evaluation through interaction, and presentation of research projects. • presentation of summaries and reports during lectures. • Evaluation of assignments. • Quiz1 & Quiz2. • Midterm exam. Final written theoretical exam.
2.3	Students should be able to explain the commutation relations between operators of position, momentum and angular momentum.	• Formal lectures • Debate and discussion. • Assignments (Co-operative & Individual assignments). • Cooperative Learning • Working in small groups Individual & group research	• Continuous evaluation through interaction, and presentation of research projects. • presentation of summaries and reports during lectures. • Evaluation of assignments. • Quiz1 & Quiz2. • Midterm exam. Final written theoretical exam.
2.4	Students should be able to explain applications of the eigen-value problems and the Schrödinger equation in one dimension, as well as in three dimensions.	• Formal lectures • Debate and discussion. • Assignments (Co-operative & Individual assignments). • Cooperative Learning • Working in small groups	• Continuous evaluation through interaction, and presentation of research projects. • presentation of summaries and reports during lectures. • Evaluation of assignments. • Quiz1 & Quiz2. • Midterm exam. Final written theoretical exam.
3.0	**Competence**		
3.1	Students should be able to use	Team work- Assignments-	• Evaluation of

Code	Course Learning Outcomes	Teaching Strategies	Assessment Methods
	information and communication technologies to gather, interpret and communicate information and ideas.	student presentation- reporting- Training on exercises solving Cooperative Learning.	individual & group works. Observation Card
3.2	Students should be able to develop their self-learning skills.	• Working in small groups Individual & group research	• Evaluation of individual & group works. Observation Card
3.2	Students should be able to demonstrate the work either independently or being a part of a team.	• Team work • small groups and the distribution of roles. • PowerPoint presentation. Writing reports	Oral discussion Report evaluation

2. Assessment Tasks for Students

#	Assessment task*	Week Due	Percentage of Total Assessment Score
1	Quiz 1	5	10
2	Midterm Written Theoretical Exam	9	20
3	Quiz2	13	10
4	Assignments, Activities & Attendance	During Semester	10
5	Final Practical Exam		
6	Lab Reports		
7	Final Written Theoretical Exam	17	50

***Assessment task** (i.e., written test, oral test, oral presentation, group project, essay, etc.)

E. Student Academic Counseling and Support

Arrangements for availability of faculty and teaching staff for individual student consultations and academic advice :

In addition to lectures, there are two ways to reach the faculty members:

1- **Office hours:** faculty members assign minimum 6 office hours per week for student consultations and academic advice. The consultation time is mentioned in the faculty members' timetable and is display on the faculty member's office door.

2- **Email:** Students may also reach the faculty members through emails, which should be written in the syllabus of the course.

Each faculty member is assigned to a group of students as an academic advisor in order to:

1- review and approve his/her students' registration forms during the registration week.

2- follow-up his/her students' academic progress.

F. Learning Resources and Facilities

1.Learning Resources

Required Textbooks	• Introductory Quantum Mechanics By R. Liboff, 4th Edition (2002), Addison Wesley. • R. R. Puri , Mathematical methods of Quantum Optics, - Berlin: Springer (2001). • A First course in Quantum Mechanics, By H. Clark (1974).

Essential References Materials	Non
Electronic Materials	• https://en.wikipedia.org/wiki/Quantum Mechanics **The BU's Learning Management System (Rafid)**
Other Learning Materials	computer-based programs/CD, professional standards or regulations and software.

2. Facilities Required

Item	Resources
Accommodation (Classrooms, laboratories, demonstration rooms/labs, etc.)	**Classrooms equipped with smart board and display screen for (30-40) students**
Technology Resources (AV, data show, Smart Board, software, etc.)	**Provision of computers for students training to be used in research on scientific topics that serve the course.**
Other Resources (Specify, e.g. if specific laboratory equipment is required, list requirements or attach a list)	-------

G. Course Quality Evaluation

Evaluation Areas/Issues	Evaluators	Evaluation Methods
Extent of achievement of course learning outcomes	**The teacher using an excel program that measure CLO's**	**Direct**
Quality of learning resources	**Students and Program Leaders**	**Direct**

Evaluation areas (e.g., Effectiveness of teaching and assessment, Extent of achievement of course learning outcomes, Quality of learning resources, etc.)
Evaluators (Students, Faculty, Program Leaders, Peer Reviewer, Others (specify)
Assessment Methods (Direct, Indirect)

H. Specification Approval Data

Council / Committee	**1-Prof. Dr. Hosny A Hessian** **2-**
Reference No.	
Date	

Course Specifications

Course Title:	Fuzzy Mathematics(Elective Course (2))
Course Code:	42041428
Program:	B. Sc in Mathematics
Department:	Department of Mathematics
College:	Faculty of Science and Arts in Qilawah
Institution:	AlBaha University

Table of Contents

A. Course Identification

1. Credit hours:	**3 Hours (Lecture)**
2. Course type	
a.	University ☐ College ☐ Department ☑ Others ☐
b.	Required ☐ Elective ☑
3. Level/year at which this course is offered:	**Level: 8 / year: 4**
4. Pre-requisites for this course (if any)**:**	**Fundamentals of Mathematics (42041221)**
5. Co-requisites for this course (if any)**:**	**Non**

6. Mode of Instruction (mark all that apply)

No	Mode of Instruction	Contact Hours	Percentage
1	**Traditional classroom**	√	**70%**
2	**Blended**	√	**5%**
3	**E-learning**	√	**5%**
4	**Correspondence**		
5	**Other**	√	**20%**

7. Actual Learning Hours (based on academic semester)

No	Activity	Learning Hours
Contact Hours		
1	**Lecture**	**45**
2	**Laboratory/Studio**	
3	**Tutorial**	
4	**Others** (specify)	
	Total	**45**
Other Learning Hours*		
1	**Study**	**90**
2	**Assignments**	**45**
3	**Library**	**45**
4	**Projects/Research Essays/Theses**	--------
5	**Others** (specify)	--------
	Total	**180**

* The length of time that a learner takes to complete learning activities that lead to achievement of course learning outcomes, such as study time, homework assignments, projects, preparing presentations, library times

B. Course Objectives and Learning Outcomes

1. Course Description

This course introduces fuzzy mathematics. The student enrolled in this course should have a background in set theory. It also deals with subjects such as the basic concepts of fuzzy mathematics: fuzzy sets theory, crisp and non-crisp sets, fuzzy membership function, Geographic representation of fuzzy sets, small and prime numbers, operation on fuzzy sets and its related properties, fuzzy relation, forming fuzzy relation, membership matrix, Graphical form, Membership matrix, Graphical form, Projections of Fuzzy Relations, first, second and global, Max-Min and Min-Max compositions, equivalence fuzzy relation.

2. Course Main Objective

The objectives of this course are four:

- To explore the foundations of fuzzy mathematics at a level and depth appropriate for someone aspiring to study higher-level mathematics and/or to become a professional mathematician.
- To present an introduction to the field of fuzzy mathematics, with emphasis on those aspects of the subject that are basic to higher mathematics.
- To introduce the student to what it means to do mathematics, as opposed to learning about mathematics or to learning to do computational exercises.
- To help the student learn how to write mathematical text according to the standards of the profession.

3. Course Learning Outcomes

CLOs		Aligned PLOs
1	**Knowledge:**	
1.1	Students should be able to define the basic concepts of fuzzy mathematics.	K1
1.2	Students should be able to state the fundamental theorems of fuzzy mathematics.	K2
1.3	Students should be able to recognize classical sets theory, fuzzy sets theory, crisp and non-crisp sets, fuzzy membership, graphic interpretation of fuzzy sets, small and prime numbers, universal, finite, infinite, empty space.	K3
2	**Skills:**	
2.1	Students should be able to solve mathematical problems by using fuzzy operation such as union, intersection, difference of fuzzy sets and their properties.	S3
2.2	Students should be able to construct the proofs of the main theorems and key results of fuzzy sets theory.	S2
2.3	Students should be able to apply fuzzy sets and fuzzy relation and their theorems in solving mathematical problems.	S1
2.4	Students should be able to interpret different mathematical ideas or relationships into mathematical representation such as ordinary relation, equivalence relation, composition, fuzzy relation, forming fuzzy relation, projection of fuzzy relation, first and second (global) max-min compositions, equivalence fuzzy relation.	S4
3	**Competence:**	
3.1	Students should be able to use information and communication technologies to gather, interpret and communicate information and ideas.	**C1**
3.2	Students should be able to develop their self-learning skills.	**C2**
3.3	Students should be able to demonstrate the work either independently or being a part of a team.	**C4**

C. Course Content

No	List of Topics	Contact Hours
1	Introduction to classical sets theory, fuzzy sets theory, crisp and non-crisp sets.	**9**
2	Fuzzy membership, graphic interpretation of fuzzy sets	**9**

3	Small and prime numbers, universal, finite, infinite, empty space.	**6**
4	Fuzzy operation, union, intersection, difference of fuzzy sets and their properties.	**9**
5	Ordinary relation, equivalence relation, composition, fuzzy relation, forming fuzzy relation, membership matrix, graphical form	**6**
6	Projection of fuzzy relation, first, second and global max-min and max-min compositions, equivalence fuzzy relation.	**6**
Total		**45**

D. Teaching and Assessment

1. Alignment of Course Learning Outcomes with Teaching Strategies and Assessment Methods

Code	Course Learning Outcomes	Teaching Strategies	Assessment Methods
1.0	**Knowledge**		
1.1	Students should be able to define the basic concepts of fuzzy mathematics.	• Lectures • Debate and discussion • Assignments (Co-operative & Individual assignments). Working in small groups	• Continuous evaluation through interaction, and presentation of summaries and reports during lectures. • Evaluation of assignments. • Quiz1 & Quiz2. • Midterm exam. Final written exams.
1.2	Students should be able to state the fundamental theorems of fuzzy mathematics.	• Lectures • PowerPoint presentation • Debate and discussion. • Assignments (Co-operative & Individual assignments). • Cooperative Learning • Working in small groups Individual & group research	• Continuous evaluation through interaction, and presentation of summaries and reports during lectures. • Evaluation of assignments. • Quiz1 & Quiz2. • Midterm exam. Final written exam.
1.3	Students should be able to recognize classical sets theory, fuzzy sets theory, crisp and non-crisp sets, fuzzy membership, graphic interpretation of fuzzy sets, small and prime numbers, universal, finite, infinite, empty space.	• Lectures • PowerPoint presentation • Debate and discussion. • Assignments (Co-operative & Individual assignments). • Cooperative Learning • Working in small groups Individual & group research	• Continuous evaluation through interaction, and presentation of summaries and reports during lectures. • Evaluation of assignments. • Quiz1 & Quiz2. • Midterm exam. Final written exams.
2.0	Skills		
2.1	Students should be able to solve mathematical problems by using fuzzy operation such as union, intersection, difference of fuzzy sets and their properties.	• Lectures • Debate and discussion. • Assignments (Co-operative & Individual assignments). • Cooperative Learning • Working in small groups	• Continuous evaluation through interaction, and presentation of summaries and reports during lectures. • Quiz1 & Quiz2. • Midterm exam.

Code	Course Learning Outcomes	Teaching Strategies	Assessment Methods
		Individual & group research	• Final written exam. Evaluation of assignments
2.2	Students should be able to construct the proofs of the main theorems and key results of fuzzy sets theory.	• Lectures • Debate and discussion. • Assignments (Co-operative & Individual assignments). • Cooperative Learning • Working in small groups Individual & group research	• Continuous evaluation through interaction, and presentation of summaries and reports during lectures. • Evaluation of assignments. • Quiz1 & Quiz2. • Midterm exam. Final written exam.
2.3	Students should be able to apply fuzzy sets and fuzzy relation and their theorems in solving mathematical problems.	• Lectures • PowerPoint presentation • Debate and discussion. • Assignments (Co-operative & Individual assignments). • Cooperative Learning • Working in small groups Individual & group research	• Continuous evaluation through interaction, and presentation of summaries and reports during lectures. • Evaluation of assignments. • Quiz1 & Quiz2. • Midterm exam. Final written exams.
2.4	Students should be able to interpret different mathematical ideas or relationships into mathematical representation such as ordinary relation, equivalence relation, composition, fuzzy relation, forming fuzzy relation, projection of fuzzy relation, first and second (global) max-min compositions, equivalence fuzzy relation.	• Lectures • PowerPoint presentation • Debate and discussion. • Assignments (Co-operative & Individual assignments). • Cooperative Learning • Working in small groups Individual & group research	• Continuous evaluation through interaction, and presentation of summaries and reports during lectures. • Evaluation of assignments. • Quiz1 & Quiz2. • Midterm exam. Final written exams.
3.0	**Competence**		
3.1	Students should be able to use information and communication technologies to gather, interpret and communicate information and ideas.	Team work- Assignments-student presentation-reporting- Scientific media Co-operative & Individual assignments. Cooperative Learning.	• Evaluation of individual & group works. Observation Card
3.2	Students should be able to develop their self-learning skills.	• Working in small groups Group research	Evaluation of individual & group works.
3.3	Students should be able to demonstrate the work either independently or being a part of a team.	• Team work • small groups and the distribution of roles. • PowerPoint presentation. Writing reports	Oral discussion Report evaluation

2. Assessment Tasks for Students

#	Assessment task*	Week Due	Percentage of Total Assessment Score

#	Assessment task*	Week Due	Percentage of Total Assessment Score
1	Quiz 1	5	10
2	Midterm Written Theoretical Exam	9	20
3	Quiz2	13	10
4	Assignments, Activities & Attendance	During Semester	10
5	Final Practical Exam	-	-
6	Lab Reports	-	-
7	Final Written Theoretical Exam	17	50

***Assessment task** (i.e., written test, oral test, oral presentation, group project, essay, etc.)

E. Student Academic Counseling and Support

Arrangements for availability of faculty and teaching staff for individual student consultations and academic advice:

In addition to lectures, there are two ways to reach the faculty members:

1- **Office hours:** faculty members assign minimum 6 office hours per week for student consultations and academic advice. The consultation time is mentioned in the faculty members' timetable and is display on the faculty member's office door.

2- **Email:** Students may also reach the faculty members through emails, which should be written in the syllabus of the course.

Each faculty member is assigned to a group of students as an academic advisor in order to:

1- review and approve his/her students' registration forms during the registration week.

2- follow-up his/her students' academic progress.

F. Learning Resources and Facilities

1.Learning Resources

Required Textbooks	• Fuzzy sets and fuzzy logic, theory and applications, by George J. Kilr, Boyon. • N.R. Vemuri, A.S. Hareesh, M.S. Srinath: Set Difference and Symmetric Difference of Fuzzy Sets, in: Fuzzy Sets Theory and Applications 2014, Liptovský Ján, Slovak Republic
Essential References Materials	• D. Dubois and H. Prade (1988) Fuzzy Sets and Systems. Academic Press, New York.
Electronic Materials	• https://en.wikipedia.org/wiki/Fuzzy_set • The BU's Learning Management System (**Rafid**).
Other Learning Materials	----------

2. Facilities Required

Item	Resources
Accommodation (Classrooms, laboratories, demonstration rooms/labs, etc.)	Classrooms equipped with smart board and display screen for (40) students
Technology Resources (AV, data show, Smart Board, software, etc.)	Provision of computers for students training to be used in research on scientific topics that serve the course.
Other Resources (Specify, e.g. if specific laboratory equipment is required, list requirements or attach a list)	-------

G. Course Quality Evaluation

Evaluation Areas/Issues	Evaluators	Evaluation Methods
Extent of achievement of course learning outcomes	The teacher using an excel program that measure CLO's	Direct
Quality of learning resources	Students and Program Leaders	Direct

Evaluation areas (e.g., Effectiveness of teaching and assessment, Extent of achievement of course learning outcomes, Quality of learning resources, etc.)
Evaluators (Students, Faculty, Program Leaders, Peer Reviewer, Others (specify)
Assessment Methods (Direct, Indirect)

H. Specification Approval Data

Council / Committee	1- Dr/ 2- Dr/ 3- Dr/
Reference No.	
Date	

Course Specifications

Course Title:	Research Project
Course Code:	42041426
Program:	B. Sc in Mathematics
Department:	Department of Mathematics
College:	Faculty of Science and Arts in Qilawah
Institution:	AlBaha University

Table of Contents

A. Course Identification

1. Credit hours: 3 H
2. Course type **a.** University ☐ College ☐ Department ☑ Others ☐ **b.** Required ☑ Elective ☐
3. Level/year at which this course is offered: : Leve 8/ Fourth Year
4. Pre-requisites for this course (if any)**:** **Completion of 100 credit Units**
5. Co-requisites for this course (if any)**:** Non

6. Mode of Instruction (mark all that apply)

No	Mode of Instruction	Contact Hours	Percentage
1	**Traditional classroom**	√	30%
2	**Blended**	√	20%
3	**E-learning**	√	30%
4	**Correspondence**	√	
5	**Other**	√	20%

7. Actual Learning Hours (based on academic semester)

No	Activity	Learning Hours
Contact Hours		
1	**Lecture**	45
2	**Laboratory/Studio**	
3	**Tutorial**	
4	**Others** (specify)	
	Total	
Other Learning Hours*		
1	**Study**	90
2	**Assignments**	45
3	**Library**	45
4	**Projects/Research Essays/Theses**	90
5	**Others** (specify)	
	Total	270

* The length of time that a learner takes to complete learning activities that lead to achievement of course learning outcomes, such as study time, homework assignments, projects, preparing presentations, library times

B. Course Objectives and Learning Outcomes

1. Course Description

2. Course Main Objective

- To learn the students to the research concept in mathematics.
- Training students to apply what he learned during his studies.
- Train students in a spirit of cooperation through the work of research groups to

configure.

- Provide students with some of the Problems and how to formulate mathematically.
- Provide students with rules known methodology for the preparation of scientific research.
- Training on various aspects of the preparation of the search.

Training in scientific writing

3. Course Learning Outcomes

CLOs		Aligned PLOs
1	**Knowledge:**	
1.1	state the principles of Research and writing article.	1.2
1.2	Acquire the basic concepts of the principles of scientific research.	1.1
1.3	Using the principles of scientific research of the preparation and implementation	
2	**Skills :**	
2.1	Ability of the student to search and learn scientific terms	
2.2	Planning for the application by using the mathematical approach	
2.3	The ability to collect and arrange information and display to solve problems The ability to comparison and analysis of mathematical results	
2.4	Using the means of illustrations, whether with computer or models	
2.5	Solve problems related to mathematics.	
3	**Competence:**	
3.1	Possesses self-learning skills and responsibilities	
3.2	Cooperation with colleagues more effectively to development team spirit.	
3.3	Communicate effectively in written and oral presentation.	
3.4	Use of information technology and resources.	

C. Course Content

No	List of Topics	Contact Hours
1	The subject of search must be approved by the department before submission to the student - the division of students to groups and distribution of each group for member of department staff.	1.5
2	Conceptual approach to the methods of scientific writing and the research methodology and documentation.	4.5
3	Preparation stages of research (identify topic - the development plan - article collection - the use of cards - etc.)	27
4	Techniques of scientific writing.	6
5	Setting search and take it out.	3
6	Scientific discussion.	3
Total		

D. Teaching and Assessment

1. Alignment of Course Learning Outcomes with Teaching Strategies and Assessment Methods

Code	Course Learning Outcomes	Teaching Strategies	Assessment Methods
1.0	**Knowledge**		
1.1	state the principles of Research and writing article.	• Lectures • Debate and discussion • Assignments (Co-operative & Individual assignments). Working in small groups	• Continuous evaluation through interaction, and presentation of summaries and reports during lectures. • Evaluation of assignments. • Final exams.
1.2	Acquire the basic concepts of the principles of scientific research.	• Lectures • PowerPoint presentation • Debate and discussion. • Assignments (Co-operative & Individual assignments). • Cooperative Learning • Working in small groups Individual & group research	• Continuous evaluation through interaction, and presentation of summaries and reports during lectures. • Evaluation of assignments. • Final written exam.
1.3	Using the principles of scientific research of the preparation and implementation	• Lectures • Debate and discussion • Assignments (Co-operative & Individual assignments). Working in small groups	• Continuous evaluation through interaction, and presentation of summaries and reports during lectures. • Evaluation of assignments. • Final exams.
2.0	**Skills**		
2.1	Ability of the student to search and learn scientific terms	• Lectures • Debate and discussion. • Assignments (Co-operative & Individual assignments). • Cooperative Learning • Working in small groups Individual & group research	• Continuous evaluation through interaction, and presentation of summaries and reports during lectures. • Final exam. • Evaluation of assignments
2.2	Planning for the application by using the mathematical approach	• Lectures • Debate and discussion. • Assignments (Co-operative & Individual assignments). • Cooperative Learning • Working in small groups Individual & group research	• Continuous evaluation through interaction, and presentation of summaries and reports during lectures. • Evaluation of assignments. • Final exam.
2.3	The ability to collect and arrange	• Lectures	• Continuous evaluation

Code	Course Learning Outcomes	Teaching Strategies	Assessment Methods
	information and display to solve problems The ability to comparison and analysis of mathematical results	• PowerPoint presentation • Debate and discussion. • Assignments (Co-operative & Individual assignments). • Cooperative Learning • Working in small groups Individual & group research	through interaction, and presentation of summaries and reports during lectures. • Evaluation of assignments. • Final exams.
2.4	Using the means of illustrations, whether with computer or models	• Lectures • PowerPoint presentation • Debate and discussion. • Assignments (Co-operative & Individual assignments). • Cooperative Learning • Working in small groups Individual & group research	• Continuous evaluation through interaction, and presentation of summaries and reports during lectures. • Evaluation of assignments. • Final exams.
2.5	Solve problems related to mathematics.	• Lectures • PowerPoint presentation • Debate and discussion. • Assignments (Co-operative & Individual assignments). • Cooperative Learning • Working in small groups Individual & group research	• Continuous evaluation through interaction, and presentation of summaries and reports during lectures. • Evaluation of assignments. • Final exams.
3.0	**Competence**		
3.1	Possesses self-learning skills and responsibilities	Team work- Assignments- student presentation- reporting- Scientific media Co-operative & Individual assignments. Cooperative Learning.	• Evaluation of individual & group works. Observation Card
3.2	Cooperation with colleagues more effectively to development team spirit.	• Working in small groups Group research	Evaluation of individual & group works.
3.3	Communicate effectively in written and oral presentation.	• Team work • small groups and the distribution of roles. • PowerPoint presentation. Writing reports	Oral discussion Report evaluation
3.4	Use of information technology and resources.	• small groups and the distribution of roles. • PowerPoint presentation. Writing reports	Oral discussion Report evaluation

2. Assessment Tasks for Students

#	Assessment task*	Week Due	Percentage of Total Assessment Score

#	Assessment task*	Week Due	Percentage of Total Assessment Score
1	Quiz 1	-	-
2	Midterm Written Theoretical Exam	-	-
3	Quiz2	-	-
4	Assignments, Activities & Attendance	During Semester	50
5	Final Practical Exam	-	-
6	Lab Reports	-	-
7	Be evaluated student performance in this decision, through a panel discussion posed department, comprising two members (Professor supervisor, and another member) to read the research and discuss its owner in the various methodological and scientific aspects, in accordance with the standards identified in the model special calendar that is supported by the department for this purpose.	17	50
8			

***Assessment task** (i.e., written test, oral test, oral presentation, group project, essay, etc.)

E. Student Academic Counseling and Support

Arrangements for availability of faculty and teaching staff for individual student consultations and academic advice :

- The presence of faculty members to provide advice, academic advice and academic guidance to the student in need within the six hours a week available to all students.
- Arrange extra hours gifted students or Program for students who default in scholastic achievement

F. Learning Resources and Facilities

1.Learning Resources

Required Textbooks	- Set of books and references by the course instructor and by the subject, as selected search. - Student learns how to obtain the appropriate reference of the research topic from the library.
Essential References Materials	- Library. - Internet
Electronic Materials	***http://www.google.com*.** **Students can search through the Internet on topics scheduled**
Other Learning Materials	**CD-ROM containing the scientific subjects in the course**

2. Facilities Required

Item	Resources
Accommodation (Classrooms, laboratories, demonstration rooms/labs, etc.)	Classrooms equipped with smart board and display screen for (40) students

Item	Resources
Technology Resources (AV, data show, Smart Board, software, etc.)	Provision of computers for students training to be used in research on scientific topics that serve the course.
Other Resources (Specify, e.g. if specific laboratory equipment is required, list requirements or attach a list)	----------

G. Course Quality Evaluation

Evaluation Areas/Issues	Evaluators	Evaluation Methods
Extent of achievement of course learning outcomes	The teacher using an excel program that measure CLO's	Direct
Quality of learning resources	Students and Program Leaders	Direct

Evaluation areas (e.g., Effectiveness of teaching and assessment, Extent of achievement of course learning outcomes, Quality of learning resources, etc.)
Evaluators (Students, Faculty, Program Leaders, Peer Reviewer, Others (specify)
Assessment Methods (Direct, Indirect)

H. Specification Approval Data

Council / Committee	
Reference No.	
Date	