# Course Specifications

| | |
|---|---|
| **Course Title:** | Abstract Algebra ( 1) |
| **Course Code:** | 42041315 |
| **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: 5 / year: 3** |
| **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** | √ | 75% |
| 2 | **Blended** | √ | 10% |
| 3 | **E-learning** | √ | 15% |
| 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** | 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**

To be familiar with the main properties of groups, group homomorphisms, simple groups, permutation groups, a group of action on a set, p-groups, Cauchy's theorem, Sylow theorems, external and internal direct products of groups, dihedral groups, quaternions, and groups of automorphisms of cyclic groups.

**2. Course Main Objective**

**3. Course Learning Outcomes**

| | CLOs | Aligned PLOs |
|---|---|---|
| 1 | **Knowledge:** | |

| CLOs | | Aligned PLOs |
|---|---|---|
| 1.1 | Define: Binary operation -semigroup, monoid, group, order of a group $G$, order of an element $a \in G$, abelian groups, cyclic group, normal subgroup, permutation groups, dihedral groups, symmetric group, quaternions, p-groups, simple groups, a group homomorphism, kernel of a homomorphism, a group isomorphism, automorphism, and external and internal direct product of groups | |
| 1.2 | State the fundamental theorem of homomorphism, Lagrange theorem, Cayley's theorem, Sylow theorems, Cauchy's Theorem, and Other related theorems. | |
| 1.3 | Draw the subgroup diagrams | |
| **2** | **Skills :** | |
| 2.1 | Verify axioms of, groups, subgroups, homomorphisms, isomorphisms, abelian groups, cyclic groups, normal subgroups, and quotient groups, in examples. | |
| 2.2 | Derive the proofs of main theorems and key results of groups. | |
| 2.3 | Apply Lagrange's theorem, the isomorphism theorems, Sylow theorems, and Cayley's theorem. | |
| 2.4 | Demonstrate knowledge of external and internal direct products of groups and groups of automorphisms of cyclic groups. | |
| 2.5 | Compute all subgroups, all cosets, the order, and the index, of a given group, the order of an element, kernel of a homomorphism, groups of automorphisms of cyclic groups, tables of Klein four group, permutations groups, $\mathbb{Z}_n$, and other groups. | |
| **3** | **Competence:** | |
| 3.1 | Take responsibility for own learning and professional development | |
| 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. | |

## C. Course Content

| No | List of Topics | Contact Hours |
|---|---|---|
| 1 | Properties of Integers - Modular Arithmetic - Complex Numbers - Equivalence Relations - Functions (Mappings) | 3 |
| 2 | Definition of Groups - Abelian Group - Examples - Uniqueness of the Identity and the inverses - Cancellation theorem - The group $D_4$ (The symmetric of square) | 6 |
| 3 | Order of a Group and an Element – Subgroup - One-Step Subgroup Test - Finite Subgroup Test – the Subgroup $< a >$ - Center of a Group. | 9 |
| 4 | Definition and Examples of cyclic Groups - Theorem of Criterion for $a^i = a^j$ and some Corollaries - Orders of Elements in Finite Cyclic Groups, - Generators of Finite Cyclic Group - Generators of $\mathbb{Z}_n$ - Subgroups of $Z_n$ - Number of Elements of Each Order in a Cyclic Group | 9 |
| 5 | Permutation Group and Examples - Group Isomorphism and Examples – Cosets and examples - Properties of Cosets - Lagrange's Theorem - External Direct Product and Examples - Normal Subgroup - Normal | 9 |

| | | |
|---|---|---|
| | Subgroup Test and Examples - kernel of a group homomorphism and examples. | |
| 6 | Cayley's theorem, Sylow theorems, Cauchy's Theorem, and Other related theorems. | 9 |
| **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 | Define: Binary operation -semigroup, monoid, group, order of a group $G$, order of an element $a \in G$, abelian groups, cyclic group, normal subgroup, permutation groups, dihedral groups, symmetric group, quaternions, p-groups, simple groups, a group homomorphism, kernel of a homomorphism, a group isomorphism, automorphism, and external and internal direct product of groups | • Lectures<br>• Debate and discussion<br>• Assignments (Co-operative & Individual assignments).<br>Working in small groups | • Continuous evaluation through interaction, and presentation of summaries and reports during lectures.<br>• Evaluation of assignments.<br>• Quiz1 & Quiz2.<br>• Midterm exam.<br>Final written exams. |
| 1.2 | State the fundamental theorem of homomorphism, Lagrange theorem, Cayley's theorem, Sylow theorems, Cauchy's<br>Theorem, and Other related theorems. | • Lectures<br>• PowerPoint presentation<br>• Debate and discussion.<br>• Assignments (Co-operative & Individual assignments).<br>• Cooperative Learning<br>• Working in small groups<br>Individual & group research | • Continuous evaluation through interaction, and presentation of summaries and reports during lectures.<br>• Evaluation of assignments.<br>• Quiz1 & Quiz2.<br>• Midterm exam.<br>Final written exam. |
| 1.3 | Draw the subgroup diagrams | • Lectures<br>• PowerPoint presentation<br>• Debate and discussion.<br>• Assignments (Co-operative & Individual assignments).<br>• Cooperative Learning<br>• Working in small groups<br>Individual & group research | • Continuous evaluation through interaction, and presentation of summaries and reports during lectures.<br>• Evaluation of assignments.<br>• Quiz1 & Quiz2.<br>• Midterm exam.<br>Final written exams. |

| Code | Course Learning Outcomes | Teaching Strategies | Assessment Methods |
|---|---|---|---|
| **2.0** | **Skills** | | |
| 2.1 | Verify axioms of, groups, subgroups, homomorphisms, isomorphisms, abelian groups, cyclic groups, normal subgroups, and quotient groups, in examples. | • Lectures<br>• Debate and discussion.<br>• Assignments (Co-operative & Individual assignments).<br>• Cooperative Learning<br>• Working in small groups<br>Individual & group research | • Continuous evaluation through interaction, and presentation of summaries and reports during lectures.<br>• Quiz1 & Quiz2.<br>• Midterm exam.<br>• Final written exam.<br>Evaluation of assignments |
| 2.2 | Derive the proofs of main theorems and key results of groups. | • Lectures<br>• Debate and discussion.<br>• Assignments (Co-operative & Individual assignments).<br>• Cooperative Learning<br>• Working in small groups<br>Individual & group research | • Continuous evaluation through interaction, and presentation of summaries and reports during lectures.<br>• Evaluation of assignments.<br>• Quiz1 & Quiz2.<br>• Midterm exam.<br>Final written exam. |
| 2.3 | Apply Lagrange's theorem, the isomorphism theorems, Sylow theorems, and Cayley's theorem. | • Lectures<br>• PowerPoint presentation<br>• Debate and discussion.<br>• Assignments (Co-operative & Individual assignments).<br>• Cooperative Learning<br>• Working in small groups<br>Individual & group research | • Continuous evaluation through interaction, and presentation of summaries and reports during lectures.<br>• Evaluation of assignments.<br>• Quiz1 & Quiz2.<br>• Midterm exam.<br>Final written exams. |
| 2.4 | Demonstrate knowledge of external and internal direct products of groups and groups of automorphisms of cyclic groups. | • Lectures<br>• PowerPoint presentation<br>• Debate and discussion.<br>• Assignments (Co-operative & Individual assignments).<br>• Cooperative Learning<br>• Working in small groups<br>Individual & group research | • Continuous evaluation through interaction, and presentation of summaries and reports during lectures.<br>• Evaluation of assignments.<br>• Quiz1 & Quiz2. |

| Code | Course Learning Outcomes | Teaching Strategies | Assessment Methods |
|---|---|---|---|
| | | | • Midterm exam.<br>Final written exams. |
| 2.5 | Compute all subgroups, all cosets, the order, and the index, of a given group, the order of an element, kernel of a homomorphism, groups of automorphisms of cyclic groups, tables of Klein four group, permutations groups, $\mathbb{Z}_n$, and other groups. | • Lectures<br>• PowerPoint presentation<br>• Debate and discussion.<br>• Assignments (Co-operative & Individual assignments).<br>• Cooperative Learning<br>• Working in small groups<br>Individual & group research | • Continuous evaluation through interaction, and presentation of summaries and reports during lectures.<br>• Evaluation of assignments.<br>• Quiz1 & Quiz2.<br>• Midterm exam.<br>Final written exams. |
| **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.<br>Cooperative Learning. | • Evaluation of individual & group works.<br>Observation Card |
| 3.2 | Work effectively in groups and exercise leadership when appropriate. | • Working in small groups<br>Group research | Evaluation of individual & group works. |
| 3.3 | Present information clearly in both written and oral form. | • Team work<br>• small groups and the distribution of roles.<br>• PowerPoint presentation.<br>Writing reports | Oral discussion<br>Report evaluation |
| 3.4 | Communicates effectively in oral and written form in educational situations related to the subjects of the course. | • small groups and the distribution of roles.<br>• PowerPoint presentation.<br>Writing reports | Oral discussion<br>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 :**

- 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** | • Contemporary Abstract Algebra - Eighth Edition - Joseph A. Gallian.<br>• Group Theory - J.S. Milne<br>• Theory and Problems of ABSTRACT ALGEBRA- Second Edition - Frank Ayres, Jr., LLOYD R. JAISINGH - Schaum's Outline Series<br>• J. B. Fraleigh, A first course in abstract algebra, Addison Westley 1999.<br>• T. W. Hungerford, Abstract Algebra An Introduction. |
| **Essential References Materials** | • J. B. Fraleigh, A first course in abstract algebra, Addison Westley 1999 |
| **Electronic Materials** | • https://www.youtube.com/watch?v=fpxaZ9Pv2HM&list=PL9fwy3NUQKwZKOpj354PRgwYPWWgxchnI<br>• https://en.wikipedia.org/wiki/Abstract_algebra<br>• https://www.youtube.com/watch?v=4gVA64KlAwY&list=PLp5QO1iuiUkN7KGvBPXUX5gE04fiw5G18<br>• https://www.extension.harvard.edu/open-learning-initiative/abstract-algebra |
| **Other Learning Materials** | ---------- |

### 2. Facilities Required

| Item | Resources |
|---|---|
| **Accommodation**<br>(Classrooms, laboratories, demonstration rooms/labs, etc.) | Classrooms equipped with smart board and display screen for (40) students |
| **Technology Resources**<br>(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**<br>(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 |

| Evaluation Areas/Issues | Evaluators | Evaluation Methods |
|---|---|---|
| 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/ Ahmed Ageeb Sayed Ahmed Elokl<br>2- Dr/<br>3- Dr/ |
| **Reference No.** | |
| **Date** | |

# Course Specifications

| | |
|---|---|
| **Course Title:** | Statistical analysis |
| **Course Code:** | 42041323 |
| **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:** | **5th Level: / 3ed year:** |
| **4. Pre-requisites for this course** (if any)**:** | Principles of statistics and probability42041217 |
| **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** | √ | 5% |
| 4 | **Correspondence** | | |
| 5 | **Other** | | 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** | 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 the sampling distribution basic concepts of sampling , with a focus on random (probabilistic) sampling .

-Simple random sampling, stratified sampling, systematic sampling, cluster sampling. Non probabilistic sampling (convenience sampling, Judgmental sampling).

-Sampling distribution of sample means, sampling distribution of sample proportions. Confidence intervals of means and variances, sample size determination.

-Testing hypotheses, introduction and general concepts of the Neyman-Pearson testing hypotheses theory.

-Composite hypotheses, Student's t distribution, Goodness of fit tests, Bayesian methods. Nonparametric methods, nonparametric estimation, nonparametric testing (the sign test, rank-sum test)

### 2. Course Main Objective

- Learn students with statistical analysis skills
- Learn the organization and display of statistical analysis.
- Learn students the skills to use computer technology in statistical analysis.
- Learn basic concepts of statistical analysis that use of IT and Web based reference material.
- Learn the basics of statistical analysis in public life issues.

### 3. Course Learning Outcomes

| | CLOs | Aligned PLOs |
|---|---|---|
| | **Knowledge** | |
| | Define the related basic scientific facts, concepts, principles and techniques in statistical analysis | K1 |
| | Recognize the relevant theories and their applications in statistical analysis | K2 |
| | Recall sampling distribution, estimation and testing hypotheses in real life. | K3 |
| | **Skills** | |
| | Apply statistical tools for statistical data analysis, scientific models and tools effectively | S1 |
| | Discuss the results of statistical measures | S1 |
| | Evaluate probability of events using different rules | S3 |
| | Solve problems using a range of formats and approaches in basic science | S3 |
| | Present the data in statistical analusis.. | S4 |
| | **Competence** | |
| | Use the internet to write reports about basic statistical analysis | C1 |
| | Work effectively in groups and exercise leadership when appropriate. | C3 |
| | Present information clearly in both written and oral form. | C2 |
| | Communicates effectively in oral and written form in educational situations related to the subjects of the course. | C1 |

## C. Course Content

| No | List of Topics | Contact Hours |
|---|---|---|
| 1 | Sampling distributions: introduction random(probabilistic) sampling , simple random sampling | 3 |
| 2 | Stratified sampling, systematic sampling, cluster sampling, non-probabilistic sampling. | 6 |
| 3 | Convenience sampling, Judgmental sampling, sampling distribution. | 6 |
| 4 | Sampling distribution of sample means, sampling distribution of sample proportions. | 6 |
| 5 | Confidence intervals of means and variances, sample size determination. | 6 |
| 6 | Testing hypotheses, introduction and general concepts of the Neyman-Pearson testing hypotheses theory. | 6 |
| 7 | Composite hypotheses, Student's t distribution, Goodness of fit tests, Bayesian methods. | 6 |
| 8 | Nonparametric methods, nonparametric estimation, nonparametric testing (the sign test, rank- sum test) | 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 | Description of the knowledge to be acquired.<br>Understand the basic and principle of sampling distribution, estimation and testing hypotheses | • Lectures<br>• Debate and discussion<br>• Assignments (Co-operative & Individual assignments).<br>Working in small groups | • Continuous evaluation through interaction, and presentation of summaries and reports during lectures.<br>• Evaluation of assignments.<br>• Quiz1 & Quiz2.<br>• Midterm exam.<br>Final written exams. |
| 1.2 | Recognize the relevant theories and their applications in basic mathematics. sampling distribution, estimation and testing hypotheses | • Lectures<br>• PowerPoint presentation<br>• Debate and discussion.<br>• Assignments (Co-operative & Individual assignments).<br>• Cooperative Learning<br>• Working in small groups<br>Individual & group research | • Continuous evaluation through interaction, and presentation of summaries and reports during lectures.<br>• Evaluation of assignments.<br>• Quiz1 & Quiz2.<br>• Midterm exam.<br>Final written exam. |
| 1.3 | Recall sampling distribution, estimation and testing hypotheses | • Lectures<br>• PowerPoint presentation<br>• Debate and discussion.<br>• Assignments (Co-operative & Individual assignments).<br>• Cooperative Learning<br>• Working in small groups<br>• Individual & group research | • Continuous evaluation through interaction, and presentation of summaries and reports during lectures.<br>• Evaluation of assignments.<br>• Quiz1 & Quiz2.<br>• Midterm exam.<br>• Final written exam |

| | | | |
|---|---|---|---|
| **2.0** | **Skills** | | |
| 2.1 | Apply statistical tools for simple data analysis, scientific models and tools effectively | • Lectures<br>• Debate and discussion.<br>• Assignments (Co-operative & Individual assignments).<br>• Cooperative Learning<br>• Working in small groups<br>Individual & group research | • Continuous evaluation through interaction, and presentation of summaries and reports during lectures.<br>• Quiz1 & Quiz2.<br>• Midterm exam.<br>• Final written exam.<br>Evaluation of assignments |
| 2.2 | Solve problems using a range of formats and approaches in basic science | • Lectures<br>• Debate and discussion.<br>• Assignments (Co-operative & Individual assignments).<br>• Cooperative Learning<br>• Working in small groups<br>Individual & group research | • Continuous evaluation through interaction, and presentation of summaries and reports during lectures.<br>• Evaluation of assignments.<br>• Quiz1 & Quiz2.<br>• Midterm exam.<br>Final written exam. |
| 2.3 | Evaluate sampling distribution, estimation and testing hypotheses | • Lectures<br>• PowerPoint presentation<br>• Debate and discussion.<br>• Assignments (Co-operative & Individual assignments).<br>• Cooperative Learning<br>• Working in small groups<br>Individual & group research | • Continuous evaluation through interaction, and presentation of summaries and reports during lectures.<br>• Evaluation of assignments.<br>• Quiz1 & Quiz2.<br>• Midterm exam.<br>Final written exams. |
| **3.0** | **Competence** | | |
| 3.1 | Use the internet to write reports about basic statistical analysis. | Team work- Assignments-student presentation-reporting-Scientific media<br>Co-operative & Individual assignments.<br>Cooperative Learning. | • Evaluation of individual & group works.<br>Observation Card |
| 3.2 | Work effectively in groups and exercise leadership when appropriate. | • Working in small groups<br>Group research | Evaluation of individual & group works. |
| 3.3 | Present information clearly in both written and oral form. | • small groups and the distribution of roles.<br>• PowerPoint presentation.<br>Writing reports | Oral discussion<br>Report evaluation |

## 2. Assessment Tasks for Students

| # | Assessment task* | Week Due | Percentage of Total Assessment Score |
|---|---|---|---|
| **1** | Homework & Classwork Assignments | During the Semester | 10% |
| **2** | Quiz 1 | The 5th Week | 10% |
| **3** | Mid-Term Exam | The 9th Week | 20% |
| **4** | Quiz 2 | The 13th Week | 10% |
| **5** | The Final Examination (Written Test) | The 16-17th Week | 50% |
| | Total | | 100 |

***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 :**

- 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

| | |
|---|---|
| **Required Textbooks** | 1-Course notes<br>2-Chapters from different text books.<br>3-Walpole, R.E., Myers, R.H. and Myers, S.L. Probability and Statistics for Engineers and Scientists, 7th ed, Prentice–Hall Inc. (2012).<br>4-Bluman, A. G., "Elementary Statistics a Step by Step Approach", 6th Edition, McGraw-Hill, (2006).<br>5- Larson, R. C. and Farber, E. , " Elementary Statistics: Picturing the World", 3rd Edition, Prentice Hall, (2006). |
| **Essential References Materials** | **Lecture**<br>● Larson & Farber, "Elementary Statistics: Picturing the World", 3rd Edition (2006 |
| **Electronic Materials** | ● https://www.youtube.com/watch?v=fpxaZ9Pv2HM&list=PL9fwy3NUQKwZKOpj354PRgwYPWWgxchnI<br>● https://en.wikipedia.org/wiki/Abstract_algebra<br>● https://www.youtube.com/watch?v=4gVA64KlAwY&list=PLp5QO1iuiUkN7KGvBPXUX5gE04fiw5G18<br>● https://www.extension.harvard.edu/open-learning-initiative/abstract-algebra |
| **Other Learning Materials** | ● Microsoft Excel 2007 – 2010<br>● Minitab<br>● SPSS |

### 2. Facilities Required

| Item | Resources |
|---|---|
| **Accommodation**<br>(Classrooms, laboratories, demonstration rooms/labs, etc.) | Classrooms equipped with smart board and display screen for (40) students |
| **Technology Resources**<br>(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**<br>(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 |
| Effectiveness of teaching | Students | Indirect (Questionnaires) |

**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 / Ahmed Hamed Abd Ellah<br>2- Dr/<br>3- Dr/ |
| **Reference No.** | |
| **Date** | |

# Course Specifications

| | |
|---|---|
| **Course Title:** | Numerical Analysis |
| **Course Code:** | 42041313 |
| **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:** | Fifth Level / Third Year. |
| **4. Pre-requisites for this course** (if any)**:** | Ordinary Differential Equations (42041222) |
| **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** | 3 | 70% |
| 2 | **Blended** | | |
| 3 | **E-learning** | 2 | 30% |
| 4 | **Correspondence** | | |
| 5 | **Other** | | |

**7. Actual Learning Hours** (based on academic semester)

| No | Activity | Learning Hours |
|---|---|---|
| **Contact Hours** | | |
| 1 | **Lecture** | 45 Hours |
| 2 | **Laboratory/Studio** | 20 Hours |
| 3 | **Tutorial** | |
| 4 | **Others** (specify) | |
| | **Total** | 65 Hours |
| **Other Learning Hours*** | | |
| 1 | **Study** | 45 Hours |
| 2 | **Assignments** | 30 Hours |
| 3 | **Library** | 45 Hours |
| 4 | **Projects/Research Essays/Theses** | |
| 5 | **Others** (specify) | |
| | **Total** | 185 Hours |

* 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 the theory and application of numerical methods to approximate mathematical solutions of problems that arise in science and engineering. Topics include errors and their sources, solving non-linear equations, solving systems of linear equations, numerical interpolation, numerical differentiation and integration and solving ordinary differential equations. The used methods of instruction will be lectures, practical and tutorial sessions and assignments.

### 2. Course Main Objective

-To teach students the concepts of numerical methods or techniques for solving mathematical problems.

-To develop the fundamental understanding of numerical algorithms and skills that students will need to implement algorithms for solving mathematical problems by using computational software packages (such as MATLAB).

### 3. Course Learning Outcomes

| | CLOs | Aligned PLOs |
|---|---|---|
| 1 | **Knowledge** | |
| 1.1 | Students should be able to define significant mathematical concepts in numerical analysis. | **K1** |
| 1.2 | Students should be able to list the numerical methods for solving non-linear equations, systems of linear equations, numerical differentiation, numerical integration and ordinary differential equations. | **K2** |
| 1.3 | Students should be able to state numerical interpolation methods for solving the mathematical problems numerically. | **K2** |
| 1.4 | Students should be able to recognize numerical algorithms. | **K3** |
| **2** | **Skills** | |
| 2.1 | Students should be able to compute the errors and the rate of convergence. | **S1** |
| 2.2 | Students should be able to apply the numerical methods and algorithms for solving non-linear equations, systems of linear equations, numerical differentiation, numerical integration and ordinary differential equations. | **S3** |
| 2.3 | Students should be able to construct an interpolation polynomial using numerical interpolation methods. | **S3** |
| **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 | **Errors and their Sources** | 3 |
| 2 | **Numerical Methods for Solving Non-linear Equations**<br>- Bisection Method and its Algorithm.<br>- Newton-Raphson Method and its Algorithm.<br>- Method of False position and its Algorithm.<br>- Secant Method and its Algorithm.<br>- Rates of convergence and error estimation. | 9 |
| 3 | **Solving Systems of Linear Equations**<br>**Direct methods:**<br>- Gauss elimination method.<br>- LU decomposition method.<br>**Indirect (iterative) methods:**<br>- The Jacobi iterative method and its algorithm.<br>- The Gauss-Siedel iterative method and its algorithm. | 9 |
| 4 | **Numerical Interpolation**<br>**Interpolation and Polynomial Approximation.**<br>**Lagrange Interpolation.**<br>**Divided Difference:** | 9 |

| | | |
|---|---|---|
| | - Newton's divided difference interpolation.<br>**Finite Difference Operators:**<br>- Forward and backward difference operators.<br>- Relation between differences and derivatives.<br>- Newton's forward difference interpolation.<br>- Newton's backward difference interpolation. | |
| 5 | **Numerical Differentiation** | 3 |
| 6 | **Numerical Integration**<br>**Numerical Methods of Integration:**<br>- Newton-Cotes Closed Quadrature Formula.<br>- Trapezoidal rule.<br>Error estimate in Trapezoidal rule.<br>- Simpson's $\frac{1}{3}$ rule.<br>Error estimate in Simpson's $\frac{1}{3}$ rule.<br>- Simpson's $\frac{3}{8}$ rule.<br>Error estimate in Simpson's $\frac{3}{8}$ rule.<br>- Boole's and Weddle's rules.<br>Error estimates in Boole's and Weddle's rules. | 6 |
| 7 | **Numerical Solutions of Ordinary Differential Equations**<br>**One-Step (Single-Step) Methods:**<br>- Taylor's series method.<br>**Step-by-Step (Marching) Methods:**<br>- Euler's method.<br>- Modified Euler's method. | 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 significant mathematical concepts in numerical analysis. | Lectures. | - Homework Assignments.<br>- Written Mid-Term Examinations.<br>- Written Final Examination. |
| 1.2 | Students should be able to list the numerical methods for solving non-linear equations, systems of linear equations, numerical differentiation, numerical integration and ordinary differential equations. | - Lectures.<br>- Laboratory. | - Homework Assignments.<br>- Written Mid-Term Examinations.<br>- Written Final Examination. |
| 1.3 | Students should be able to state numerical interpolation methods for solving the mathematical problems | - Lectures.<br>- Laboratory. | - Homework Assignments.<br>- Written Mid-Term Examinations. |

| Code | Course Learning Outcomes | Teaching Strategies | Assessment Methods |
|---|---|---|---|
| | numerically. | | - Written Final Examination. |
| 1.4 | Students should be able to recognize numerical algorithms. | - Lectures.<br>- Laboratory. | - Homework Assignments.<br>- Written Mid-Term Examinations.<br>- Written Final Examination. |
| **2.0** | **Skills** | | |
| 2.1 | Students should be able to compute the errors and the rate of convergence. | - Lectures.<br>- Laboratory. | - Homework Assignments.<br>- Written Mid-Term Examinations.<br>- Written Final Examination. |
| 2.2 | Students should be able to apply the numerical methods and algorithms for solving non-linear equations, systems of linear equations, numerical differentiation, numerical integration and ordinary differential equations. | - Lectures.<br>- Laboratory. | - Homework Assignments.<br>- Written Mid-Term Examinations.<br>- Written Final Examination. |
| 2.3 | Students should be able to construct an interpolation polynomial using numerical interpolation methods. | - Lectures.<br>- Laboratory. | - Homework Assignments.<br>- Written Mid-Term Examinations.<br>- Written Final Examination. |
| **3.0** | **Competence** | | |
| 3.1 | Students should be able to use information and communication technologies to gather, interpret and communicate information and ideas. | Teaching students how to use ICT. | - Homework Assignments. |
| 3.2 | Students should be able to develop their self-learning skills. | Encouraging students to develop their self-learning skills from different learning resources such as printed book, eBook, online courses, websites, educational applications, etc. | - Homework Assignments. |
| 3.3 | Students should be able to demonstrate the work either independently or being a part of a team. | - Inspiring students to believe in themselves.<br>- Encouraging students to use cooperative learning as an educational approach. | - Homework Assignments.<br>- Group discussions in the classroom. |

### 2. Assessment Tasks for Students

| # | Assessment task* | Week Due | Percentage of Total Assessment Score |
|---|---|---|---|
| 1 | Homework Assignments | During the Semester | 10% |
| 2 | Quiz 1 | The 5th Week | 10% |
| 3 | Mid-Term Exam | The 9th Week | 20% |
| 4 | Quiz 2 | The 13th Week | 10% |
| 5 | The Final Examination (Written Test) | The 16th Week | 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** | - Richard L. Burden and J. Douglas Faires, Numerical Analysis, 9th Edition, 2010.<br>- Walter Gautschi, Numerical Analysis, Springer, 2011.<br>- Rao V. Dukkipati, Numerical Methods, New Age International Publishers, 2010. |
| **Essential References Materials** | - Richard L. Burden and J. Douglas Faires, Numerical Analysis, 9th Edition, 2010.<br>- Rao V. Dukkipati, Numerical Methods, New Age International Publishers, 2010.<br>- Lecture Notes. |
| **Electronic Materials** | The BU's Learning Management System (**Rafid**). |
| **Other Learning Materials** | |

## 2. Facilities Required

| Item | Resources |
|---|---|
| **Accommodation** (Classrooms, laboratories, demonstration rooms/labs, etc.) | - Classrooms.<br>- Laboratories. |
| **Technology Resources** (AV, data show, Smart Board, software, etc.) | - Data show.<br>- Smart or regular board.<br>- Computational software packages (such as MATLAB, Wolfram Mathematica or Maple). |
| **Other Resources** (Specify, e.g. if specific laboratory equipment is required, list requirements or attach a list) | Computer laboratory. |

# G. Course Quality Evaluation

| Evaluation Areas/Issues | Evaluators | Evaluation Methods |
|---|---|---|
| Effectiveness of teaching and assessment. | -Students.<br>-Department head. | Indirect. |
| Extent of achievement of course learning outcomes. | -Faculty.<br>-Department head. | Direct. |
| Quality of learning resources. | -Students.<br>-Department head. | 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** | Dr. Ahmad Ali Alalyani<br>Dr. Ghada Ahmed<br>Dr. Mohammad Ibrahim<br>Dr. Abdulellah Kamal |
| **Reference No.** | |
| **Date** | |

# Course Specifications

| | |
|---|---|
| **Course Title:** | Partial Differential Equations |
| **Course Code:** | 42041317 |
| **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 | |
| **2. Course type** | |
| **a.** University ☐ College ☐ Department ☑ Others ☑ | |
| **b.** Required ☑ Elective ☐ | |
| **3. Level/year at which this course is offered: Level 5/ Third year** | |
| **4. Pre-requisites for this course** (if any)**:** Ordinary Differential Equations (42041222) | |
| **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** | 3 | 70% |
| 2 | **Blended** | | |
| 3 | **E-learning** | 2 | 30% |
| 4 | **Correspondence** | | |
| 5 | **Other** | | |

**7. Actual Learning Hours** (based on academic semester)

| No | Activity | Learning Hours |
|---|---|---|
| **Contact Hours** | | |
| 1 | **Lecture** | 45 Hours |
| 2 | **Laboratory/Studio** | |
| 3 | **Tutorial** | |
| 4 | **Others** (specify) | |
| | **Total** | |
| **Other Learning Hours*** | | |
| 1 | **Study** | 45 Hours |
| 2 | **Assignments** | 15 Hours |
| 3 | **Library** | 30 Hours |
| 4 | **Projects/Research Essays/Theses** | |
| 5 | **Others** (specify) | |
| | **Total** | 135 Hours |

* 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 deals with the definitions and concepts of partial differential equations (PDEs) and their relation to other sciences and how they are formed. Different types of PDEs are solved using different methods. Some examples of PDEs are well studied such as the Heat equation, the Wave equation and the Laplace equation.

**2. Course Main Objective:**

- Students should be able to understand the concept of Partial Differential Equations.
- Students should be able to solve various types of Partial Differential Equations.
- Be able to recognize the main applications of Partial Differential Equations.

### 3. Course Learning Outcomes

| CLOs | | Aligned PLOs |
|---|---|---|
| 1 | **Knowledge:** | |
| 1.1 | Students should be able to recognize the types of PDEs and classify them by order, linearity and homogeneity. | K1 |
| 1.2 | Students should be able to describe the concepts of PDEs, their solutions and applications. | K2 |
| 1.3 | Students should be able to distinguish second order PDEs as elliptic, parabolic and hyperbolic. | K3 |
| **2** | **Skills :** | |
| 2.1 | Students should be able to apply suitable methods for solving first, second and higher order PDE. | S1 |
| 2.2 | Students should be able to form PDEs by elimination of constants or arbitrary functions. | S2 |
| 2.3 | Students should be able to solve Laplace, Wave and Heat equations. | S3 |
| **3** | Competence: | |
| 3.1 | Students should be able to use information and communication technologies to collect, interpret and analyze information. | 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 | Review of partial derivatives and integrations | 3 |
| 2 | Introduction to PDE (Definition, classification, formation and solutions) | 6 |
| 3 | Solving linear first order PDE: Lagrange's Method, | 6 |
| 4 | Solving non-linear first order PDE : Charpit and Jacobi Method. | 6 |
| 5 | Solving PDE by using direct integration. | 6 |
| 6 | Solving PDE by using the separation of variables. Applications: The Heat equation, the Wave equation and the Laplace equation. | 6 |
| 7 | Second order PDE: Classifications (hyperbolic, parabolic, elliptic). | 3 |
| 8 | Solving homogeneous linear PDE with constant coefficients: The complementary function and the particular integral. | 6 |
| 9 | Solving non-homogeneous linear PDE with constant coefficients. | 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 | Students should be able to recognize the types of PDEs and classify them by order, linearity and homogeneity. | -Looking for an exciting entrance to every lesson | -Homework, Assignments<br>-Periodic Exam |

| Code | Course Learning Outcomes | Teaching Strategies | Assessment Methods |
|---|---|---|---|
| 1.2 | Students should be able to describe the concepts of PDEs, their solutions and applications. | (Question, Mistake, Object…)<br>-Provide positive feedback for class participation to encourage this activity throughout the semester. | -Mid-term Exam<br>-Final Exam |
| 1.3 | Students should be able to distinguish second order PDEs as elliptic, parabolic and hyperbolic. | | |
| **2.0** | **Skills** | | |
| 2.1 | Students should be able to apply suitable methods for solving first, second and higher order PDE. | -Provide more examples to clarify all difficulties.<br>-Engage students in discussion with questions and answers<br>-Work in classroom group.<br>-Encourage students to make presentations in the classroom. | -Homework, Assignments<br>-Mid-Term Exam 1<br>-Mid-Term Exam 2<br>-Final Exam |
| 2.2 | Students should be able to form PDEs by elimination of constants or arbitrary functions. | | |
| 2.3 | Students should be able to solve Laplace, Wave and Heat equations. | | |
| **3.0** | **Competence** | | |
| 3.1 | Students should be able to use information and communication technologies to collect, interpret and analyze information. | -Encourage students to use technologies to interpret and analyse information.<br>-Inspiring students to believe in themselves<br>-Encourage students to rise up them abilities to participate actively during group sessions. | -Homework, Assignments<br>-Groupe discussion |
| 3.2 | Students should be able to develop their self-learning skills. | | |
| 3.3 | Students should be able to demonstrate the work either independently or being a part of a team. | | |

## 2. Assessment Tasks for Students

| # | Assessment task* | Week Due | Percentage of Total Assessment Score |
|---|---|---|---|
| **1** | Homework and Assignments | During the semester | 10% |
| **2** | Quiz 1 | The 5 th week | 10% |
| **3** | Mid-Term Exam | The 9 th week | 20% |
| **4** | Quiz 2 | The 13 th week | 10% |
| **5** | Final Exam | The 16 th week | 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 :**

There are two ways to reach the faculty members:

- Office hours.
- Email.

In addition, Each faculty member is assigned to a group of students as an academic advisor.

## F. Learning Resources and Facilities

### 1.Learning Resources

| | |
|---|---|
| **Required Textbooks** | Course notes |
| **Essential References Materials** | -Elements of Partial differential equations, ***Ian N. Sneddon***<br>-Partial Differential Equations, ***Bhamra K. S***<br>-Differential and Integral Equations, ***Petter J. Collins***<br>-An Introduction to Partial Differential Equations, ***Y. Pinchover and J. Rubinstein.*** |
| **Electronic Materials** | *http://www.google.com* |
| **Other Learning Materials** | |

### 2. Facilities Required

| Item | Resources |
|---|---|
| **Accommodation**<br>(Classrooms, laboratories, demonstration rooms/labs, etc.) | Classrooms |
| **Technology Resources**<br>(AV, data show, Smart Board, software, etc.) | Smart Board |
| **Other Resources**<br>(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 | Students | Direct |
| Extent of achievement of course learning outcomes | Faculty | Direct |
| Quality of learning resources | Students | 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** | |

# Course Specifications

| | |
|---|---|
| **Course Title:** | Vector Analysis |
| **Course Code:** | 42041319 |
| **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:** | | | | | | | | |
| **4. Pre-requisites for this course** (if any)**:** Differential and Integral (3) 42041220 | | | | | | | | |
| **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. **Summary of the main learning outcomes for students enrolled in the course.**

To learn the students to the basic concepts methods, theorems and results in Vector Analysis (vectors, derivatives of vector functions, Gradient, divergence and curl, applications on integration of vector functions, orthogonal curvilinear coordinates).

2. Briefly describe any plans for developing and improving the course that are being implemented. (eg increased use of IT or web based reference material, changes in content as a result of new research in the field)

- Increasing use of references and the Internet in the collection of knowledge resources that are difficult to be provided in the library of Faculty / university
- 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 vectors and their operations. | |
| K2 | State the principles of calculus in vector analysis such as gradient, divergence, curl, coordinate transformation and of tensor calculus or tensor analysis and of tensor calculus or tensor analysis. | |
| K3 | Recognize vector analysis theorems and Algorithms. | |
| S0 | **Skills :** | |
| S1 | Determine the linear, surface and volume integrals of vector functions and some the applications on integration of vector functions. | |
| S2 | Students should be able to construct mathematical arguments and proofs. | |
| S3 | Students should be able to solve mathematical problems by using numerical and analytical methods. | |
| S4 | Able to interpret different mathematical ideas or relationships into mathematical representations such as graphs, diagrams, number lines, tables, grids, etc. | |
| 3 | **Competence:** | |
| C1 | Students should be able to use information and communication technologies to collect, interpret and analyze information in both verbal and written forms. | |
| C2 | Students should be able to develop their self-learning skills. | |
| C3 | Students should be able to take responsibility for their own learning. | |
| 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 vector operators** :<br>The differential operator∇. Gradient, divergence, curl, Laplace operator - Its Properties and its applications. | 9 |
| 2 | **vectors functions integral :**<br>Line integral of vector functions, physical meaning of line integral (work done by force across a path, surface integral of vectors functions, volume integral of vectors functions. | 9 |
| 3 | **Applications on of vector functions integral :**<br>Gauss's (divergence) theorem, Stokes theorems, Green theorem and its applications. | 9 |
| 4 | **Orthogonal curvilinear coordinates :**<br>Equation of coordinate transformation – curvilinear coordinate - unit vector curvilinear coordinate – length, arc and volume elements in curvilinear coordinate - curvilinear coordinate - Gradient, divergence and curl in curvilinear coordinate- special orthogonal coordinates systems, cylindrical coordinates system, spherical coordinates system, parabolic cylindrical coordinates, paraboloidal coordinates, elliptic cylindrical | 9 |

| | | |
|---|---|---|
| | coordinates, prolat spheroidal coordinates, oblate spheroidal coordinates, ellipsoidal coordinates, bipolar coordinates | |
| 5 | **Tensor algebra and analysis**<br>Tensors of different types and orders – Tensors and its properties – Tensors algebra - Tensor form of Gradient, divergence and curl- The Geodesics | 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** | Calculate the main concepts of the vectors and their operations. | Developing basic communicative ability through:<br>• Lectures<br>• Team work<br>• Oral discussion<br>• Scientific discussion.<br>• Open discussion. | • Homework.<br>• Periodic tests<br>• Web search<br>• Class Participation<br>• Midterm tests<br>Final exams |
| **1.2** | State the principles of calculus in vector analysis such as gradient, divergence, curl, coordinate transformation and of tensor calculus or tensor analysis and of tensor calculus or tensor analysis. | | |
| **1.3** | Recognize vector analysis theorems and Algorithms. | | |
| **2.0** | Skills | | |
| **2.1** | Determine the linear, surface and volume integrals of vector functions and some the applications on integration of vector functions | • Lectures<br>• Exercises<br>• Case studies<br>• Individual<br>• Presentations<br>Brainstorming. | • Class Participation<br>• Essay Question<br>• Presentation<br>Research |
| **2.2** | Construct vector analysis arguments and proofs. | | |
| **2.3** | Solve problems in Tensor algebra and analysis | | |
| **3.0** | Competence | | |
| **3.1** | Students should be able to use information and communication technologies to collect, interpret and analyze information in both verbal and written forms. | • Small group discussion<br>• Whole group discussion<br>• Brainstorming<br>Presentation. | • Written Exam<br>• Web search and writing reports.<br>• Class Activities<br>• Periodic tests |
| **3.2** | Students should be able to develop their self-learning skills. | | |
| **3.3** | Students should be able to take responsibility for their own learning. | | |
| **3.4** | Students should be able to demonstrate the work either independently or being a part of a team. | | |

### 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% |

| # | Assessment task* | Week Due | Percentage of Total Assessment Score |
|---|---|---|---|
| 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)**<br>• Course notes<br>• Chapters from different text books |
| **2. Essential References**<br>**[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)**<br>**[1] H. Anton, I. Bivens, and S. Davis. Calculus, 8th Edition. John Wiley and Sons, 2005.**<br>**[2] James Stewart. Calculus Early Transcendentals, 5th edition. Thomson, 2003.**<br>**[3] R. Larson, R. Hostetler, and B. Edwards. Calculus, 7th edition . Houghton Mifflin Company, 2002.**<br>**[4] H. Anton. Calculus, 7th Edition. John Wiley and Sons, 2002.**<br>**[5] E. Swokowski, M. Olinic, and D. Pence Calculus, 6th Edition. PWS Publishing Company,1994.**<br>**[6] M. R. Spiegel Vector Analysis, Schaum's Outline Series, McGraw-Hill Book Company, 2009.** | |
| **4-.Electronic Materials, Web Sites etc**<br>*http://www.google.com.* | |

### 2. Facilities Required

| Item | Resources |
|---|---|
| **Accommodation**<br>(Classrooms, laboratories, demonstration rooms/labs, etc.) | Teaching classes equipped with white board and display screen for (30) students |
| **Technology Resources**<br>(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**<br>(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 |
|---|---|---|

| 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:** | Mathematical applications in Computer |
| **Course Code:** | 42041321 |
| **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 Theoretical: 2 Practical: 2** |
| **2. Course type**<br>**a.** University ☐ College ☐ Department ☑ Others ☐<br>**b.** Required ☑ Elective ☐ |
| **3. Level/year at which this course is offered: Level: 5 / year: 3** |
| **4. Pre-requisites for this course** (if any)**: Computer Skills (42051202)** |
| **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** | 4 | %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** | 30 |
| 2 | **Laboratory/Studio** | 30 |
| 3 | **Tutorial** | |
| 4 | **Others** (specify) | |
| | **Total** | 60 |
| **Other Learning Hours*** | | |
| 1 | **Study** | 5 |
| 2 | **Assignments** | 5 |
| 3 | **Library** | 5 |
| 4 | **Projects/Research Essays/Theses** | 5 |
| 5 | **Others** (specify) | 20 |
| | **Total** | |

* 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 increase academic proficiency in expression of mathematical solutions. It provides an introduction to a disciplined approach to computer programming and problem solving, with an emphasis on procedural abstraction and good programming style. Algorithmic concepts are also introduced.

**2. Course Main Objective**

1- To teach students how to solve mathematical problems in the technical fields that require skills in both analytical mathematics and computer science.
2- To develop the fundamental understanding of skills that students will need to apply programming skills in solving a variety of mathematical problems.

**3. Course Learning Outcomes**

| CLOs | | Aligned PLOs |
|---|---|---|
| 1 | **Knowledge:** | |
| 1.1 | define the fundamental notations in mathematical software (MATLAB, MATHEMATICA or MAPLE). and Perform mathematical and statistical calculations with vectors | ✓ |
| 1.2 | recognize the idea of algorithms. | ✓ |
| 1.3 | list the methods that can be used in mathematical software (MATLAB, MATHEMATICA or MAPLE) to solve mathematical problems. | ✓ |
| **2** | **Skills:** | |
| 2.1 | identify algorithms with which to solve mathematical problems, and write programs from the underlying algorithms. | ✓ |
| 2.2 | create functions or subroutines. | ✓ |
| 2.3 | do basic 2- and 3-D plotting. | ✓ |
| 2.4 | write code using for/do loops, while constructions, conditional statements (if, then, else), and make use of logical constructs in the context of mathematics. | ✓ |
| **3** | **Competence:** | |
| 3.1 | use university library and web search for collecting information. | ✓ |
| 3.2 | work effectively both in team and independently. | ✓ |
| 3.3 | participate actively in constructive competition. | ✓ |
| 3.4 | Students should be able to create and use representations to organize, record, and communicate mathematical ideas. | ✓ |

## C. Course Content

| No | List of Topics | Contact Hours |
|---|---|---|
| 1 | Introduction to Mathematical programs [ MATHEMATICA or MATLAB or MAPLE] (Getting into mathematical program, variables and assignment statements, Expressions, characters and encoding ...) | 8 |
| 2 | Vectors and matrices (creating row vectors, creating column vectors, creating matrix variable, Dimensions, using functions with vectors and matrices) | 8 |
| 3 | Introduction to programming in mathematical program (Algorithm – looping) | 4 |
| 4 | Using any Mathematical program engine in calculus operations (Limits – differentiation – integration | 4 |
| 5 | Using any Mathematical program for linear algebra (matrices and its operations – determinants – systems of equations – eigenvalues and eigenfunctions) | 12 |
| 6 | Using mathematical program in Numerical Analysis (roots finding problems, maximization and minimization problems (linear programing problem)), numerical differentiation and numerical integration | 12 |
| 7 | Ordinary Differential Equations (ODE Solvers, High-Order ODEs in the Standard Form) | 4 |
| 6 | Using any Mathematical program in graphing applications (plotting functions in 2 and 3D- plotting functions with contour graphs- plotting parametric curves of functions) | 8 |
| **Total** | | 60 |

## D. Teaching and Assessment

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

| Code | Course Learning Outcomes | G x | Assessment Methods |
|---|---|---|---|
| **1.0** | **Knowledge** | | |
| 1.1 | define the fundamental notations in mathematical software (MATLAB, MATHEMATICA or MAPLE). and Perform mathematical and statistical calculations with vectors | . Start each chapter by general idea and the benefit of it.<br>. Demonstrate the course information and principles through lectures<br>. Provide main ways to deal with the exercises.<br>. Edit and analyze some topics during the lectures. | . Discussion in lectures.<br>.Follow-up in the practical lessons and correct test.<br>.Homework assignments.<br>. Solve Problems<br>. Achievement tests. (Periodic tests Midterm tests -final exams).<br>Lab Report |
| 1.2 | recognize the idea of algorithms. | | |
| 1.3 | list the methods that can be used in mathematical software (MATLAB, MATHEMATICA or MAPLE) to solve mathematical problems. | | |
| **2.0** | **Skills** | | |
| 2.1 | identify algorithms with which to solve mathematical problems, and write programs from the underlying algorithms. | Discussion collectively and then individually for the development of thinking skills with the group and constructive cooperation to solve problems. | .Place some degrees as part of encouragement<br>. Oral discussion.<br>.lab Report |
| 2.2 | create functions or subroutines. | Making work groups of students cooperate in joint research | .Practical exam<br>.Oral discussion. |
| 2.3 | do basic 2- and 3-D plotting. | Share the students in understanding the skill and practice it. | .observation and continuous evaluation.<br>.Tests |
| 2.4 | write code using for/do loops, while constructions, conditional statements (if, then, else), and make use of logical constructs in the context of mathematics. | | |
| **3.0** | **Competence** | | |
| 3.1 | use university library and web search for collecting information. | .Discussion collectively and then individually for the development of thinking skills with the | Check list<br>. grading report<br>.place some degrees as apart of |

| Code | Course Learning Outcomes | G x | Assessment Methods |
|---|---|---|---|
| | | group and constructive cooperation to solve problems. | encouragement<br>•periodic examination<br>•practical exams |
| 3.2 | work effectively both in team and independently. | - Making work groups of students cooperate in joint research | |
| 3.3 | participate actively in constructive competition. | Encouraging competition among students and groups | |
| 3.4 | create and use representations to organize, record, and communicate mathematical ideas. | | |

**2. Assessment Tasks for Students**

| # | Assessment task* | Week Due | Percentage of Total Assessment Score |
|---|---|---|---|
| **1** | Quiz 1 | 5 | 10% |
| **2** | Mid term Exam | 12 | 20% |
| **3** | Home work | During the term | 10% |
| **4** | Quiz 2 | 13 | 10% |
| **6** | Final theoretical exam | 16 | 50% |
| **7** | | | |
| **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:**

- 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 service to assist the teacher to attend an office hours

## F. Learning Resources and Facilities

**1.Learning Resources**

| | |
|---|---|
| **Required Textbooks** | -Course notes<br>-Chapters from different text books |
| **Essential References Materials** | 1) Introduction to MATLAB (ACM11 Spring 2015, California Institute of Technology)<br>2) MATLAB: A Practical Introduction to Programming and Problem Solving (By Stormy Attaway College of Engineering, Boston<br><br>3)SCHAUM'S SERIES IN MATHEMATICA |

| | |
|---|---|
| | 4 University Boston, MA) أستخدام برنامج MATLAB في الرياضيات<br>الجامعية تاليف د. عبير حميدي الحربي, الناشر: جامعة الملك سعود |
| **Electronic Materials** | http://www.wolfram.com/<br>http://www.mathworks.com/<br>http://www.mackichan.com/ |
| **Other Learning Materials** | **3- Recommended Books and Reference Material (Journals, Reports, etc) (Attach List)**<br>**[1]- B.N. Dale, C. Weems and M.R. Headington, Programming and Problem Solving with C++, Jones and Bartlett Publishers Inc., 2002.** |

## 2. Facilities Required

| Item | Resources |
|---|---|
| **Accommodation**<br>(Classrooms, laboratories, demonstration rooms/labs, etc.) | **Teaching classes equipped with white board and display screen for (30) students** |
| **Technology Resources**<br>(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**<br>(Specify, e.g. if specific laboratory equipment is required, list requirements or attach a list) | - |

## G Course Evaluation and Improvement Processes

**1 Strategies for Obtaining Student Feedback on Effectiveness of Teaching**

- Thinking and information research.
- Search in the scientific literature (books).
- Assign students to prepare some topics and explain them.
- Search the Internet for course topics.
- Making work groups of students cooperate in joint research
- Encouraging competition among students and groups.
- Continuous evaluation**.**

**2 Other Strategies for Evaluation of Teaching by the Instructor or by the Department**

- Presenting the results of a sample of students to an external reviewer.
- Analyzing the results of students.
- Follow-up of graduates after graduation.
- Workshops within the department**.**

**3. Processes for Improvement of Teaching**

- Training programs for the teacher.
- Maintain the means related to the course (the book - computer).
- Create the right atmosphere for students through social programs, and entertainment.
- Improve the relationship between teacher and student relationship to be a father and his sons.
- Follow-up to what's new special of the course.
- Continuous follow-up by a member of the faculty

| |
|---|
| - Use the Internet to introduce some useful sites for the course**.** |
| **4. Processes for Verifying Standards of Student Achievement** (eg. check marking by an independent faculty member of a sample of student work, periodic exchange and remarking of a sample of assignments with a faculty member in another institution)<br>- A sample of student work will be checked by a faculty member, who will exchange the corrected sample with another member for further check. |
| **5 .Describe the planning arrangements for periodically reviewing course effectiveness and planning for improvement**.<br>- Host a visiting teacher to evaluate the course.<br>- Workshops for teachers.<br>- Periodic meetings with students to know the distinguished positive and negative aspects.<br>- Taking the opinion of other teacher's course development. |

## H. Specification Approval Data

| | |
|---|---|
| **Council / Committee** | |
| **Reference No.** | |
| **Date** | |