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| **NAME** |  |
| **PRACTICAL/TUTORIAL GROUP**  |  |

Unit Course book

**Functional Analysis**

**Dr. Abdulkhalik Lazim**

2012/2013



**Soran University**

**Faculty of Science**

**Department of Mathematics**

**Stage 4**

Welcome to department of mathematics at Soran University. This handbook summarise all the general information you need to guide you during the fourth stage of your selected course. This booklet also describes in details the content of Functional Analysis unit, the names of academic staff who will teach the unit, and what you will be expected to do to make sure your success in this unit. We hope you enjoy the unit and that you will find the work inspiring and challenging.

Keep in mind that good attendance at lectures and tutorials is important to give you a good basis for work throughout the course. If any students may experience difficulty with this unit, is important to sort things out as soon as possible. Make an appointment with unit coordinator who may be able to help, your year tutor, or other academic staff that involved with this unit.

Please note: you are provided with a hardcopy of teaching materials. It may be necessary to change the order of lectures, deadlines etc, which you will be informed. Therefore, it is ESSENTIAL that you check the Department of Mathematics notice board regularly in order to keep up to date with any changes.

**Course Overview and Goals**

This course covers definition of normed and Banach space, finite dimensional normed space, linear functional and dul space, inner product space, Hilbert space, orthonormal space and sequences, Riesz’s representation theorem, sequilinear forms, Hilbert-adjoint operators, self-adjoint unitary and normal operators, Zorn’s lemma, Hann-Banach theorem, reflexive space, category theorem, strong and weak convergence, open mapping and closed graph theorem. Finally each lecture is ended by solving numerous problems by the students and lecturer.

**Communications with Academic Staff**

This handbook gives information on how to contact and communicate with staff. We provide room numbers and email addresses of staff to you. The staffs in this department want to help you as much as possible so that you will be successful in your programme. We also want to encourage you to take responsibility for yourselves and for your learning so it will help you in your future careers.

**The email rules**

* Write your email in acceptable English.
* In your emails you must include: full name, stage, department and the unit title.
* We only respond to queries from students using genuine/Soran University email accounts.
* Appointments can be arranged through the email system, if you wish.
* We respond to genuine problems and queries as soon as possible, normally within 7 days.
* We will not respond to emails which do not have a subject line.

**Staff associated with the unit**

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| --- | --- | --- |
| **Staff** | **Room Number** | **Email** |
| **Dr. Abdulkhalik Lazim** | **Instructors Room in Math Dep.** | **AbdulkhalikLazim@gmail.com** |

 **Soran University**

**Department of Mathematics**

**Unit: Functional Analysis**

**Credit: 3**

**Method of Assessment:**

Lectures: 3 hours / week

**Examination and grading**

| **ACTIVITIES** |  **PERCENTAGES** |
| --- | --- |
| Exams  |  40% |
| Final exam |  60% |

**Unit Timetable/Content**

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| --- | --- |
| **Week** | **Lecture Title & Content**  |
| 1 | Normed Linear Space |
| 2 | Banach Space |
| 3 | Linear Operator |
| 4 | Inverse Operator |
| 5 | **Exam1**, Bound and Continuous Linear Operator |
| 6 | Differentiation Operator, Integral Operator |
| 7 | Cauchy-Schwarz Inequality |
| 8 | Theorem about Bounded Linear Operator |
| 9 | Problem solving sessions |
| 10 | **Exam2**, Linear Functional |
| 11 | Normed Space of Operators |
| 12 | Hann-Banach Theorem |
| 13 | Linear Null, Sublinear Functional |
| 14 | Zorn’s Lemma |
| 15 | **Exam3**, Theorems |
| 16 | Category Theorem |
| 17 | Graph |
| 18 | Closed Graph Theorem |
| 19 | pre-Hilbert Space |
| 20 | **Exam4**, Property of pre-Hilbert Space |
| 21 | Null Space $N(T)$ |
| 22 | Some Theorem about pre-Hilbert Space |
| 23 | Orthogonal Vectors |
| 24 | Hilbert-adjoint Operator |
| 25 | **Exam5**, Self-adjoint (Hermition) Operator |
| 26 | Riesz’s Theorem |
| 27 | **Final Exam** |

**Recommended Reading**

1. David M. Burton, ***Introduction to Modern Abstract Algebra***, AW
2. Fraleigh, ***A first Course in Abstract Algebra***, JMU