4/1/4. Course Specification:

COURSE SPECIFICATIONS

Form

Course Title: **Distribution Theory and Fourier Analysis: An Introduction**

Course Code: **4047106-4**

Course Specifications

Institution: Umm Al-Qura University	Date: March 31, 2018
College/Department:	

A. Course Identification and General Information

1. Course title and code: Distribution Theory and Fourier Analysis: An Introduction 4047106-4			
2. Credit hours: 4 Credit Hours			
3. Program(s) in which the course is offered. (If general elective available in many programs indicate this rather than list programs) PhD in Mathematics			
4. Name of faculty member responsible for the course Dr. Mohamed			
5. Level/year at which this course is offered:			
6. Pre-requisites for this course (if any): General Topology (4046601-4)			
7. Co-requisites for this course (if any): ------			
8. Location if not on main campus: Main Campus + Girls sections			
9. Mode of Instruction (mark all that apply):			
a. traditional classroom	√	What percentage?	100
b. blended (traditional and online)		What percentage?	
c. e-learning		What percentage?	
d. correspondence		What percentage?	
f. other		What percentage?	

Comments:

B Objectives

1. What is the main purpose for this course?

Distribution theory can be thought of as the completion of diff erential calculus, just as Lebesgue integration theory can be thought of as the completion of integral calculus. It was created by Laurent Schwartz in the 20th century, as was Lebesgue's integration theory.

Distribution theory is a powerful tool that works very well in conjunction with the theory of Fourier transforms. One of the main areas of applications is to the theory of partial diff erential equations. In this course we give an introduction to these three theories.

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

- Updating references used in teaching process.
- Using e-learning facilities more efficiently.
- Encouraging students to collect problems from web-based reference material and supervise classroom discussions.

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

Course Description:
This is a 4 credit hours course comprising approximately 60 hours of lectures.

1. Topics to be Covered

List of Topics	No. of Weeks	Contact hours
Test functions and distributions on Rn: definitions and examples, Dirac δ- function, approximate identities and constructions using convolution of functions.	2	8
The calculus of distributions on Rn : functions as distributions, operations on distributions, adjoint identities, consistency of derivatives, distributional and weak solutions of PDEs, Sobolev functions.	2	12
The Fourier transform on Rn: from Fourier series to Fourier integrals (only for n=1n=1), the Schwartz class S of test functions on Rn , properties of the Fourier transform on S, the Fourier transform of a Gaussian and the inversion formula on S.	2	12
Fourier transforms of tempered distributions: definitions and examples, convolutions with tempered distributions.	3	12
Solving PDEs using Fourier transformation: the Laplace equation, the heat equation, the wave equation, Schrödinger's equation.	3	12

Fourier Analysis: the Riemann-Lebesgue lemma, Paley-Wiener theorems, the Poisson summation formula, the uncertainty principle.	3	12

2. Course components (total contact hours and credits per semester):

	Lecture	Tutorial	Laboratory/ Studio	Practical	Other:	Total
Contact Hours	60	0				60
Credit	4	0				4

3. Additional private study/learning hours expected for students per week.
Four hours weekly for homework and revision

4. Course Learning Outcomes in NQF Domains of Learning and Alignment with Assessment Methods and Teaching Strategy

On the table below are the five NQF Learning Domains, numbered in the left column.

First, insert the suitable and measurable course learning outcomes required in the appropriate learning domains (see suggestions below the table). **Second**, insert supporting teaching strategies that fit and align with the assessment methods and intended learning outcomes. **Third**, insert appropriate assessment methods that accurately measure and evaluate the learning outcome. Each course learning outcomes, assessment method, and teaching strategy ought to reasonably fit and flow together as an integrated learning and teaching process. (Courses are not required to include learning outcomes from each domain.)

Code #	NQF Learning Domains And Course Learning Outcomes	Course Teaching Strategies	Course Assessment Methods
1.0	**Knowledge:** After successful completion of the course, the student should be able to		
1.1	1) Students will become acquainted with the basic techniques that in many situations form the starting point for the modern treatment of PDEs.	Lectures Tutorials Discussion Problem Solving	Exams Home work.
2.0	**Cognitive Skills**		
2.1	2) Planning rigorous proofs of different propositions and assertions in this context. 3) Investigate examples to which the theories under concern can be applied. 4) Use lecture notes and other texts to	Lectures	Periodic written and oral tests. Discussion. Observation.

	solve challenging problems.		
3.0	**Interpersonal Skills & Responsibility**		
3.1	1) Punctual attendance of classes is required. 2) Students should demonstrate their sense of responsibility for learning by completing both reading and writing assignments in due time. 3) Students learn to manage their time. 4) Students should act responsibly and ethically in carrying.		
4.0	**Communication, Information Technology, Numerical**		
4.1	Work effectively in groups and independently.	Tasks assigned and homework.	Marking the assignments
4.2	Solve problems concerning the topics of the course.	Homework	Evaluating the homework
5.0	**Psychomotor**		
5.1	Not applicable	Not applicable	Not applicable
5.2	Not applicable	Not applicable	Not applicable

5. Schedule of Assessment Tasks for Students During the Semester

	Assessment task (i.e., essay, test, quizzes, group project, examination, speech, oral presentation, etc.)	Week Due	Proportion of Total Assessment
1	First periodic exam	6	20
2	Second periodic exam	10	20
4	Homework + reports + Quizzes	Over all weeks	20
5	Final exam	End	40

D. Student Academic Counseling and Support

1. Arrangements for availability of faculty and teaching staff for individual student consultations and academic advice. (include amount of time teaching staff are expected to be available each week)

1- Office hours per week in the lecturer schedule (4 hours per week).

2- Contact with students by e-mail, SMS, and e-learning facilities.

E Learning Resources

1. List Required Textbooks

1) R.S. Strichartz, A Guide to Distribution Theory and Fourier Transforms (World Scientific, 1994. Reprinted: 2008, 2015)
In particular, Chapters 1-5 and Sections 7.1, 7.2, 7.3 and 7.5.

2. List Essential References Materials (Journals, Reports, etc.) 2) L.C. Evans, Partial Diff erential Equations (Amer. Math. Soc. 1998) 3) E.H. Lieb and M. Loss, Analysis (Amer. Math. Soc. 1997) 4) E.M. Stein and R. Shakarchi, Fourier analysis. An introduction (Princeton Univ. Press 2003)
3. List Electronic Materials, Web Sites, Facebook, Twitter, etc.
4. Other learning material such as computer-based programs/CD, professional standards or regulations and software. Microsoft Word, Latex

F. Facilities Required

Indicate requirements for the course including size of classrooms and laboratories (i.e. number of seats in classrooms and laboratories, extent of computer access, etc.)
1. Accommodation (Classrooms, laboratories, demonstration rooms/labs, etc.) Classroom with capacity of 30-students. - Library.
2. Technology resources (AV, data show, Smart Board, software, etc.)
3. Other resources (specify, e.g. if specific laboratory equipment is required, list requirements or attach list) None

G Course Evaluation and Improvement Processes

1 Strategies for Obtaining Student Feedback on Effectiveness of Teaching: • Student feedback through electronic survey organized by the deanship of registration and acceptance.
2 Other Strategies for Evaluation of Teaching by the Instructor or by the Department • Evaluation of the teachers by internal & external faculty members. • Visiting to the classrooms. • Mutual visits between colleagues and giving advices to each other after each lecture
3 Processes for Improvement of Teaching • Analysis of student course evaluation and feedback • Peer evaluation and feedback • Review of course portfolios

• Workshops on pedagogical methods
4. Processes for Verifying Standards of Student Achievement (eg. check marking by an independent member teaching staff of a sample of student work, periodic exchange and remarking of tests or a sample of assignments with staff at another institution) • Analysis of course assessments by other reviewers on a periodic basis.
5 Describe the planning arrangements for periodically reviewing course effectiveness and planning for improvement. • Material and learning outcomes are periodically reviewed internally and externally. • Comparing course content and teaching methodologies with similar courses offered at other departments and universities. • Studying the outcomes of the students' evaluations of the course and use it to improve teaching strategies.

Name of Course Instructor:

Signature: _____ Date Specification Completed: _____

Program Coordinator: _____

Signature: _____ Date Received: _____