

4/1/4. Course Specification:

COURSE SPECIFICATIONS

Form

Course Title: Random Matrices and Orthogonal Polynomials

Course Code: 4046105-4

Course Specifications

Institution: Umm Al-Qura University	Date: November 10, 2018
College/Department : Faculty of Applied Science – Department of Mathematical Sciences	

A. Course Identification and General Information

1. Course title and code: Random matrices and orthogonal polynomials (4046105-4)			
2. Credit hours: 4 Hours			
3. Program(s) in which the course is offered. (If general elective available in many programs indicate this rather than list programs) Master of Sciences (Pure Mathematics)			
4. Name of faculty member responsible for the course		Dr. B. Mohamed	
5. Level/year at which this course is offered: level 3			
6. Pre-requisites for this course (if any): Linear Algebra1 (4042402-4), Linear Algebra 2 (403404-3), Measures theory (404210-3), Special Functions (434477-4).			
7. Co-requisites for this course (if any):			
8. Location if not on main campus: Al-Abdia Campus and Al-Zahir campus			
9. Mode of Instruction (mark all that apply):			
a. traditional classroom	<input checked="" type="checkbox"/>	What percentage?	<input type="text" value="100"/>
b. blended (traditional and online)	<input type="checkbox"/>	What percentage?	<input type="text"/>
c. e-learning	<input type="checkbox"/>	What percentage?	<input type="text"/>
d. correspondence	<input type="checkbox"/>	What percentage?	<input type="text"/>
f. other	<input type="checkbox"/>	What percentage?	<input type="text"/>
Comments:			

B Objectives

1. What is the main purpose for this course?

The main purpose of this course is to introduce to student, the random matrices theory. The theory includes Gaussian random matrices. The Wigner semi-circle law, by using Method of orthogonal polynomials, method of logarithmic potential. Mehta formula and Fredholm determinant.

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)

- 1) Updating references used in teaching process.
- 2) Using e-learning facilities more efficiently.
- 3) 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
Orthogonal polynomials, recurrence relations, zeros and Christoffel Darboux formula	3	12
Moments generating functions, Weak convergence of measures and Lévy-Cramer theorem	3	12
Logarithm potential of probability measure: existence and unicity	3	12
Ensemble of Gaussian random matrices, Weyl integration formula, Mehta formula and Fredholm determinant, Statistical density of eigenvalues	3	12
Wigner theorem: method of orthogonal polynomials	3	12
Wigner theorem: method of potential logarithmic theory		

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. Three 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) Understand the Gaussian complex ensemble and be able to generalize to real and quaternion Gaussian ensemble 2) Apply the orthogonal method to others random matrices ensemble 3) Apply the logarithmic potential method to others examples 4) Apply the Fredholm determinant to study the local spectrum of random matrices	Lectures Tutorials Discussion Problem Solving	Exams Home work.
2.0	Cognitive Skills		
2.1	5) Planning rigorous proofs of different	Lectures	Periodic written

	propositions and assertions in this context. 6) Apply basic theorems for random matrices. 7) Investigate examples to which the theories under concern can be applied.		and oral tests. Discussion. Observation.
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	5	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 Percy Deift, <i>Orthogonal polynomials and random matrices: a Riemann-Hilbert approach</i> . Courant Institute of Mathematical Sciences & A.M.S (2000).
2. List Essential References Materials (Journals, Reports, etc.) 1) M L Mehta, <i>Random matrices</i> . Academic Press (1991). 2) Forrester.J. P. <i>Log-Gases and random matrices</i> . Princeton university Press (2010).
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: Dr. B. Mohamed

Signature: _____ Date Specification Completed: November 10, 2018
Program Coordinator: _____

Signature: _____ Date Received: _____