4/1/4. Course Specification:

COURSE SPECIFICATIONS
Form

Course Title: Introduction to Orthogonal Polynomials

Course Code: 4046107-4

Course Specifications

Institution: Umm Al-Qura University	Date: April 09, 2018
College/Department:	

A. Course Identification and General Information

1. Course title and code: Introduction to Orthogonal Polynomials 4046107-4
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 in Mathematics
4. Name of faculty member responsible for the course Dr. Alaya Atef
5. Level/year at which this course is offered: level 3
6. Pre-requisites for this course (if any):
7. Co-requisites for this course (if any):
8. Location if not on main campus: Al-Abdia Campus
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:
A computer Lab equipped with Matlab®, Mathematica® and Maple® is needed for some lectures

B Objectives

1. What is the main purpose for this course?
   The aim of this course is to introduce orthogonal polynomials algebraically.

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) Encouraging students to handle several Mathematical software packages which are useful for computations.
   2) Improve the use of some important web-databases like:
      NIST Digital Library of Mathematical Functions (https://dlmf.nist.gov/),
      http://www.walfram.com. ….

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

Course Description:

1. Series.
2. Some special functions.
3. Calculus in C[X] and its dual.
4. The orthogonality.
5. Recurrence relation and Favard's theorem.
6. Derivative operators.
7. The classical case.
8. Some applications.

1. Topics to be Covered

List of Topics	No. of Weeks	Contact hours
Series.	2	8
Some special functions	2	8

Calculus in C[X] and its dual	2	8
The orthogonality	1	4
Recurrence relation and Favard's theorem	1	4
Derivative operators.	2	8
The classical case	3	12
Some applications	2	8

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) Know the different versions of orthogonality. 2) Handle different characterizations of classical orthogonal polynomials. 3) Identify the classical polynomials (discrete and continuous) and their properties. 4) Identify the analogues of classical orthogonal polynomials. 5) Construct new orthogonal sequences or quasi-definite linear forms. 6) Use some mathematical software packages to compute different coefficients related to orthogonal polynomials.	Lectures Tutorials Discussion Problem Solving	Exams Home work.
2.0	**Cognitive Skills**		
2.1	7) Planning rigorous proofs of different propositions and assertions in this context. 8) Investigate examples to which the theories under concern can be applied. 9) Use lecture notes and other texts to solve challenging problems. 10) Write down some codes with mathematical software packages	Lectures/ Tutorials	Periodic written 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	1) Ability to communicate in written and in oral. 2) Ability to write reports in English Ability to explain each step in the problem-solving process.	Lectures tutorials brain storming	Periodic written and oral tests. Discussion. Observation.

	3) Ability to apply course concepts to mathematical problem-solving model. 4) Ability to use information technology in communication and research projects. 5) Interact with life problems using different methods of thinking and problem solving.		
5.0	**Psychomotor**		
5.1	Not Applicable		
5.2			

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	Midterm 1	5th week	20 %
2	Midterm 2	10th week	20%
4	Homework + reports + Quizzes	During the semester	20%
5	Final exam	End of semester	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) N. Lebedev and Richard A. Silverman, Special Functions and Their Applications, New York, Dover, 1972.
2) M. Ismail and E. Koelink, Theory and Applications of Special Functions, Springer, 2005.
3) Mourad E. H. Ismail, Classical and Quantum Orthogonal Polynomials in One Variable, Cambridge University Press, 2009.

4) G. Szego, Orthogonal Polynomials, A.M.S. Coll. Publ. vol 23. Providence, Rhode Island, 1978
5) T. S. Chihara: An Introduction to Orthogonal Polynomials, Dover,2011.
6) G. Andrews and, R. Askey and R. Roy Special functions, Cambridge University Press, 1999.
7) R. Askey Orthogonal polynomials and special functions-SIAM (1975)
8) F. Marcell and W. Van Assche, Orthogonal Polynomials and Special Functions, Computation and Applications, 2008.
9) Orthogonal Polynomials and Painlevé Equations, Australian Mathematical Society Lecture Series 27, Cambridge University Press, 2018
10) B. G. S. Doman, The Classical Orthogonal Polynomials, World Scientific Publishing Company, 2016.

1) List Essential References Materials (Journals, Reports, etc.)

- T. S. Chihara: An Introduction to Orthogonal Polynomials, Dover,2011
- G. Szego, Orthogonal Polynomials, A.M.S. Coll. Publ. vol 23. Providence, Rhode Island, 1978.
- B. G. S. Doman, The Classical Orthogonal Polynomials, World Scientific Publishing Company, 2016.
- R. Askey Orthogonal polynomials and special functions-SIAM (1975).
- http://lists.siam.org/mailman/listinfo/siam-opsf
- https://dlmf.nist.gov/
- http://www.walfram.com.

3. List Electronic Materials, Web Sites, Facebook, Twitter, etc.
http://www.ams.org/home/page
https://www.sciencedirect.com/
https://sdl.edu.sa/SDLPortal/EN/Publishers.aspx

1. Other learning material such as computer-based programs/CD, professional standards or regulations and software.
   Matlab®, Mathematica® and Maple®, 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 - Computer Laboratory
2. Technology resources (AV, data show, Smart Board, software, etc.) Data show, Smart Board, Matlab®, Mathematica® and Maple®, Latex®
2. Other resources (specify, e.g. if specific laboratory equipment is required, list requirements or attach list) A computer Lab equipped with Matlab®, Mathematica® and Maple® and Latex.

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
- Attendance of OPSF summer schools.

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: Alaya Atef

Signature: _____ Date Specification Completed: 10/04/2018

Program Coordinator: _____

Signature: _____ Date Received: _____