COURSE SPECIFICATIONS
(CS)

Mathematical Physics 3

PHYS 404

June 2018

Course Specifications

Institution: King Saud University	Date: 12/2017
College/Department: Science/Physics and Astronomy	

A. Course Identification and General Information

1. Course title and code: Mathematical Physics 3 - **PHYS 404**
2. Credit hours: 3(3+0+0)
3. Program(s) in which the course is offered: B.Sc. in Physics (If general elective available in many programs indicate this rather than list programs)
4. Name of faculty member responsible for the course: Dr. Maien Yahya Binjonaid
5. Level/year at which this course is offered: Level 7
6. Pre-requisites for this course (if any): PHYS 301
7. Co-requisites for this course (if any): None
8. Location if not on main campus: NA

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? 1. The student should get acquainted with the basic concepts of special functions, and transforms 2. The student should learn the basic properties of some important special functions. 3. The student should learn how to evaluate differential equations of special functions and how to solve their integrals and recurrence relations. 4. The students should learn how to use the mathematical concepts of this course in specific problems of physics.
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). The content of the course will be made available via Blackboard. The use of mathematical physics packages such as Mathematica and Matlab will be implemented in the problem-solving skills of the course.

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

Course Description: **Gamma and beta functions, Legendre special functions and their application in electrostatics. Associated Legendre functions and applications in magnetostatics and nuclear physics. Spherical harmonics and applications in quantum mechanics. Bessel functions of all types and their applications in the wave mechanics, electrodynamics and quantum mechanics. Laguerre and Associated Laguerre functions and applications in quantum mechanics. Hermite functions and their applications in solving the quantum harmonic oscillator. Fourier series, transformations and integrals and their applications in the physics of waves. Laplace transformations, and their application in the physics of waves, heat transfer and quantum mechanics.**

1. Topics to be Covered

List of Topics	No. of Weeks	Contact hours
Gamma and Beta functions	**2**	**4**
Legendre, Applications of Legendre functions in electrostatics Associated Legendre, Applications of Legendre functions in magnetostatics and nuclear physics	2	4
Spherical Harmonics, Applications in quantum theory of angular momentum and the quantum mechanics of the hydrogen atom	2	4
Bessel functions of all types, Applications in the diffraction of waves, in electrodynamics, in propagation of waves, in quantum mechanics	2	4
Hermite, Applications in the quantum mechanics of the simple harmonic oscillator	2	4
Fourier series, transformation and integrals. Applications in the physics of waves.	3	6
Laplace Transformation. Applications in the physics of waves, heat transfer and in quantum mechanics.	2	4

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

	Lecture	Tutorial	Laboratory or Studio	Practical	Other:	Total
Contact Hours	45					45
Credit	45					45

3. Additional private study/learning hours expected for students per week. 3

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.)

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

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Code #	NQF Learning Domains And Course Learning Outcomes	Course Teaching Strategies	Course Assessment Methods
1.0	**Knowledge**		
1.1	To define special functions	Lecture, Smart Board	Exams and homework
1.2	To outline how methods are used in physics	Lecture, Smart Board	Exams and homework
2.0	**Cognitive Skills**		
2.1	Explain special functions and their properties	Lecture, Discussion	Discussion
2.2	Analyze relevant physics problems	Lecture, Discussion	Discussion
3.0	**Interpersonal Skills & Responsibility**		
3.1	Demonstrate ability to solve problems using the mathematical tools of special functions	Role playing / inverted class	Presentation / discussion
3.2			
4.0	**Communication, Information Technology, Numerical**		
4.1	Illustrate the role of special functions in physics	Group presentation	Presentation
4.2			
5.0	**Psychomotor**		
5.1			
5.2			

6. Schedule of Assessment Tasks for Students During the Semester			
	Assessment task (e.g. essay, test, group project, examination, speech, oral presentation, etc.)	Week Due	Proportion of Total Assessment
1	Midterm 1	5	15%
2	Midterm 2	11	15%
3	Quiz	Throughout	10%
4	Homework	Throughout	10%
5	In-class discussion	Throughout	10%
6	Final	End of term	40%
7			
8			

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) 2 hours per week of office hours

E Learning Resources

1. List Required Textbooks Mathematical Methods for Physicists By George Arfken Hans Weber Frank E. Harris, Seventh Edition, 2012, Academic Press Mathematical Methods for Physics and Engineering By by K. F. Riley, M. P. Hobson, S. J. Bence, Thrid Edition, 2006, Cambridge Press
2. List Essential References Materials (Journals, Reports, etc.)

3. List Recommended Textbooks and Reference Material (Journals, Reports, etc)
4. List Electronic Materials, Web Sites, Facebook, Twitter, etc.
5. Other learning material such as computer-based programs/CD, professional standards or regulations and software.

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.) Lecture hall for 30 students
2. Computing resources (AV, data show, Smart Board, software, etc.) Smart Board
3. Other resources (specify, e.g. if specific laboratory equipment is required, list requirements or attach list)

G Course Evaluation and Improvement Processes

1 Strategies for Obtaining Student Feedback on Effectiveness of Teaching Feedback to be taken at the end of each class
2 Other Strategies for Evaluation of Teaching by the Instructor or by the Department Peer consultation
3 Processes for Improvement of Teaching Developing teaching based on regular feedback and peer consultation
4. Processes for Verifying Standards of Student Achievement (e.g. 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) Double-checking by independent peers
5 Describe the planning arrangements for periodically reviewing course effectiveness and planning for improvement. Creating a table for the course to ensure that the goals are achieved, and taking into account

feedback and peer consultation

Name of Instructor: _____

Signature: _____ Date Report Completed: _____

Name of Field Experience Teaching Staff _____

Program Coordinator:_____

Signature: _____ Date Received: _____