هيئة تقويم التعليم
Education Evaluation Commission
المركز الوطني للتقويم والاعتماد الأكاديمي
National Center for Academic Accreditation and Evaluation

ATTACHMENT 5.

T6. COURSE SPECIFICATIONS (CS)

Nuclear Reactors Physics

Phys 581

هيئة تقويم التعليم
Education Evaluation Commission

Course Specifications

Institution: ; **King Saud University**	Date: **Jan 2018**
College/Department : **College of Science - Physics and Astronomy Department**	

A. Course Identification and General Information

1. Course title and code: **Nuclear Reactor Physics (Phys 581)**
2. Credit hours: **3 (3+0+0)**
3. Program(s) in which the course is offered.
(If general elective available in many programs indicate this rather than list programs)
M.Sc. Physics Program
4. Name of faculty member responsible for the course **Dr. Mohamed S. Al Garawi**
5. Level/year at which this course is offered: **Level 3 (Second year)**
6. Pre-requisites for this course (if any):): **Phys 506 (Statistical Physics)**
7. Co-requisites for this course (if any):---
8. Location if not on main campus: -----
9. Mode of Instruction (mark all that apply):

✓ a. traditional classroom	✓	What percentage?	20
✓ b. blended (traditional and online)	✓	What percentage?	80
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?

This course aims to present a detailed description of basic ideas of nuclear physics reactors

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- The course content has been revised and a new syllabus was written.
2- Students are encouraged to communicate through the e-mail of the lecturer site which has many links to important sources of knowledge in the field of nuclear physics.
3- Encourage students to search in the specialized web sites in the internet to increase their knowledge about nuclear reactors and to follow any result of new research in the field.

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

Course Description:

Neutron Physics: Properties of neutrons, Neutron sources, microscopic and macroscopic cross-sections, elastic and inelastic scattering, absorption and fission reactions, BF_3 detectors, Mechanism of energy loss by scattering collisions, scattering law, Neutron lethargy and average logarithmic decrement, Moderating ratio, Slowing down equation for homogenous mixture , Neutron current density.
- Nuclear Fission by thermal neutron in homogenous reactors: Scattering Cross Section, Energy release from fission, Neutron yield, Energy distribution among fission neutrons and fragments. Reproduction constant, neutron balance, Resonance Escape Probability, Reactor Criticality, Neutron cycle and the multiplication factor.
Two group theory: Fermi age theory, Diffusion of neutrons; multi group diffusion theory, Diffusion equation applied to infinite and finite reactors, Fast neutron diffusion. Calculating the six factors formula, Fuel depletion Fission product poisoning, Reactor Kinetics, Concept of reactivity, Classical aspects of reactor control.

1. Topics to be Covered

- Neutron Physics, Nuclear Fission by thermal neutron in homogenous reactors, Reactor. **Two group theory.**

List of Topics	No. of Weeks	Contact hours
- Neutron reactions: neutron interaction with matter cross-sections, attenuation, reaction rate, scattering cross-section absorption cross-section fission cross-section.	**3**	**9**
- Nuclear fission, fission yield, Energy distribution among fission neutrons and fragments, regeneration factor	**2**	**6**
-Thermal neutrons: energy distribution, effective cross section, moderation, average energy loss.	**2**	**6**
Average energy logarithmic decrement, SDP, MR and resonance escape probability.	**2**	**6**
-The Nuclear chain reaction: neutron cycle, thermal utilization factor and the four factors formula for infinite reactor.	**2**	**6**
Diffusion of neutrons; multi group diffusion theory, thermal and fast neutron leakage. Fermi age theory, the six formula factor for finite reactor. Fuel depletion Fission product poisoning, Reactor Kinetics, Concept of reactivity, Classical aspects of reactor control, calculating the six factors formula	**3**	**9**
Integral transport theory, Solution of transport equation, Fast breeder reactor, possible breeding cycles, doubling time, breeding ratio, Cell parameters, physics of PWR and Fast Breeder Reactor.	**1**	**3**

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

		Lecture	Tutorial	Laboratory/ Studio	Practical	Other:	Total
Contact Hours	Planed	**45**	--	--	---	--	45
	Actual	**45**	--	--	---	--	45
Credit	Planed	**45**	--	--	---	--	45
	Actual	**45**	--	--	---	--	45

3. Additional private study/learning hours expected for students per week. 2/Week

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

2 hours in average weekly for solving home work problems.

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**		
1.1	**This is speciality course, which gives the student a wide and general look at the different aspects of nuclear reactor physics that related to: Neutron reactions: cross-sections, attenuation, reaction rate, fission Cross-section, energy distribution, effective cross section, moderation, average energy loss, Average energy logarithmic decrement, SDP, MR and resonance escape probability,**	**1- Give notes 2- Text books 3- Homework 4- Encourage students to seek information through the Internet**	**1- Four home works 2- Quizzes. 2- Two exams through the term 3- Final exam**
1.2	**The Nuclear chain reaction: neutron cycle, thermal utilization factor and calculating the four factors formula, Fermi age theory, Diffusion of neutrons; multi group diffusion theory, Fuel depletion Fission product poisoning, Reactor Kinetics, Concept of reactivity, Classical aspects of reactor control**		
2.0	**Cognitive Skills**		
2.1	**Ability to solve problems related to: - cross-sections, attenuation, reaction rate, fission Cross-section, energy effective cross section, moderation, neutron average energy loss, neutron average energy logarithmic decrement, SDP, MR and resonance escape probability.**	**1- Spontaneous questions during lectures 2- Homework 3- Discussions 4- Seek information through the Internet**	**1- Spontaneous questions to connect different parts of the course to each other 2- Homework 3- Two exams through the term and a final exam**
2.2	**The Nuclear chain reaction: neutron cycle, thermal utilization factor , calculating the four factors formula and the six factors formula.**		
3.0	**Interpersonal Skills & Responsibility**		

3.1	**- Work independently**	**- Encouraging students to solve problems independently and through communication and discussion with other members of the group**	**- Grading homework.**
3.2	**- Work within a group and Share research ideas and findings with other members of the group**	**- Set group assignments involving internet search, and essay writing**	**- Grading group assignments**
4.0	**Communication, Information Technology, Numerical**		
4.1	**- Strongly encourage the students to use the internet in search for knowledge .**	**- Send and receive homework through the lecturers electronic site - Encourage students to use the Internet to seek course related information.**	**-Grading the student homework**
4.2	**- Essay writing**	**- Set homework based on search through the inter-net with the help of key links provided by the lecturer through his electronic site**	Grading essays
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	**Class activities (questions, discussion, and homework)**	**continuous**	**20%**
2	**Term exam I**	**6**	**20%**
3	**Term exam II**	**12**	**20%**
4	**Final exam**	**16**	**40%**
5			

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) **Office hours: 10 hours/ week**

E Learning Resources

1. List Required Textbooks **Introduction to Nuclear Reactor Theory**, by John R. Lamars. **Publisher:** Addison-Wesley Publishing Company
2. List Essential References Materials (Journals, Reports, etc.) - **Elementary Introduction to Nuclear Reactor Physics by: S. E. Liverhant** **Publisher: John Wiley**
3. List Electronic Materials, Web Sites, Facebook, Twitter, etc. **Websites on the internet that are relevant to the topics of the course such as:** **http://en.wikipedia.org/wiki/Nuclear_reactor_physics** **http://www.google.com/search?q=Nuclear+reactor+physics&rls=com.microsoft:en-us&ie=UTF-8&oe=UTF-8&startIndex=1&startPage=1** **http://www.viniti.ru/~peisv/P/index.html** **http://ie.lbl.gov/toi.html** **http://www.ne.anl.gov/capabilities/rpfca/index.html** **http://www.ne.anl.gov/ne_web_photos/index.php?cid=9**
4. 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 room with at least 10 seats**.
2. Technology resources (AV, data show, Smart Board, software, etc.) **- Scientific calculator for each student** **- Personal Computer.**
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

-Examination results and type of questions answered **-Course evaluation by student.**
2. Other Strategies for Evaluation of Teaching by the Instructor or by the Department **- Peer consultation on teaching** **- Departmental council discussions** **- Discussions within the group of faculty teaching the course**.
3. Processes for Improvement of Teaching **Workshops on teaching and learning methods**;
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) **- Providing statistical information based on examination results** .
5. Describe the planning arrangements for periodically reviewing course effectiveness and planning for improvement. **-The course material is periodically reviewed and the changes to be taken are approved in the departmental and higher councils.** **- The head of department and faculty take the responsibility of implementing the proposed changes.**

Name of Course Instructor: : **Dr. Mohamed Saleh Al Garawi** _____

Signature: _____ Date Specification Completed: **3rd Jan 2018**

Program Coordinator: _____

Signature: _____ Date Received: _____