Course Specification

(Postgraduate Programs)

Course Title: Research Methodology
Course Code: PHYS 630
Program: Master of Science in Physics
Department: Physics
College: College of Science
Institution: Majmaah University
Version: 1
Last Revision Date: 30/12/2024

Table of Contents

A. General information about the course:

1. Course Identification

1. Credit hours: (2)					
2. Course type					
A.	☒ University	☐College	☐ Department	☐Track	☐Others
B.	☒ Required		☐Elective		
3. Level/year at which this course is offered: (1st/2)					
4. Course general Description:					
This course provides graduate students with the essential concepts, tools, and techniques for conducting scientific research in physics. It aims to develop the students' ability to design, execute, analyze, and present research in both theoretical and experimental contexts. Emphasis is placed on understanding research methodologies relevant to the department's specializations, including materials science, nuclear physics, and environmental radioprotection. The course covers experimental design, theoretical and computational modeling, data acquisition and processing, and the use of advanced laboratory instrumentation. Students will also gain proficiency in scientific computing, numerical simulation, and data visualization. The course further develops essential scholarly skills, including conducting literature reviews, writing academically, adhering to ethical research practices, and communicating scientific results through oral presentations, technical reports, and publications. In addition, students will learn to access and utilize digital information resources—such as the Saudi Digital Library (SDL) and major international databases—to support their research activities					
5. Pre-requirements for this course (if any):					
none					
6. Co-requisites for this course (if any):					
none					
7. Course Main Objective(s):					
1- By the end of the course, students will be able to: 2- Understand the nature of scientific research and apply the principles of the scientific method to formulate research questions and hypotheses relevant to advanced areas of physics. 3- Identify, interpret, and correctly use key scientific terminology and conventions in writing, presenting, and discussing physics research.					

4- Design and plan a coherent research project, including defining objectives, selecting appropriate methodologies (experimental, theoretical, or computational), and developing a feasible research schedule.
5- Select and implement suitable data collection methods, ensuring validity, reliability, accuracy, and ethical integrity in experimental and theoretical research practices.
6- Apply appropriate techniques for data analysis, including statistical methods, computational modeling, and graphical visualization, to extract meaningful physical insights from research data.
7- Effectively communicate research outcomes through scientific writing, oral presentations, and visual data representation, following professional and ethical standards.
8- Utilize modern research tools and digital resources, including the Saudi Digital Library (SDL) and international databases, to access, evaluate, and cite scientific literature effectively.
9- Demonstrate critical thinking and problem-solving skills in designing and interpreting experiments or simulations related to material science, environmental radioprotection, or advanced nuclear physics.

2. Teaching mode (mark all that apply)

No	Mode of Instruction	Contact Hours	Percentage
1	Traditional classroom	30	100%
2	E-learning		
3	Hybrid • Traditional classroom • E-learning		
4	Distance learning		

3. Contact Hours (based on the academic semester)

No	Activity	Contact Hours
1.	**Lectures**	30
2.	**Laboratory/Studio**	
3.	**Field**	
4.	**Tutorial**	
Total		**30**

B. Course Learning Outcomes (CLOs), Teaching Strategies and Assessment Methods

Code	Course Learning Outcomes	Code of PLOs aligned	Teaching Strategies	Assessment Methods

		with program		
1.0	**Knowledge and understanding**			
1.1	Understand research and scientific methods.	**K2**	Lectures-In-class discussions-Exercises	Exams-Homework-Classwork-Quizzes
1.2	Apply statistical error calculation and research ethics.	**K2**	Lectures-In-class discussions-Exercises	Exams-Homework-Classwork-Quizzes
1.3	Research design, planning, sampling, validity, and reliability.	**K3**	Lectures-In-class discussions-Exercises	Exams-Homework-Classwork-Quizzes
1.4	Experimental methods, data collection, and evaluation of research.	**K3**	Lectures-In-class discussions-Exercises	Exams-Homework-Classwork-Quizzes
2.0	**Skills**			
2.1	Analyze the research proposal and its potential outcomes.	**S2**	Lectures-In-class discussions-Exercises	Exams-Homework-Classwork-Quizzes
2.2	Reviewing Literature and Data Analysis.	**S4**	Lectures-In-class discussions-Exercises	Exams-Homework-Classwork-Quizzes
3.0	**Values, autonomy, and responsibility**			
3.1	Work effectively both in groups and individually.	**V2**	Class discussions. Making students aware of time management. Counsel students on how to deliver an effective presentation. Encourage students to help each other.	Evaluation of group reports and individual contributions within the group. Self-assessment
3.2	Present a short report in a written form and orally using appropriate scientific language.	**V3**	Class discussions. Making students aware of time management. Counsel students on how to deliver an effective presentation. Encourage students to help each other.	Evaluation of group reports and individual contributions within the group. Self-assessment

C. Course Content

No	List of Topics	Contact Hours
1.	Course introduction and course distribution. Research definition, research types, and scientific methods.	4
2.	Research design, planning, sampling, validity, and reliability. Writing a research proposal.	4
3.	Reviewing the Literature. Experimental methods, data collection, and evaluation of research.	4
4.	Quantitative and qualitative data analysis.	4
5.	Correlation between the analyzed data and prior research.	4
6.	Discussion and explanation of results.	4
7.	Review/ Writing the report.	6
Total		**30**

D. Students Assessment Activities

No	Assessment Activities *	Assessment timing (in week no)	Percentage of Total Assessment Score
1.	First exam	7	15%
2.	Second exam	12	15%
3.	Final exam	End of the semester	40%
4.	Homework	Every week	10%
5.	E-exam	one time/ semester	5%
6.	Quizzes	End of topics	5%
7.	Presentation/Discussions	one time/ semester	10%

*Assessment Activities (i.e., Written test, oral test, oral presentation, group project, essay, etc.).

E. Learning Resources and Facilities

1. References and Learning Resources

Essential References	1. Methods in Scientific Research & A Guide to Writing an Excellent Paper, Prof George K. Toworfe, Create Space Independent Publishing Platform (April 2, 2014), ISBN-13: 978-1497499782, - 2014 Innovation in Scientific Research and Emerging Technologies, A Challenge to Ethics and Law, Laura Palazzani, Springer, Cham (2019)
Supportive References	Quality Management in Scientific Research, Challenging Irreproducibility of Scientific Results, Antonella Lanati, Springer, Cham (2018)
Electronic Materials	2. Saudi Digital Library (SDL)

	3. https://www.wikipedia.org/ 4. https://www.sciencedirect.com 5. https://link.springer.com 6. Web of Knowledge 7. MIT Courseware
Other Learning Materials	n/a

2. Required Facilities and equipment

Items	Resources
facilities (Classrooms, laboratories, exhibition rooms, simulation rooms, etc.)	A furnished lecture room is equipped with a smart board and a computer.
Technology equipment (projector, smart board, software)	Computational Lab with proper software.
Other equipment (depending on the nature of the specialty)	Library, Seminar Room, and Wi-Fi internet connections.

F. Assessment of Course Quality

Assessment Areas/Issues	Assessor	Assessment Methods
Effectiveness of teaching	Internal Reviewer Committee	Direct
Effectiveness of Students assessment	Students	Indirect
Quality of learning resources	Qiyas Center, Stockholder, and Others	Direct
The extent to which CLOs have been achieved	Peer Reviewer	Direct

Assessors (Students, Faculty, Program Leaders, Peer Reviewers, Others (specify)

Assessment Methods (Direct, Indirect)

G. Specification Approval

COUNCIL /COMMITTEE	Physics Department
REFERENCE NO.	16
DATE	30/12/2024