



Course Specification

(Postgraduate Programs)

Course Title: **Dissertation**

Course Code: **PHYS 640**

Program: **Master of Science in Physics**

Department: **Physics**

College: **College of Science**

Institution: **Majmaah University**

Version: **I**

Last Revision Date: **30/12/2024**



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A. General information about the course:

1. Course Identification

1. Credit hours: (6)

2. Course type

A. University College Department Track Others
 B. Required Elective

3. Level/year at which this course is offered: (2nd / 2)

4. Course general Description:

The dissertation aims to enable students to conduct independent, original, and scientifically rigorous research in their chosen area of specialization (Nuclear Physics, Radiation Protection, or Physics of Materials and Applications). Through this work, students will demonstrate their ability to identify a research problem, review relevant literature, apply appropriate theoretical, experimental, or computational methods, analyze and interpret results, and communicate scientific findings in accordance with academic and professional standards.

5. Pre-requirements for this course (if any):

PHYS 630

6. Co-requisites for this course (if any):

none

7. Course Main Objective(s):

1. Develop Research Competence: Enable students to design and execute an independent research project in their selected field of specialization.
2. Apply Advanced Knowledge and Methods: Integrate and apply advanced theoretical, experimental, or computational techniques to address complex problems related to the track or interdisciplinary areas.
3. Promote Critical and Analytical Thinking: Cultivate the ability to critically analyze scientific data, evaluate methodologies, and draw sound conclusions supported by evidence.
4. Enhance Scientific Communication: Train students to effectively communicate their research findings through a well-structured written





dissertation and oral defense that meet professional and academic standards.

5. Encourage Ethical and Professional Research Practice: Instill a strong sense of scientific integrity, safety, and ethical responsibility in research involving materials, radiation, and advanced physical systems.
6. Prepare for Advanced Careers and Further Research: Equip graduates with the skills, experience, and confidence required for doctoral studies, research positions, or professional careers in industry and academia.
7. Consolidate Innovation and Problem-Solving Ability: Enable students to identify, formulate, and solve new or emerging problems in their field of specialization through creative and evidence-based research approaches.

2. Teaching mode (mark all that apply)

No	Mode of Instruction	Contact Hours	Percentage
1	Traditional classroom		
2	E-learning		
3	Hybrid <ul style="list-style-type: none"> • Traditional classroom • E-learning 		
4	Distance learning		
5	Supervised Research	180	100%

3. Contact Hours (based on the academic semester)

No	Activity	Contact Hours
1.	Lectures	
2.	Laboratory/Studio	
3.	Field	
4.	Tutorial	
5.	Supervised Research	180
Total		180



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

Code	Course Learning Outcomes	Code of PLOs aligned with program	Teaching Strategies	Assessment Methods
1.0	Knowledge and understanding			
1.1	Demonstrate deep understanding of advanced concepts and current research trends in the selected specialization area.	K2	- Individual supervision meetings - Directed readings and literature review	- Supervisor evaluation of research proposal
1.2	Identify and formulate a significant research problem relevant to nuclear physics, radiation protection, or materials physics.	K4	- Research methodology seminars	- Literature review report
2.0	Skills			
2.1	Design and implement a research plan using appropriate theoretical, experimental, or computational methods	S1	- Research supervision - Peer discussion sessions	- Progress reports - Supervisor evaluation
2.2	Critically analyze, interpret, and synthesize data to draw scientifically sound conclusions.	S2,S3		
2.3	Evaluate the reliability, limitations, and implications of research findings.	S4		
3.0	Values, autonomy, and responsibility			
3.1	Conduct research ethically and responsibly in accordance with scientific and institutional standards	V2	- Research ethics orientation - Continuous supervisor mentorship	- Supervisor assessment of research conduct - Compliance with ethical and safety requirements
3.2	Demonstrate initiative, time management, and independence in conducting long-term research.	V3		
3.3	Adhere to professional and safety standards, particularly in handling radiation or materials.	V1		



C. Course Content

No	List of Topics	Contact Hours
1.	Phase 1: Research Orientation and Proposal Development (Weeks 1–3) - Selection of research topic aligned with one of the two specialization tracks. - Assignment of academic supervisor. - Review of recent literature. - Definition of research objectives, scope, and methodology.	36
2.	Phase 2: Literature Review and Methodology Design (Weeks 4–7) - Comprehensive review of current scientific literature. - Development of a detailed research plan, including theoretical framework, experimental or computational methods, and data acquisition plan. - Preparation of ethics and safety documentation (especially for radiation-related work).	48
3.	Phase 3: Experimental / Computational / Theoretical Work (Weeks 8–11) - Execution of the approved research plan. - Data collection, experiment setup, or simulation execution, depending on the research type. - Regular progress discussions with the supervisor.	48
4.	Phase 4: Data Analysis and Interpretation (Weeks 12–13) - Data organization and statistical or theoretical analysis. - Interpretation of results in light of established literature. - Identification of uncertainties and limitations.	24
5.	Phase 5: Dissertation Writing and Presentation (Weeks 14–15) - Compilation of results, discussion, and conclusions. - Writing of the dissertation following academic formatting and referencing guidelines. - Preparation of oral presentation and defense.	24
Total		180

Examples of research themes:

Track 1:

- Nuclear reactor physics and neutron transport modeling
- Radiation shielding and dosimetry
- Environmental radiation measurement and safety analysis
- Atomic instrumentation and detector calibration
- Radioisotope applications in medicine and industry



Track 2:

- Nanomaterials synthesis and characterization
- Optical, electrical, and magnetic properties of advanced materials
- Thin film deposition and surface analysis
- Computational materials physics and simulations
- Energy materials (photovoltaics, thermoelectrics, batteries)

Deliverables

1. Approved research proposal
2. Periodic progress reports
3. Final written dissertation
4. Oral defense in front of an academic committee

D. Students Assessment Activities

No	Assessment Activities *	Assessment timing (in week no)	Percentage of Total Assessment Score
1.	Research Proposal Submission	4	10%
2.	Periodic Progress Reports	4, 8, 12	30%
3.	Interim Seminar or Presentation	12	20%
4.	Final Dissertation Document	end of term	40%

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

Additional Notes

- Students must maintain regular communication with their supervisors and submit progress reports as scheduled.
- Plagiarism or unethical research conduct results in automatic failure of the course.

E. Learning Resources and Facilities

1. References and Learning Resources

Essential References

Bevington, P. R., & Robinson, D. K. (2003). Data Reduction and Error Analysis for the Physical Sciences (3rd ed.). McGraw-Hill.
Creswell, J. W., & Creswell, J. D. (2018). Research Design: Qualitative, Quantitative, and Mixed Methods Approaches (5th ed.). SAGE Publications.





	<p>Knoll, G. F. (2010). Radiation Detection and Measurement (4th ed.). John Wiley & Sons.</p> <p>Krane, K. S. (1988). Introductory Nuclear Physics. John Wiley & Sons.</p> <p>Callister, W. D., & Rethwisch, D. G. (2020). Materials Science and Engineering: An Introduction (11th ed.). John Wiley & Sons.</p> <p>Ashcroft, N. W., & Mermin, N. D. (2011). Solid State Physics. Cengage Learning.</p>
<p>Supportive References</p>	<p>Leo, W. R. (1994). Techniques for Nuclear and Particle Physics Experiments: A How-to Approach. Springer.</p> <p>Lilley, J. (2013). Nuclear Physics: Principles and Applications. John Wiley & Sons.</p> <p>Ziman, J. M. (2001). Principles of the Theory of Solids (2nd ed.). Cambridge University Press.</p> <p>Ohring, M. (2001). Materials Science of Thin Films: Deposition and Structure (2nd ed.). Academic Press.</p> <p>Poole, C. P., & Owens, F. J. (2003). Introduction to Nanotechnology. John Wiley & Sons.</p> <p>Bevington, P. R. (1995). Analysis of Experimental Data. McGraw-Hill.</p> <p>Introduction to Radiological Physics and Radiation Dosimetry by Frank Herbert Attix, September 2008, Wiley</p>
<p>Electronic Materials</p>	<p>ScienceDirect – https://www.sciencedirect.com</p> <p>IEEE Xplore Digital Library – https://ieeexplore.ieee.org</p> <p>SpringerLink – https://link.springer.com</p> <p>American Physical Society (APS) Journals – https://journals.aps.org</p> <p>IAEA Publications and Safety Standards https://www.iaea.org/publications</p> <p>Materials Project Database – https://materialsproject.org</p> <p>Zotero Reference Manager – https://www.zotero.org</p> <p>Radiological Society of North America (RSNA) Online Courses</p> <p>Health Physics Society (HPS) Webinars and Webcasts</p> <p>National Nuclear Data Center (NNDC) Online Database</p>
<p>Other Learning Materials</p>	<p>Laboratory manuals and instrumentation guides for radiation detection, spectroscopy, and materials characterization.</p> <p>Software tools: MATLAB, OriginPro, COMSOL Multiphysics, Python (NumPy, SciPy, Matplotlib), and MCNP for radiation modeling.</p> <p>University Research Ethics and Safety Handbook – outlining procedures for radiation safety, laboratory conduct, and research integrity.</p> <p>Workshops and seminars on scientific writing, presentation skills, and data visualization.</p>



Video Lectures and Documentaries: Visual aids can enhance understanding of complex concepts.
Saudi Digital Library (SDL)

2. Required Facilities and equipment

Items	Resources
facilities (Classrooms, laboratories, exhibition rooms, simulation rooms, etc.)	Offices for students
Technology equipment (projector, smart board, software)	A smart board
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	Program Coordinator Dissertation Supervisors Departmental Postgraduate Committee	Indirect
Effectiveness of Students assessment	Examination Committee	Direct
The extent to which CLOs have been achieved	Examination Committee	Direct

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

Assessment Methods (Direct, Indirect)

G. Specification Approval

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

