2025

Curriculum Overview& Study Plan

MASTER OF SCIENCE IN PHYSICS

College of Science

Jazan University

https://jazanu.edu.sa/en

List of Abbreviations and Acronyms

JU	Jazan University
NCAA	National Commission for Academic Accreditation and Assessment
SDL	Saudi Digital Library
ASIIN	The Accreditation Agency for Study Programmes in Engineering, Informatics, Natural Sciences and Mathematics
IT	Information Technology
CES	Course Evaluation by Students
APR	Annual Program Report
PES	Program Evaluation Survey
PLOs	Program Learning Outcomes
APR	Annual Program Report
CLOs	Course Learning Outcomes
SES	Student Experience Survey
IELTS	International English Language Testing System
GPA	Grade Point Average
ECTS	European Credit Transfer and Accumulation System
EHEA	European Higher Education Area
PCC	Program Curriculum Committee
PQC	Program Quality Committee
MScPH	Master of Science in Physics
JULOs	Jazan University Learning Outcomes
JUGA	Jazan University Graduate Attribute

Content

1. About the Program

1.1 Establishment

The Master of Science in Physics program was established at Jazan University as per the decree of the council of higher education, No 9, dated 10/5/1440H (16/1/2019). Jazan University has been fully accredited for the period from October 2018 to September 2025 by the National Commission for Academic Accreditation and Assessment (NCAAA), and then the Physical Sciences Department program has been fully accredited for the period from June 23, 2023 to September 30, 2028 by the Accreditation Agency for Study Programmes in Engineering, Informatics, Natural Sciences and Mathematics (ASIIN).

1.2 Vision

The Physics program at Jazan University aspires to achieve excellence in physics education, scientific research and community service to become a leading Physics Program locally and globally.

1.3 Mission

The Master of Science in Physics program seeks to achieve innovation and excellence in physics education and scientific research to prepare highly skilled graduates who meet the needs of development and society.

1.4 Goals

- Provide high-quality advanced education in diverse fields of physics combined with training to extend the frontiers of physics and encourage innovation.
- Implement high-quality research in interdisciplinary areas of physics, and enhance expertise in theoretical, computational and experimental physics.
- Contribute to the workforce and serving the community.

1.5 Objectives

- Prepare graduate students with knowledge and critical thinking skills applicable to theoretical, computational, and experimental physics research.
- Direct graduation theses to be based on innovative ideas and publishing research and patents.
- Prepare graduate students with communication skills and values through oral presentations, scientific writing ethics, teamwork and lifelong learning.
- Provide physicists who are able to contribute to the workforce and serve society.

The Master of Science in Physics program follows the values of Jazan University.

1.6 Values	
Citizenship	Pride in the national identity and a sense of social responsibility
Belonging	A feeling of commitment and initiative towards the goals and objectives of the University
Responsibility	Adherence to ethical standards and work values
Excellence	The application of standard practices and offering quality services
Capacity Building	Investing in human capital
Teamwork	Promoting cooperation and imbibing the team spirit

1.7 Degree Offered	1.8 Teaching Language
Master of Science in Physics	English

2. Program General Information

2.1 Branches and Locations.
2.2 Resources &Teaching Facilities
2.3 Teaching Strategies.
2.4 Other Facilities.
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2.6 Attendance and Exam Policies.

PROGRAM GENERAL INFORMATION

University	Jazan University
College	College of Science
Department	Physical Sciences
Name of the Program Degree	Master of Science in Physics
Duration of Study	2 Years (4 Semesters)
Total Credit Hours	33 Credit Hours
Total ECTS	120 ECTS
Website of Jazan University	https://jazanu.edu.sa/en
Website of College of Science	https://jazanu.edu.sa/en/colleges/sci
Website of Physical Sciences Department	https://jazanu.edu.sa/en/colleges/sci/psci/msc-phys
Master Program Started on	2020-2021
Expected No. intake	10
Types of Fees	Tution fees/ free scholarships
Contact Person	Head of Department: Dr. Hussain Gebreal Athlawi
Email	hathlawi@jazanu.edu.sa
Telephone	+966 569540133
Postal Address	Department of Physical Sciences, College of Science, Jazan University, Kingdom of Saudi Arabia. PO Box 2097, Zip Code:45142
ASIIN Coordinator	Prof. Ahlam EL-Barbary

2.1 Branches & Locations

The Master of Science in Physics program at Jazan University is offered at the main campus

Main Campus	Place and Location
Male	Campus at University city building
Female	Campus at Mahlia

2.2 Resources &Teaching Facilities

Learning resources play an important role in providing a good learning environment for students. These resources include classrooms, laboratories, library services, information technology, parking, cafeteria, etc. Classrooms are important in teaching as students spend most of their time acquiring new knowledge. These classrooms are well-equipped for both male and female sections with an average capacity of thirty students and are equipped with air conditioning, smart board, internet, student chairs and teacher's desk. There are also two research laboratories, one in the male campus and the other in the female campus. There are three computer laboratories, one in the male campus and two in the female campus. Students can use the shared computers in the library area, or in the computer lab which is equipped with computers and software packages. There are two main libraries, one in the male campus and the other in the female campus. The girls' and boys' libraries have a variety of textbooks, and all libraries are equipped with internet, computer, scanner and printer. The library follows the guidelines of the Deanship of Libraries in borrowing textbooks and working hours. To meet the needs of students and faculty members for textbooks, the Deanship of Libraries is officially contacted by the head of the department to request the textbooks needed for physics programs. There is also the Saudi Digital Library (SDL), which provides effective services that include many databases that include many full texts to compensate for the scarcity of paper books in the library. The Training and Media Department of the Deanship of Libraries is also always launching its electronic training programs to get the most out of its services.

2.3 Teaching Strategies

The Master of Science in Physics program relies on different teaching strategies depending on the learning areas and the type of courses. It is a face-to-face degree, which uses several teaching strategies for each course such as lectures, problem-based teaching, interactive discussion and case studies. To complement the curriculum, the Research and Innovation Unit organizes a webinar Series every semester every semester. Scientists from different parts of the College of Science give lectures on their research, covering different subject areas. Webinars are conducted to give each student the opportunity to attend and ask questions.

2.4 Other Facilities

All faculty and students have email addresses. The IT department encourages the use of email for communication and provides a robust and high-performance network for research, teaching and administrative needs and can be accessed in faculty and administrative staff offices, classrooms and laboratories. There are various infrastructure facilities such as cafeterias, toilets, reading rooms, theater halls, sports rooms and parking for both staff and students, in addition to free wireless internet access. The department provides a printing machine in the secretarial office and a printing machine for some staff and faculty for educational purposes. The University provides various electronic services for students, staff, faculty and visitors such as e-learning, Blackboard, Office 365, Edugate portal, employee affairs services, online university account services, academic calendar, SDL, IT support, ZOOM services, e-registration, graduation degree verification, financial services system, training systems, and loan service application.

2.5 Student admission& academic procedures

STUDENT ADMISSION

The university council determines the number of students admitted each year to graduate studies programs based on the recommendation of the council of the deanship of graduate studies, and the proposal of the departments and colleges concerned in accordance with the Articles No. 43 and No. 45 of graduate studies regulations.

2.5.1 Student Admission

I. <u>STUDENT ADMISSION REQUIREMENTS</u>:

The deanship of graduate studies shall be responsible for the applicants' admission and registration in coordination with the deanship of admission and registration.

1.General Instructions

For admission to graduate studies, the applicant must fulfill the following general requirements:

- Applications are available through the electronic portal and during the specified period for postgraduate programs. No paper applications or any applications will be received after the end of the application period.
- This application is for Saudis only and depends on the applicant's civil registry number. Non-Saudis must have obtained an official scholarship.
- The applicant must pay the application fee of 575 riyals, which is a non-refundable fee, paid through the electronic payment system.
- All admission requirements announced for each program must be met during the application period on the electronic portal, including the general aptitude tests for university students and English language tests.

- The general aptitude test for university students will not be accepted after five years from the date of the test, nor will English language tests be accepted after two years for TOEFL and IELTS, and three years for competencies from the date of the test.
- The applicant uploads all documents in one file in PDF format.
- The applicant can modify his/her application during the application submission period, even after saving the application, through the service (Modify Application for Admission).
- Upon completion of filling out the application, the data and application number are printed or saved.
- The applicant is fully responsible for the accuracy of his/her data and documents entered on the admission portal, and the deanship has the right to cancel his/her application or withdraw his/her acceptance even after he/she has started studying in the case the data is not completed, or the required documents are not uploaded. If the data and documents entered are proven to be incorrect, the university has the right to take the necessary regulatory measures against the applicant.
- Candidates will be contacted to take the tests and be selected for the required programs after completing the data verification procedures and the entered documents.
- Bring the employer's approval after announcing the names of those accepted and the applicant receiving the acceptance notice.
- The applicant must ensure the accuracy of his/her communication data (mobile number - email).
- The student's enrollment in the program will not be considered until he/she is notified of the final acceptance by the deanship.
- The university has the right not to open the program if the required number for the program is not completed.
- The allocation in the thesis or research project system is based on the student's average in the first semester, the opinion of the academic advisor, and the department's capacity.

2.General Requirements

The following are generally required for admission to graduate studies:

- The applicant must be a Saudi or have an official scholarship for graduate studies if he/she is a non-Saudi.
- The applicant must have a bachelor's degree according to the required average for each major at the undergraduate level and have a graduation document and academic record, and the certificate must be equivalent from the Ministry of Education if the qualification is obtained from outside the Kingdom.

- The applicant must be of good conduct and medically fit.
- The applicant must submit two academic recommendations from professors who have previously taught him/her.
- The employer's approval for the study if he/she is an employee.

3. General Documents

The documents required to be uploaded to the website:

- A copy of the national ID.
- Bachelor's degree document.
- Academic record
- General Aptitude Test score for university students.
- English language test score
- Scientific recommendations.

4. Admission requirements for the Master of Science in Physics program

- The applicant must have a Bachelor's degree in Physics with a general grade of no less than C+ " above average" and a grade of no less than "very good" in the specialization subjects from a recognized educational institution and have a graduation document and an academic record that is equivalent to the Ministry of Education if the qualification is obtained from outside the Kingdom.
- The applicant must have obtained a minimum of (70) points in the General Aptitude Test for University Students.
- The applicant must have obtained (4) in the International English Language Testing System (IELTS) test or its equivalent.
- The applicant must pass the comparison criteria conducted by the department.
- The applicant must pass the supplementary subjects that the department deems necessary to join the program, provided that the added and non-financially affected are treated in accordance with the decisions of the university council.
- Payment of the program application fee of five hundred and seventy-five riyals (575 riyals) including the value of the value-added tax and is non-refundable
- Payment of any other service fees.
- Any other conditions at the time by the permanent committee for graduate Studies.

II. SUPPLEMENTARY COURSES

The student may be accepted in a field other than his/her field of specialization based on the recommendation of the relevant department council and the approval of the college council. The relevant department may require that the student pass a number of supplementary exams in a previous stage or pass a related learning outcomes test in order for the student to be eligible to join the program according to the controls approved by the permanent committee based on a proposal from the department council and the approval of the college council in accordance with Article No. 17 as follows:-

- The scientific department approves the supplementary courses that it deems necessary from the bachelor's stage.
- The period for passing the supplementary courses is not included in the subject specified for obtaining the degree.
- The supplementary courses are not included in calculating the cumulative average for the graduate stage.
- The department may authorize registration in the graduate program courses for those who have passed 75% of the supplementary course units.
- Those who did not pass the supplementary courses due to compelling circumstances may reapply for admission to the same specialization with the possibility of calculating the supplementary courses that the student previously studied during the first admission.
- The examination of learning outcomes related to supplementary courses may include local or international standardized tests based on the proposal of the department council, the approval of the college council, and the approval of the permanent committee.

III. COURSES EQUIVALENCY

It is permissible to equate academic courses that the student has previously passed at a university or educational institution inside or outside the Kingdom, provided that they are licensed in the country of study based on the recommendation of the department council and the approval of the college council. The academic courses that have been equated shall be recorded in the student's academic record. The university council determines the controls regulating this, including the possibility of calculating them within the student's cumulative average in the academic record, taking into account Articles 30 and 31 of the graduate studies regulations. The following conditions shall be required for the equating of the academic courses:

- The number of academic units must not be less than the number of academic units for the corresponding courses in the program to which he/she is transferred.
- The academic content of both courses must match by at least 75%.

- The course grade must not be less than very good in any of the courses to be equated.
- The course to be equated must not have been studied more than three years ago.
- The percentage of academic units for the courses to be equated must not exceed 30% of the units of the study plan for the program.
- The equivalence shall be upon the recommendation of the department council to which the course belongs and the approval of the college council.
- The course grade is calculated after approval of its equivalence within the cumulative average in the academic record.

2.5.2 Academic procedures

I. POSTPONEMENT OF STUDY

With the approval of the relevant department council and the dean of the college, the student may postpone his/her acceptance for one time. The postponement cannot be accepted after the student has started his/her studies according to the controls approved by the university council, based on the proposal of the permanent committee. Postponement requirements according to the graduate studies regulations, Article No. 20, are as follows:

- The accepted student, if he/she wishes to postpone his/her acceptance, must fill out the amended form for that purpose and the postponement request must have convincing justifications.
- Requests for postponement of acceptance are approved according to the academic calendar for graduate studies and scientific research, provided that the postponement period does not exceed one academic year and is not counted within the maximum period for obtaining the degree.
- The student whose acceptance is postponed after the end of the postponement period and the resumption of his/her studies is subject to the administrative procedures, academic requirements and scientific requirements that apply to the graduate studies program and its students in the year of resuming study.
- In case of suspension of the program, the student's postponement is extended until the program is resumed, even if the suspension extends for more than one academic year, provided that he/she studies at the first opportunity in which the program is opened or for a period not exceeding two academic years.

II. APOLOGY FOR ONE OR MORE COURSES

The student may apologize for continuing to study one or more courses or all courses of the semester after the end of the registration period based on the recommendation of the relevant department council and the approval of the dean of the college in accordance with the controls approved by the university council based on the proposal of the permanent committee. Requests to apologize for continuing to study one or more courses or all courses of the semester will be accepted according to the academic calendar for graduate studies and scientific research and in accordance with Article No. 23 as follows:-

- The request for apology is submitted according to the academic calendar for graduate studies and scientific research and to the permanent committee in cases of necessity for exemption from this period based on the recommendation of the department council and the approval of the dean of the college.
- There must be justifications for the apology to be accepted by the department.
- This semester must not be among the additional opportunities or opportunities to raise the cumulative average.
- The total period of apology and postponement must not exceed two academic years.
- The semester in which the student is exempted from all courses is counted within the period of postponement and apology in accordance with Article No. 22 of the graduate studies regulations.
- The financial treatment of the course or courses for which an apology is made (financial compensation) is according to the approved financial controls.
- The apology semesters are counted within the maximum period for obtaining the degree.
- The student is not entitled to apologize for one or more of the supplementary courses.
- The student has the right to submit a request to apologize for one or more courses during the semester, provided that the number of approved academic units registered for the student after the apology is not less than three credit units.
- The number of times the student is exempted from one or more courses does not exceed two times as a maximum during the academic stage.
- In the case of an apology for one or more courses, the academic department is not obligated to offer the course in the following semester.

III. WITHDRAWAL, DISCONTINUITY AND CANCELLATION

If a graduate student withdraws from the university and then wants to re-enroll, the university may apply the admission requirements to him/her at the time of the new application according to Article No. 24 of graduate studies regulations. The student is considered to have discontinued his/her studies if he/she does not register during the specified period for registration in each semester in which he/she is available to register in accordance with Article No. 25 of graduate studies regulations. The students' registration can be cancelled in accordance with Article NO. 26 in the following cases:

- If he/she discontinued his/her studies in accordance with the Article 25 of the graduate studies regulations:
- If he/she did not pass the supplementary courses according to the controls approved by the permanent committee.
- If his/her cumulative average falls below a very good rating in two consecutive semesters.
- If it becomes clear that his/her acceptance is based on his/her submission of completely or partially incorrect information or documents.
- If he/she does not obtain the academic degree within the specified period for the program

Also, the students' registration is cancelled by a decision of the permanent committee based on the recommendation of the department council and the approval of the college council in the following cases:

- If it is proven lack of seriousness in the scientific thesis stage.
- If he/she did not pass the comprehensive exam after being allowed to repeat it once.
- If the examination committee on the scientific thesis decides that it is not suitable for discussion or not accepted after the discussion
- If he/she violates academic integrity, whether during the stage of studying the courses or during his/her preparation of the scientific thesis or violates the relevant regulations, bylaws or decisions.

IV. RE-REGISTRATION

A student whose registration has been cancelled may be re-enrolled if the obstacle preventing him/her from continuing his/her studies is circumstances acceptable to the department council and the college council. Re-enrollment shall be by decision of the permanent committee in accordance with Article NO. 27, taking into account the following:-

- A student who has completed more than three academic years ago shall be treated as a new student in terms of re-studying courses regardless of the previous stage of study. The university council may make an exception to this in accordance with controls issued by the university council based on a proposal from the permanent committee.
- A student whose registration was cancelled three years ago or less shall re-study some courses determined for him/her by the department council and approved by the college council. The units he/she studied after re-excusing his/her studies shall be counted within his/her cumulative average. The period the student spent studying before his/her registration was cancelled shall also be counted within the maximum period for obtaining the master's degree.

V. TRANSFER

TRANSFER TO JAZAN UNIVERSITY

The student's transfer to the university will be accepted from a university or educational institution inside or outside the Kingdom, provided that it is licensed by the competent authority in the country of study, and that he/she has not been dismissed from it for any reason based on the recommendation of the department and college councils. The courses that have been equated will be recorded in the student's academic record, and the university council determines the controls regulating this, including the possibility of calculating them within the student's cumulative average in his/her academic record.

According to Article No. 30, transfer requests to the university must meet the following requirements:

- General conditions for admission to the university.
- Conditions for admission to the program to which the transfer is requested and any other conditions deemed by the department.
- The student must have passed at least one semester at his/her university from which he/she is transferring.
- The student's cumulative average must not be less than 3.75 from 5 or its equivalent.
- The academic department must specify the courses that can be equated when requesting a transfer.

A graduate student from a non-Saudi group may study some courses at a Saudi university according to the regulations approved by the university council based on the proposal of the permanent committee, in accordance with Article 33 of the graduate studies regulations.

TRANSFER WITHIN THE UNIVERSITY

A student may be transferred from one program to another within the university based on the recommendation of the department council to which he/she will be transferred and the approval of the college in accordance with the terms and conditions approved by the university council based on the proposal of the permanent committee. The following conditions must be met for transfer requests from one program to another within the university, in accordance with Article No. 31:-

- Admission requirements for the program to which he/she is requested to transfer and any other conditions deemed by the department.
- The student must have passed at least one semester at his/her university from which he/she is transferring.
- The student's cumulative GPA must not be less than 3.75 from 5 or its equivalent.
- The academic department shall specify the courses that can be equated when requesting a transfer.
- The transfer from one program to another shall be for one time during the period specified for obtaining a master's degree.

TRANSFER TO A UNIVERSITY INSIDE OR OUTSIDE THE KINGDOM

A graduate student may, based on the recommendation of the department council and the approval of the college council, study some courses at a university or educational institution inside or outside the Kingdom, provided that they are licensed in the country of study, and that the academic units he/she has studied are equated to him/her. The courses that have been equated are recorded in the student's academic record, and the university council determines the controls regulating this, including the possibility of calculating them within the student's cumulative average in his/her academic record in accordance with Article No. 32.

2.5.3 Thesis

THESIS AND ITS REQUIREMENTS

The university council sets the rules governing the registration of the scientific thesis of the graduate student and the mechanism for determining the supervisor of the scientific thesis and the assistant supervisor, if any, based on the recommendation of the permanent committee.

I. Registration of the scientific thesis

The procedures of scientific guidance

- Each graduate student shall have a scientific advisor at the beginning of his/her enrollment in the program to guide him in his/her studies and assist him/her in choosing the thesis topic and preparing the research plan.
- Passing the research plan “research seminar course” is a requirement for registering the scientific thesis.

The procedures for registration of the thesis

- A graduate student may, after passing at least 50% of the academic courses and a cumulative average of no less than very good in the master's stage, submit the research plan for the scientific thesis topic to the department based on the approval of the scientific advisor.
- After a recommendation for approval, the department council proposes the name of the thesis supervisor and the assistant supervisor, if any, and this is submitted to the college council for approval.
- The research plan is submitted after its approval to the deanship of graduate studies and scientific research.
- If the student needs to make a fundamental amendment to the approved research plan or to the title or if the amendment exceeds 25%, he/she submits a request for amendment to the department based on the approval of his/her supervisor and submits it to the college council for approval.

II. Scientific Supervision

The selection of the scientific supervisor

- The scientific thesis is supervised by professors and associate professors, and the subject of the thesis must be in the field of specialization of the supervisor. The assistant professor may supervise scientific theses in accordance with Article No. 38 of the regulations of graduate studies at Jazan University, which states that “the assistant professor supervises scientific theses if he/she has two research papers in his/her field of specialization that are published or accepted for publication in a peer-reviewed scientific journal.”

The procedures for defense

- The discussion committee shall prepare a report signed by all its members and submitted to the department head within one week of the date of the discussion (Article No. 50),

The criteria for evaluation and approval of the thesis

1. Accepting the thesis and recommending awarding the degree.
2. Accepting the thesis with some amendments, without further discussion. One of the members of the discussion committee shall be authorized to recommend awarding the degree after ensuring that these amendments have been taken into account within a period not exceeding three months from the date of the discussion. The college council may make an exception to this, provided that it does not exceed six months from the date of the discussion Council.
3. Completing the deficiencies in the scientific thesis, and the committee will rediscuss it within the period specified by the college council, based on the recommendation of the relevant department council, provided that it does not exceed one year from the date of the discussion.
4. Not accepting the scientific thesis. Each member of the discussion committee on the scientific thesis has the right to submit any opposing views or reservations he has in a detailed report to the head of the department within a period not exceeding one week from the date of the discussion, and it will be submitted to the dean of the college with the report of the discussion committee.

2.6 Student Advising Policy

The academic guidance and counseling services in the department of physical cciences at Jazan University provide academic guidance (through the academic advisor), career guidance (through the graduates committee), educational and personal guidance to help students achieve the best results, adapt to the university environment and take advantage of opportunities. The department follows the university's guidelines, guides students, handles student complaints, and organizes refresher courses. It assists students in the decision-making process in their academic journeys without imposing personal preferences, as well as knowing the latest university policies, rules and regulations. The student guidance and academic counseling committee is responsible for student guidance. A group of students are assigned to each college for guidance. Faculty members are available for student guidance during specific working hours every day. The department, together with the college administration and the deanship of students, tries to create suitable conditions for the study of students and applicants with special needs without reducing the requirements for their academic performance and in accordance with the principles of equal treatment, in addition to determining the exam and the method of taking it according to their special needs.

- Supervisors with experience in the field of scientific thesis research from outside the faculty members, whether from inside or outside the university, may supervise or assist in supervising scientific theses based on the recommendation of the department council and the approval of the college council (Article No. 39).
- The supervisor, whether alone or jointly with others, has the right to supervise a maximum of seven scientific theses at one time. The permanent committee may make an exception to this, based on the recommendation of the department and college councils, in accordance with controls approved by the university council based on the proposal of the permanent committee (Article *No. 45*). The supervision quota for a faculty member, whether head or assistant, for each thesis is calculated within the teaching load, according to controls approved by the university council based on the proposal of the permanent committee (Article No. 46).

The procedures/mechanisms of the scientific supervision and follow-up:-

- The supervisor evaluates the student's performance at the end of each semester and determines the extent of his/her progress in the scientific thesis, according to the mechanisms approved by the permanent committee (Article *No. 42*). If it is proven that the student is not serious in the thesis stage - based on the report of the thesis supervisor- the student will be warned by a letter from the relevant department. If the student is warned twice and does not address the reasons for the warning, his/her registration will be cancelled, based on the recommendation of the department and college councils Committee (*Article No. 44*).

The regulations for selection of the defense/examination committee

- A committee is appointed to discuss the scientific thesis by a decision of the college council, based on the recommendation of the department council (*graduate studies regulations No. 48*). The University Council sets the criteria for selecting members of the master's dissertation discussion committees and the mechanism for conducting these discussions, based on the proposal of the permanent committee council (*Article No. 49*).

The requirements to proceed for thesis defense

- After the student has completed preparing the thesis, the supervisor of the thesis shall submit a report on its completion to the head of the department, attaching a copy of the thesis, in preparation for completing the discussion procedures determined by the college council (*Article No. 47*).

2.7 Attendance and Exam Policies

According to the graduate studies regulation, Article No. 34, examinations and grades in graduate courses are in accordance with the study and examination regulations for the undergraduate stage, except for the student's pass with a grade of no less than C+ and his/her cumulative average in all courses is no less than very good (B). As for alternative examinations, the college council shall take what it deems appropriate regarding them based on the department's recommendation.

Gradual points:-

The Master of Science in Physics follows an evaluation system that is consistent with the University's policies and is almost the unified system followed in higher education institutions around the world. The student obtains the degree in the form of marks out of 100. The marks are converted into letter grades and gradual points as shown in Tables 1 and 2. The student is assigned a cumulative grade point average (GPA) in each semester, and a cumulative grade point average is assigned to him at the end of the academic year as shown in the following examples:

Table 1: The grading system at Jazan University

Grade Points	Letter Grade	Grade Description	Marks out of100 Letter
5	A+	Exceptional	95-100
4.75	A	Excellent	90-less than 95
4.5	B+	Superior	85-less than 90
4.0	B	Very Good	80-less than 85
3.75	C+	Above average (Pass)	75-less than 80
3.5	F	Fail	Less than 75

Table 2: GPA (Grade Point Average) calculation method for first semester

Courses	Credit Hours (C.H.)	Marks	Obtained Course Grade	Quality Point / Credit Hour (Q.P./C.H.)	Computed Quality Points (C.H. x Q.P./C.H.)
PHYS600	3	96	A+	5	15
PHYS601	3	81	B	4	12
PHYS602	3	85	B+	4.5	13.5
Total	9				40.5
Computed GPA for the First Semester = Computed Quality Points/ Credit Hours = 40.5 / 9 = 4.5 (out of 5.00)					

Duties of a member of the examination supervisory committee

- Follow up on the progress of the exam.
- Follow up on the attendance and departure of the members of the examination committee.
- Visit the examination halls periodically to ensure that the exams are proceeding properly.
- Solve any problems that students may face during the course exam.
- Receive examination progress reports for each hall from the examination committee.
- Communicate with the head of the examination committee and the relevant authorities in the college as needed.
- Prepare and sign the minutes of the examination period.
- Submit examination progress minutes to the head of the examination committee.

Duties of the invigilator

- Each invigilator must arrive at the examination committee headquarters twenty minutes before the start of the examination to sign attendance and receive student attendance sheets and examination progress reports.
- Receive exam questions and answers from the course instructor.
- Verify the student's ID card before distributing the examination paper.
- Inform students of the examination instructions.
- Prevent the circulation of examination tools (calculator, ruler, pen, etc.) among students and do not allow students to enter the examination after half an hour from the start time.

- No student is allowed to enter the examination hall if her/his name is not registered in the attendance sheet, nor is the deprived student.
- Ensure that the student writes all the required data on the cover of the answer sheet.
- Sign the students' attendance sheet after filling in all the required data.
- Count the students present and absent and record the data of the absent students in the examination progress report.
- In the event of cheating, a cheating report form is prepared for this purpose and signed by the invigilators and one of the members of the examination committee, then submitted with all documents proving the case of cheating (if any) and the student's answer sheet.

Duties of the course professor

- Prepare the exam paper envelopes and write the necessary information on the envelopes such as the name of the course, the course code, the number of answer sheets, the name of the professor, the phone number, etc.
- Come to the examination committee headquarters to sign the attendance sheet ten minutes before the exam time.
- Write all the exam instructions on the exam paper.
- Do not enter the examination hall during the exam.
- Receive the answer sheets and student attendance sheets from the supervisor immediately after the exam.

3. Employment Outlook

3.1 Graduates skills
3.2 Consistency of Program and JU Graduates attributes

3. Employment Outlook

Graduates of the Master of Science in Physics at Jazan University obtain a degree with multiple career paths.

- Graduates can participate in research and development in the private or public industrial sector: water stations, geology organization, electric power stations and petroleum factories.
- Graduates can teach physics at high school (public and private).
- Graduates can work at Research centers and Universities.
- Graduates can work at Laboratories.
- Graduates can complete their higher education in physics, PhD.

Graduates of Jazan University have a set of characters (JUGA) and features as shown below:

JUGA1: Research and knowledge inquisitiveness and practical application of knowledge:

- Graduates show a comprehensive and extensive knowledge of specialization and an understanding of the link of specialization with other areas through the practical application of knowledge and continuous self-learning.

JULGA2:The ability to solve problems and make decisions:

- Identifying problems by critical analytical thinking and solutions using creative thinking, and is able to evaluate opinions and make informed decisions.

JULGA3: Commitment to values, ethics and responsibility

- Committed to professional ethics, Islamic and community values, social responsibility through good citizenship and community service as well as responsibility, appreciation of cultural diversity and respect for other cultures.

JUGA4: Effective communication

- Graduates can communicate effectively and in writing.

JUGA5: Digital communication

- The graduate is able to access, evaluate and use information effectively and efficiently and creatively in sustainable learning, scientific research, and effective communication.

JUGA6: Leadership and teamwork

- Graduates can lead teams and guide them towards achieving the desired goals, and work to develop entrepreneurial ideas and projects in self-determination and in cooperation with others.

JUGA7: Professional Scientific ethics

- Graduates are aware of all scientific ethics.

3.1 Graduates skills

Table 3: Characterization of Master of Science (MSc) in Physics program

Category	Employment Skills	Description
Specialist	Deep knowledge of areas of specialization	Comprehensive knowledge and understanding of their field of specialization, and the ability to apply their knowledge in practical practice.
Critical/ innovator	Critical and creative thinking	The ability to solve problems effectively and can apply critical and creative thinking to come up with innovative responses to future challenges.
Active	Effective Teamwork and Communication	The ability to communicate effectively with others.
Leader	Leadership and Responsibility	Ability to take leadership roles in their chosen occupations or careers and communities.
Honest	Integrity and professional ethics	Cultural and Ethical Competence: Committed to integrity and professional ethics in various fields.
Researcher	Scientific research	Follow the scientific method in research work, conduct original and distinguished scientific research in the field of specialization, participate in research projects in the field of specialization and produce scientific research and publish it in accredited journals.
Self-taught	Digital and lifelong learning	The ability to access and use information in lifelong learning, scientific research and communication.

3.2 Consistency of Program and JU Graduates attributes

Master of Science in Physics graduates have employability skills that align with Jazan University graduate attributes and job skills needs. The following Table shows the characterization of graduates of Master of Science in Physics program.

Table 4: Consistency of Master of Science (MSc) in Physics program and JU graduates attributes (JUGA)

MScPH	JUGA1	JUGA2	JUGA3	JUGA4	JUGA5	JUGA6	JUGA7
Specialist	✓						
Critical/ innovator		✓					
Active				✓			
Leader						✓	
Honest			✓				✓
Researcher							✓
Self-taught					✓		

4. Learning Outcomes

4.1 Program Learning Outcomes (PLO's).
4.2 JU Learning Outcomes (JULO's).
4.3 Consistency of PLO's with the University Learning Outcomes.
4.4 Courses and Program Learning Outcomes Mapping.
4.5 Assessments Plan of LO's.

4.1 PROGRAM LEARNING OUTCOMES (PLO'S)

Table 5: The Program learning outcomes of Master of Science in Physics

Code	Program Learning Outcomes	Teaching Strategies
Knowledge and Understanding "upon completion of the program, students will be able to" :		
K1	Describe theories, techniques, practices, materials, and terminology relevant to physics topics	Lectures, Tutorials, and Interactive discussions.
K2	Discuss physical phenomena and their recent developments in various research fields.	Lectures, Tutorials, and Interactive discussions.
Skills "upon completion of the program, students will be able to" :		
S1	Apply theories and creative solutions to solve physical problems	Lectures, Problems, and Interactive discussions
S2	Build critical thinking skills to provide reasonable justification analysis.	Lectures, Problems, and Interactive discussions
S3	Demonstrate abilities in qualitative and quantitative methods for analyzing and reporting data using computational and IT tools.	Lectures, Problems, Presentation, Written essay, Interactive discussions, and Seminars.
S4	Develop sufficient skills to conduct advanced experimental work and high-level graduate research (theoretical and experimental).	Hands -on practice, Expository discovery and Interactive discussions
Values, Autonomy and Responsibility "upon completion of the program, students will be able to" :		
V1	Adhere to the ethical principles and safety requirements.	Hands -on practice, Expository discovery and Interactive discussions
V2	Demonstrate the ability of independent lifelong learning.	Expository and Discovery, and Interactive discussions.
V3	Show effective individual responsibility and teamwork.	Expository and Discovery, and Interactive discussions.

4.2 JU LEARNING OUTCOMES (JULO'S)

JULO1
Analyze and explain theories, concepts, principles, skills and practices in different disciplines (knowledge and understanding).

JULO2
Apply the skills and ethics of scientific research, innovation and creativity efficiently (skills).

JULO3
Apply knowledge by accomplishing practical skills brilliantly (practical skills).

JULO4
Apply independent and critical thinking innovatively to solve complex problems (skills).

JULO5
Demonstrate leadership qualities and skills needed to communicate effectively with others orally and written in a sound language (skills and values).

JULO6
Apply sustainable learning skills in all scientific and community aspects on environmental, economic and social issues (values).

JULO7
Promote the concept of community responsibility towards scientific and life issues (values).

JULO8
Commit to professional and ethical behaviors and show team spirit (values).

4.3 Consistency of PLO's with the JU Learning Outcomes

Table 6: The consistency of PLOs for Master of Science (MSc) in Physics program with Jazan University (JU) learning outcomes

MSc in Physics	JU LO2	JU LO2	JU LO3	JU LO4	JU LO5	JU LO6	JU LO7	JU LO8
PLO1.1	✓							
PLO1.2	✓							
PLO2.1				✓				
PLO2.2				✓				
PLO2.3		✓	✓					
PLO2.4			✓					
PLO3.1					✓			✓
PLO3.2						✓	✓	
PLO3.3								✓

4.4 COURSES AND PROGRAM LEARNING OUTCOMES MAPPING

Table 7: The course and program learning outcome mapping

Course Code & NO.		Program Learning Outcomes								
		Knowledge and Understanding		Skills				Values, Autonomy, and Responsibility		
		K1	K2	S1	S2	S3	S4	V1	V2	V3
Mathematical Physics	PHYS600	I	I	I		I				I
Classical Mechanics	PHYS601	I	I	I					I	I
Classical Electrodynamics	PHYS602	P		P	P	P				P
Quantum Mechanics	PHYS603	P		P		P				P
Statistical Mechanics	PHYS604	M	M	M					M	M
Computational Physics	PHYS610		M	M	M	M				M
Physics Laboratory	PHYS611	M	M			M	M	M		M
Atomic and Molecular physics	PHYS620	M	M	M	M				M	
Quantum Optics	PHYS621	M	M	M					M	
Plasma Physics	PHYS622	M	M	M					M	M
Solid State Physics	PHYS640	M	M	M						M
Materials Science	PHYS641	M	M	M	M	M				M

Continue with Table 6:		Program Learning Outcomes								
Course Code & NO.		Knowledge and understanding		Skills				Values, Autonomy, and Responsibility		
		K1	K2	S1	S2	S3	S4	V1	V2	V3
Magnetism and Superconductivity	PHYS642	M	M	M					M	M
Nuclear Structure and Spectroscopy	PHYS650	M	M	M					M	
Radiation Physics	PHYS651	M	M	M					M	
Quantum Field Theory	PHYS660	M		M						M
Particle Physics	PHYS661	M	M	M		M			M	
Special Topics in Physics	PHYS665	M	M	M	M	M				M
Research Seminar	PHYS695	M	M	M	M	M	M	M	M	
Thesis	PHYS699	M	M	M	M	M	M	M	M	M

(I = Introduced P = Practiced M = Mastered))

4.5 ASSESSMENTS PLAN OF LO'S

1. PROCESS

NCAAA regulations and forms apply to all documents. Internally, the Physical Sciences Department periodically reviews its entire curriculum, re-evaluates textbooks, monitors national curriculum trends, and studies the distribution of course grades each semester. Additionally, faculty participate in and review examinations, regularly collect student evaluations of teaching, assess learning outcomes for each course, and report the scores of CLOs each semester from various tests. The Physical Sciences Department also periodically collects annual feedback from alumni and employers.

2. DATA COLLECTION

In collecting data, a balance was pursued between cost (time, money, etc.) and usefulness of the data while not placing unreasonable demands on faculty, University resources, students, and alumni.

3. CURRENT PRACTICES

The Plan-Do-Check-Act (PDCA) loop is used in all the process starting from planning tol implementation.

Plan-Do-Check-Act (PDCA) loop

4.PLAN

4a. PLOs Assessment Plan using CLOs: Data is collected and evaluated each year to assess learning outcomes. An improvement plan report is then prepared including a list of minor and major changes based on the results of the learning outcomes assessment and their associated learning outcomes. Minor changes can be implemented during the assessment cycle while major changes can be implemented by the end of the assessment cycle timeline.

4b. The CLOs are identified with the participation of all instructors and consideration of the main topics and concepts of the courses. The CLOs are mapped to the PLOs to ensure that the CLOs contribute to the PLOs at different levels in the program.

4c. Course Assessment Plan: Each instructor develops a course-based assessment plan (as described in the course specifications) that describes the assessment methods that will be used to assess the CLOs in order to accurately measure and evaluate learning outcomes. In other words, course-level assessment methods (tests, assignments, homework, etc.) are designed to assess and evaluate the extent to which each of CLO has been achieved.

5.DO

5a. Teaching Strategies Plan: In the course specifications, appropriate teaching strategies and other instructional practices (lecture, group discussion, etc.) are identified and will be followed during teaching. These teaching strategies are aligned with the CLOs and support the needs of the students. The CLOs assessment methods, and teaching strategies are an integrated learning and teaching process.

5b. Design of Course Assessment Methods: To accurately measure the level of achievement of the CLOs, all questions are designed according to the CLOs. In other words, instructors align the questions of all course assessment methods with the CLOs. Moreover, the difficulty levels of the questions should be highly consistent with the level of learning in the CLOs. For example, introductory information is mostly related to the knowledge and understanding levels while application, analysis, and design are linked to skills levels.

5c. MSc in Physics Strategy for Selecting Assessment Methods

Use multiple methods to assess each learning outcome, including direct and indirect measures, qualitative and quantitative measures, and passive and active assessment methods. Choose what to observe or measure. Prioritize objectives/outcomes, be flexible, use what has already been accomplished, and allocate time for assessment

5d. Procedures for Selecting Assessment Methods for Each Learning Outcome:

The assessment method should be consistent with the outcome to be assessed. Criteria are defined in terms of scores out of 5, percentages, averages, or other quantitative measures.

5e. Conducting Assessment and Collecting Data:

Student performance is then collected through exams, assignments, projects, theses, etc. at the course level. More specifically, their performance on questions related to the CLOs should be observed and analyzed in each course.

6a. Evaluation Results:

Instructors evaluate students' performance according to CLOs. In other words, student grade reports are prepared for each CLO. By the end of the semester, the instructors prepare the CLOs. An Excel template has been prepared to make the process clear and straightforward and includes data analysis for all types of tests and activities to obtain grades and student achievements in all CLOs with graphical representation.

6b. The quality unit should be responsible for analyzing and interpreting the data. It is important to summarize the results in a way that can be reviewed and actions needed to improve the program are identified. Based on the context, objectives are set as shown in Table 8. Furthermore, the corresponding PLOs achievements are calculated at the course level using the CLOs to PLOs mapping and the CLOs achievement report.

6c. Finally, the achievements of the program's PLOs are calculated using students' performances in CLOs. Master of Science in Physics is planning to implement the following methods:

- The method of factoring contribution of all courses (weight % to course based on the level of learning domain and level of the program), it is the most accurate and consistent with % of learning domains in the program.
- The method of selective contribution from Thesis and some required and elective courses.
- The PLO is achieved if the average of the overall achievements score is >=3.75 and the % of students who exceeded 75% is 80% and above.

Table 8: The key to the schemes used

Schemes	Scored	% of student's achievement (the % of students who get or exceeded 75%)
Exemplary(E)	5	>=90
Satisfactory (S)	4	from 85 and < 90
Adequate(A)	3	from 80 and < 85
Meet the criteria	2	from 75 and < 80
Unsatisfactory (U)	1	< 75

7. ACT

7a. Designing Improvements:

Using the results of the CLOs and PLOs evaluation, it is now important to design a set of improvements to improve the quality of the program. The improvements are designed by the end of each year. More specifically, each instructor uses the results of the CLOs and PLOs evaluation to prepare a course report that contains a list of actions to improve the curriculum, syllabus, course delivery, and instructor performance. In addition, the Program Curriculum Committee (PCC) meets with the Program Quality Committee (PQC) with faculty and agrees on a list of minor and major improvements. Minor actions can be implemented at any time during the evaluation cycle and may affect any aspect of the program (teaching strategies, examinations, guidelines, policies, etc.). However, major improvements are reserved for later discussion and approval. Cumulative major improvements are discussed with other stakeholders for final approval by the end of the evaluation cycle. The key components of our improvement plan using the CLOs evaluation data are the actions to be taken, the person or unit responsible, the timeline (start date and deadline), and the type of actions (major or minor).

7b. Implementing Improvements

The department head then distributes the improvement plan designed in the previous point to the responsible persons for further action. The Quality Committee monitors the implementation of the improvement plan.

The CLOs assessment method has many advantages such as direct assessment of PLOs, faculty involvement in the assessment process, ease of implementation, and continuous improvement process based on the semester. However, there are still some limitations related to the validity of the data and the accuracy of the assessment results because students' grades in the courses may be affected by the diversity of the instructors. To enhance the assessment of PLOs using CLOs, a set of procedures was implemented:

- The main procedures are based on cumulative results over an assessment cycle rather than single semester data.
- Ensure that the learning perspective is oriented towards learning outcomes.
- Appoint a faculty member for each course as a course coordinator in case the same course is taught by more than one faculty member as in the case of research seminar course, and special topics in physics. The main role of the course coordinator is to ensure that the same curriculum (content, topics, and classification) is followed for instructors at the same course. The course coordinator also reviews the assessment methods at the course level to ensure that they are appropriate for the CLOs.
- Regularly review the alignment of CLOs with PLOs to ensure better improvement.

- Follow a unified grading policy and system to ensure that students' knowledge and skills are represented by the grade.
- Improve the mechanism for distributing courses to teachers to ensure that the right teachers with good experience are teaching the right courses.
- At this stage of the continuous improvement cycle, planned changes should be implemented.

7c. Implementing changes:

Changes may be proposed to any or all the following: -

- **Assessment Plan:** Review the statement(s) of CLOs and the methods of measurement.
- **Curriculum:** Review prerequisites, course sequence, course content, and add/drop course(s).
- **Academic Operations:** Change of teaching staff, implementation of additional training, etc.

PROVIDE FEEDBACK

The results and information obtained should be distributed to faculty and other stakeholders to obtain their ideas on how to improve the program. Faculty will link the results to educational/curricular initiatives and will assess the degree of alignment between them and the program goals and CLOs. The evaluation results will be used to initiate work aimed at improving the program.

Table 9: The frequency of assessment

Assessment type	Frequency	Stakeholder involved	Performance Targets	How data is collected	Evaluation results (analysis)
CLOs	• Every semester	• Students • Faculty	• 3.75 / 5 with 80% exceeding the level of 75%	• Course reports	Quality Committee
PLOs	• Every year • Every assessment cycle	• Students • Faculty • Alumni • Employer	• 3.75 / 5 with 80% exceeding the level of 75%	• Course files • Rubrics • Surveys	Quality Committee

5. Program Structure

Program Workload and Credits

5.1 GENERAL OUTLINES

The Master of science in physics requires 33 Credit Units with at least grade of B " very good" (cumulative grade 4 of 5 with % >=80), according to the Postgraduate Studies Regulations No. 54.

5.2 ECTS

The European Credit Transfer and Accumulation System is the process of accumulating credits awarded for achieving learning outcomes for educational components in formal contexts and for other learning activities undertaken in informal and non-formal contexts. A student may accumulate credits towards qualifications, as required by the awarding institution and to document personal achievements for lifelong learning purposes. For Master of Science in Physis program, students complete 120 ECTS points upon completion of the program. The ECTS system is a benchmark for comparing academic achievement and student performance across the European Higher Education Area (EHEA) and making studies and courses more transparent. It helps students move between countries and gain recognition for their academic qualifications and study periods abroad. The ECTS points express the cumulative load based on the defined learning outcomes and the workload associated with them.

Workload is an estimate of the time an individual would normally need to complete all learning activities such as lectures, seminars, projects, practical work, internships and individual study required to achieve specified learning outcomes in formal learning environments. The typical full-time workload for a two-year full-time Master of Science in Physics is 120 credits and the workload is 3360 hours. It should be recognized that this represents an average workload and that the actual time to achieve learning outcomes for individual students will vary.

Self-Learning Calculation

1. Multiply each contact hour by 15 (the official week number of the semester) to obtain learning hours.
2. Each contact hour is considered 50 minutes according to the University rules.
3. For most courses of the program, it was found through student surveys that each contact hour requires approximately 3 to 4 hours of teaching, except for the research seminar course and Thesis where each contact hour requires 5 hours.
4. Add all the learning hours together with exam preparation times, homework, lab reports, case studies, etc. to obtain the total learning hours spent by the student on the course.
5. Divide the learning hours (workload) by 28 to obtain ECTS points:

ECTS equivalent points = Total workload / 28

5.3 CURRICULUM

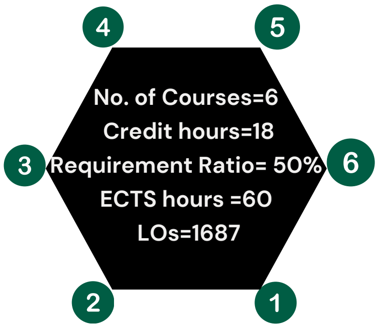
Table 10 shows the program requirements of Master of Science in Physics. program.

Table 10: The curriculum of Master of Science in Physics program

Requirements	Credit Hours	Workload	ECTS	Ratio %
6 Compulsory Courses	18	1687	60	50%
3 Elective Courses	9	840	30	25%
Thesis	6	829	30	25%
Total	33	3360	120	100%

If the total ECTS hours for the three elective courses is less than 30 hours, the remaining hours have to be fulfilled by attending or presenting at workshops or conferences.

- **The curriculum of the Master of Science in Physics program** is designed for two years, four semesters and consists of 33 credit hours, which is equivalent to 120 ECTS points, with sixty ECTS credits for compulsory and thirty ECTS for elective courses, and thirty ECTS credits for the master's thesis. Ideally, students should take 3 courses each semester during the first 3 semesters and begin their thesis in the fourth semester while completing their studies within 2 years. In the Master of Science in Physics program, there are six compulsory courses (Mathematical Physics, Classical Mechanics, Classical Electrodynamics, Quantum Mechanics, Statistical Mechanics and Research Seminar), three elective courses out of thirteen elective courses (which can be chosen according to the students' areas of interest) and the thesis. Electives include, for example, courses such as " Computational Physics", "Quantum Optics", "Magnetism and Superconductivity ", "Particle Physics", " Selected Topics in Specialized Physics", etc.
- **Compulsory and elective courses** are designed to provide students with the theoretical knowledge, practical and modelling abilities necessary for different disciplines in physics research in theoretical, experimental and modelling areas. In the first semester, students take the first three compulsory courses: Mathematical Physics, Classical Mechanics, and Classical Electrodynamics. Then, in the second semester, students take two compulsory courses: Quantum Mechanics and Statistical Mechanics, in addition to one elective course according to the students' areas of interest. Then, in the third semester, students take two more elective courses in their areas of interest and the last compulsory course, which is the research seminar course. In the research seminar course students prepare a project on a selected topic to be presented in front of a member's scientific jury at the end of the semester. In the research seminar, the research question needs to be precisely determined, followed by a literature survey, research method and a summary of the scientific knowledge on which the thesis will be based. In the fourth semester, students take the thesis. The thesis must encompass an independent scientific achievement appropriate in-depth to the intended level of education. Therefore, be associated with either experimental, theoretical or modeling study. The degree program is full-time study for two years.



6 Compulsory courses

1	PHYS 600-3	Mathematical Physics
2	PHYS 601-3	Classical Mechanics
3	PHYS 602-3	Classical Electrodynamics
4	PHYS 603-3	Quantum Mechanics
5	PHYS 604-3	Statistical Mechanics
6	PHYS 695-3	Reseach Seminar

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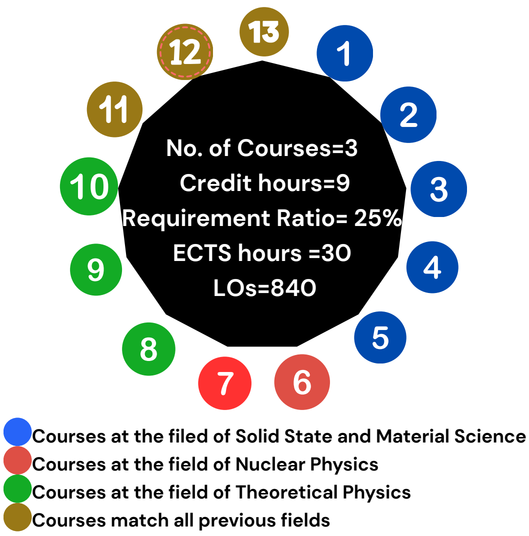

3 Elective courses out of 13 courses

1	PHYS620-3	Atomic and Molecular Physics
2	PHYS622-3	Plasma Physics
3	PHYS640-3	Solid State Physics
4	PHYS641-3	Materials Science
5	PHYS642-3	Magnetism and Superconductivity
6	PHYS650-3	Nuclear Structure and Spectroscopy
7	PHYS651-3	Radiation Physics
8	PHYS621-3	Quantum Optics
9	PHYS660-3	Quantum Field Theory
10	PHYS661-3	Particle Physics
11	PHYS665-3	Selected Topics in Specialized Physics
12	PHYS610-3	Computational Physics
13	PHYS611-3	Physics Laboratory

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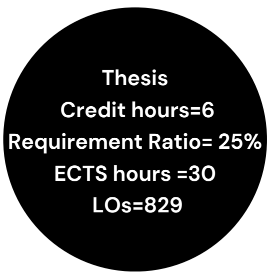

1	PHYS699-6	Thesis

Program Structure of Master of Science in Physics at Jazan University

5.4 PROGRAM STRUCTURE

Table 11 shows the curriculum of Master of Science in Physics program.

Table 11a: The compulsory courses of Master of Science in Physics program

#	Course Code	Course Title	Compulsory Courses					Prerequisite
			Lec./ week	Ex./ week	Credit Units	Workload	ECTS	
1	PHYS600	Mathematical Physic	3	-	3	244	9	
2	PHYS601	Classical Mechanics	3	-	3	229	8	
3	PHYS602	Classical Electrodynamics	3	-	3	255	9	
4	PHYS603	Quantum Mechanics	3	-	3	309	11	
5	PHYS604	Statistical Mechanics	3	-	3	229	8	
6	PHYS695	Research Seminar	3	-	3	421	15	
Total			18	-	-	1687	60	

Table 11b: The elective courses of Master of Science in Physics program

#	Course Code	Course Title	Elective Courses					Prerequisite
			Lec./ week	Ex./ week	Credit Units	Workload	ECTS	
1	PHYS610	Computational Physics	2	2	3	318	11	
2	PHYS611	Physics Laboratory*	0	6	3	358	13	
3	PHYS620	Atomic and Molecular Physics	3	0	3	241	9	
4	PHYS621	Quantum Optics	3	0	3	246	9	
5	PHYS622	Plasma Physics*	3	0	3	242	9	

Table 11b: Continue on the elective courses of Master of Science in Physics program

#	Course Code	Course Title	Elective Courses					Prerequisite
			Lec./ week	Ex./ week	Credit Units	Workload	ECTS	
6	PHYS640	Solid State Physics	3	0	3	240	9	
7	PHYS641	Materials Science	3	0	3	261	9	
8	PHYS642	Magnetism and Superconductivity*	3	0	3	262	9	
9	PHYS650	Nuclear Structure and Spectroscopy*	3	0	3	242	9	
10	PHYS651	Radiation Physics*	3	0	3	242	9	
11	PHYS660	Quantum Field Theory	3	0	3	240	9	
12	PHYS661	Particle Physics	3	0	3	245	9	
13	PHYS665	Selected Topics in Specialized Physics	3	0	3	327	12	
Average ECTS hours per elective course taught							10	

(*) Asterisks indicate elective courses that have not yet been taught and the ECTS hours have been assessed by the teacher. The average ECTS hours for each elective course are calculated as the ratio of the total ECTS hours of all elective courses assessed by the students to their total number

Table 11c: The Thesis of Master of Science in physics program

#	Course Code	Course Title	Thesis					Prerequisite
			Lec./ week	Ex./ week	Credit Units	Workload	ECTS	
1	PHYS699	Thesis	6	-	6	829	30	

6.Program Study Plan

6.1 Complete Study Plan (Courses List per Semester)
6.2 Courses Descriptions

6. COMPLETE STUDY PLAN (COURSES LIST PER SEMESTER)

#	Course Code	Course Title	level 1					Prerequisite
			Lec./ week	Ex./ week	Credit Units	Workload	ECTS	
1	PHYS600	Mathematical Physics	3	-	3	244	9	
2	PHYS601	Classical Mechanics	3	-	3	229	8	
3	PHYS602	Classical Electrodynamics	3	-	3	255	9	
Total			9	-	9	728	26	

#	Course Code	Course Title	level 2					Prerequisite
			Lec./ week	Ex./ week	Credit Units	Workload	ECTS	
4	PHYS603	Quantum Mechanics	3	-	3	309	11	
5	PHYS604	Statistical Mechanics	3	-	3	229	8	
3	PHYS6XX	First Elective Course	3	-	3	252-280	9-10	
Total			9		9	790-818	28-29	

#	Course Code	Course Title	level 3					Prerequisite
			Lec./ week	Ex./ week	Credit Units	Workload	ECTS	
1	PHYS 6XX	Second Elective Course	3	-	3	252-280	9-10	
2	PHYS6XX	Third Elective Course	3	-	3	252-280	9-10	
3	PHYS695	Research Seminar	3	-	3	421	15	
Total			9		9	925-981	33-35	

#	Course Code	Course Title	level 4					Prerequisite
			Lec./ week	Ex./ week	Credit Units	Workload	ECTS	
1	PHYS699	Thesis	6	-	6	829	30	

Course Title	Course Code	Number of Study Hours				Year	Level	Prerequisites
		Theo.	Lab.	Credit	ECTS			
Mathematical Physics	PHYS600	3	-	3	9	1st	1st	-

Student's workload			
In-class activities	Contact Hours	Self-learning/study	Hours
Lectures	45	Preparation for classes	116
Laboratory	-	Case studies	-
Exams and quizzes	5	Working on lab experiment	-
Lab demo	-	HW/Assignments	31
		Study for exam	47
Total	50	Total	194
Total Learning Hours = 244		Equivalent ECTS points = Total LH/28 = 9	

BRIEF COURSE DESCRIPTION

- This course is designed to provide a mathematical foundation for theoretically oriented research areas. It covers basic mathematical tools such as the eigenvalue problem, tensor analysis, transformations and solutions of partial differential equations.

COURSE OBJECTIVES

The main objectives of this course are focused on the following:

1. Perform calculations in vector calculus in different coordinates.
2. Solve eigenvalue problem.
3. Apply matrix theory and tensor analysis to solve problems with many variables.
4. Solve first-order and second-order partial differential equations using various techniques.
5. Apply special functions to carry out various integrations.
6. Perform calculations of complex valued functions and variables including integration.

COURSE CONTENTS

- Vector analysis in different coordinates
- Matrix theory , tensor analysis and eigenvalue problems and orthonormal functions
- Complex variables and functions
- Laplace and Fourier transforms
- Special functions
- Solution of partial differential and integral equations

ASSESSMENT CRITERIA

- Mid-Term exams and Quizzes: 30 %
- Assignments, classroom activities: 20 %
- Final Exam: 50%

COURSE TEACHING STRATEGIES

- Lectures, Discussion, Expository and Discovery, and Interactive Discussions.

TEXT BOOK

- G. Arfken and H. J. Weber, Mathematical Methods for Physicists (Elsevier academic press, 2005).

REFERENCE BOOKS

- J. Matthews and R. L. Walker, Mathematical Methods of Physics (W. A. Benjamin, Inc, 1970).
- P. Dennereyand A. Kryzwicki, Mathematics for Physicists (Dover, 1996).
- G. L. Trigg, Mathematical Tools for Physicists, (John Wiley & Sons, 2006)

Course Title	Course Code	Number of Study Hours				Year	Level	Prerequisites
		Theo.	Lab.	Credit	ECTS			
Classical Mechanics	**PHYS601**	**3**	**-**	**3**	**8**	**1st**	**1st**	**-**

Student's workload				
In-class activities	**Contact Hours**		**Self-learning/study**	**Hours**
Lectures	**45**		**Preparation for classes**	**104**
Laboratory	**-**		**Case studies**	**-**
Exams and quizzes	**5**		**Working on lab experiment**	**-**
Lab demo	**-**		**HW/Assignments**	**29**
			Study for exam	**46**
Total	**50**		**Total**	**179**
Total Learning Hours = 229			**Equivalent ECTS points = Total LH/28 = 8**	

BRIEF COURSE DESCRIPTION

- This course covers the Lagrange mechanics: variation principle, Lagrange's equation, conservation laws; Central force field: Kepler's laws, virial theorem, scattering; Rotation of rigid bodies: orthogonal transformation, Euler's equation, Euler's angles, moment of inertia; Oscillation: formulation, forced oscillation, damped oscillation, parametric oscillation; Hamilton theory: Hamilton's equation of motion, Legendre transformation, canonical transformation, Hamilton'-Jacobi equation.

COURSE OBJECTIVES

The main objectives of this course are focused on the following:

1. Apply the basic foundation for courses such as quantum mechanics and electrodynamics.
2. Use the Lagrange and Hamilton formulations that are required to study the dynamics of physical systems.
3. Reformulate the Newton's laws of motion as variational principle, using Lagrange's equation for deriving equation of motions for system of particles.
4. Apply the conservation laws to study system such as rigid bodies.
5. Carry out analysis associated with vibrations of multi-degree of freedom and continuous systems, and transition from classical mechanics to quantum mechanics.

COURSE CONTENTS

- Short review of classical physics
- Lagrange Mechanics
- Central force field
- Rotation of rigid bodies
- Oscillations
- Hamilton's mechanics

ASSESSMENT CRITERIA

- Mid -Term exams: 30 %
- Assignments, classroom activities and Quizzes: 20 %
- Final Exam: 50%

COURSE TEACHING STRATEGIES

- Lectures, Discussion, Tutorial, Expository and Discovery, and Interactive Discussions.

TEXT BOOK

- H. Goldstein, Charles P. Poole & John Safko, Classical Mechanics, (Pearson Education, (2011)).

REFERENCE BOOKS

- L. D. Landau and E. M. Lifshitz, Mechanics (Course of Theoretical Physics-Volume1),3r dedition, (Butterworth-Heinemann, 1976).
- John R. Taylor, Classical Mechanics, (University Science Books, 2005).
- S. T. Thornton and J. B. Marion, Classical Dynamics of Particles and Systems, 5th edition, (Cengage Learning, 2003).

Course Title	Course Code	Number of Study Hours				Year	Level	Prerequisites
		Theo.	Lab.	Credit	ECTS			
Classical Electrodynamics	**PHYS602**	3	-	3	9	1st	1st	-

Student's workload			
In-class activities	**Contact Hours**	**Self-learning/study**	**Hours**
Lectures	45	Preparation for classes	115
Laboratory	-	Case studies	-
Exams and quizzes	5	Working on lab experiment	-
Lab demo	-	HW/Assignments	42
		Study for exam	48
Total	50	Total	205
Total Learning Hours = 255		Equivalent ECTS points = Total LH/28 = 9	

BRIEF COURSE DESCRIPTION

- This course provides a rigorous foundation for advanced classical electrodynamics and some of its applications. It covers the physics and classical mathematics necessary to understand electromagnetic fields in materials and at surfaces and interfaces. Particular focus is given to time-dependent phenomena in which the calculation of the time-dependent scalar and vector potentials, and electric and magnetic fields, can be traced to the Green function formalism. The course develops a good knowledge on the Boundary–Value Problems in Electrostatics, Multipoles, Electrostatics of Macroscopic Media, Dielectric, Magnetostatics, Time-Varying Fields, Maxwell's Equations,

COURSE OBJECTIVES

The main objectives of this course are focused on the following:

1. Demonstrate knowledge of fundamental concepts of classical electrodynamics.
2. State and deal with the fundamental problems and theories of classical electrodynamics.
3. Develop physical intuition, mathematical reasoning, and problem-solving skills.
4. Apply the theory to discuss quantum phenomena quantitatively.
5. Solve a wide range of specific theoretical problems.

COURSE CONTENTS

- Introduction to Electrostatics: Coulomb's law, Electric field, Gauss's law, Differential form of Gauss's law, Scalar potential, Surface distributions of charges and dipoles, Poisson's and Laplace's equations, Green's theorem, Uniqueness theorem, Formal solution of boundary value problem, Green' functions, Electrostatic potential energy.
- Boundary–Value Problems in Electrostatics, I: Method of images, Point charge and a grounded conducting sphere, Point charge and a charged, insulated, conducting sphere, Point charge and a conducting sphere at fixed potential, conducting sphere in a uniform field, Method of inversion, Green's function for a sphere, Conducting sphere with hemispheres at different potentials, Orthogonal functions and expansions, Separation of variables in rectangular coordinates.
- Boundary-Value Problems in Electrostatics, II: Laplace's equation in spherical coordinates, Legendre polynomials, Boundary-value problems with azimuthal symmetry, Spherical harmonics, Addition theorem for spherical harmonics, Cylindrical coordinates, Bessel functions, Boundary-value problems in cylindrical coordinates, Expansion of Green's functions in spherical coordinates, Use of spherical Green's function expansion, Expansion of Green's functions in cylindrical coordinates.
- Multipoles, Electrostatics of Macroscopic Media, Dielectric: Multipole expansion, Multipole expansion of the energy of a charge distribution in an external field, Macroscopic electrostatics, Simple dielectrics and boundary conditions, Boundary–value problems with dielectrics, Molecular polarizability and electric susceptibility, Models for molecular polarizability, Electrostatic energy in dielectric media.
- Magnetostatics: Introduction and definitions, Biot and Savart law, Differential equations of Magnetostatics, Ampere's law, Vector potential, Magnetic induction of a circular loop of currents, Localized current distribution, magnetic moment, Force, and torque on localized currents in an external field, Macroscopic equations, Boundary conditions, uniformly magnetized sphere in an external field, Permanent magnets, Magnetic shielding.
- Time-Varying fields, Maxwell's Equations, Conservations Laws: Faraday's law of induction, Energy in the magnetic field, Maxwell's displacement current, Maxwell's equations, Vector and scalar potentials, wave equations, Gauge transformations, Green's function for the time dependent wave equation, Initial-value problem, Kirchhoff's integral representation, Poynting's theorem, Conservation laws, Macroscopic equations.

ASSESSMENT CRITERIA

- Mid-Term exams: 20 %
- Assignments, classroom activities: 30 %
- Final Exam: 50%

COURSE TEACHING STRATEGIES

- Lectures, Expository and Discovery, and Interactive Discussions.

TEXT BOOK	REFERENCE BOOKS
• J. D. Jackson, Classical electrodynamics, 3rd Edition, John Wiley and Sons, 1999.	• W. Greiner , Classical Electrodynamics, Springer-Verlag New York, Inc., 1998. • D. J. Griffith, Introduction to Electrodynamics, 4th Edition, Prentice Hall, 2013.

Course Title	Course Code	Number of Study Hours				Year	Level	Prerequisites
		Theo.	Lab.	Credit	ECTS			
Quantum Mechanics	**PHYS603**	**3**	**-**	**3**	**11**	**1st**	**2nd**	**-**

Student's workload				
In-class activities	Contact Hours		Self-learning/study	Hours
Lectures	**45**		**Preparation for classes**	**148**
Laboratory	**-**		**Case studies**	**-**
Exams and quizzes	**5**		**Working on lab experiment**	**-**
Lab demo	**-**		**HW/Assignments**	**61**
			Study for exam	**50**
Total	**50**		**Total**	**259**
Total Learning Hours = 309			**Equivalent ECTS points= Total LH/28 = 11**	

BRIEF COURSE DESCRIPTION

- This course is designed to establish the foundation of quantum mechanics starting with the axioms of quantum mechanics in finite and infinite dimensional vector spaces and their applicability to physics examples such as spin, position and momentum. The course then develops the use of unitary transformation and its essential role in deriving the commutation relations of various physical quantities. The course also addresses the quantum dynamics and provides the essential techniques to solve various physical systems. The theory of angular momentum is extensively studied in view of rotational symmetry, orbital angular momentum, Schrodinger's equation for central potentials, addition of angular momenta and tensor operators.

COURSE OBJECTIVES

The main objectives of this course are focused on the following:

1. Design vector spaces related to the physical quantities of interest in both Dirac representation and matrix representation.
2. Perform essential calculations such as expectation values, commutation relations and uncertainty relations.
3. Discuss the role of symmetry and unitary transformation in physics in general and in quantum mechanics in particular such as in deriving the commutation relation and comparing them to their classical analogues when existed, the time evolution of a quantum system.
4. Solve the eigenvalue problems for various quantum mechanical systems such as a particle in a box, the harmonic oscillator and the hydrogen atom, addition of angular momenta problems.
5. Distinguish between Schrödinger and Heisenberg pictures while studying the dynamics of quantum systems.
6. Perform commutation relations for angular momenta operators including spin.

COURSE CONTENTS

- The Stern-Gerlach Experiment, Kets, Bras, and Operators, Base Kets and Matrix Representations
- Measurements, Observables, Uncertainty Relations. Change of Basis.
- Position, Momentum, and Translation, Wave Functions in Position and Momentum Space.
- Time Evolution and the Schrodinger Equation.
- The Schrodinger Versus the Heisenberg Picture.
- Simple Harmonic Oscillator, Schrödinger Wave Equation.
- Elementary Solution to the Schrodinger equation: Various Examples.
- Rotations and Angular Momentum Commutation Relations, Spin 1/2 Systems in Finite Rotation.
- SO(3), SU(2) and Euler Rotations, Density Operators and Pure Versus Mixed Ensembles SO(3), SU(2) and Euler Rotations, Density Operators and Pure Versus Mixed Ensembles.
- Eigenvalues and Eigenstates of Angular Momentum. Orbital Angular Momentum.
- Schrodinger's Equation for Central Potentials, Addition of Angular Momenta, Tensor Operators.

ASSESSMENT CRITERIA	COURSE TEACHING STRATEGIES
• Mid-Term exams: 20 % • Assignments, classroom activities and Quizzes: 30 % • Final Exam: 50%	• Lectures, Discussion, Hands-on Tutorials, Active Learning.

TEXT BOOK	REFERENCE BOOKS
• J. J. Sakurai and Jim J. Napolitano, Modern Quantum Mechanics, (3rd edition, Cambridge University Press, 2021).	• L. E Ballentine, Quantum Mechanics: a Modern Development, (2nd edition, World Scientific, 2014). • R. Shankar, Principles of Quantum Mechanics, (2nd edition, Kluwer Academic, 1994).

Course Title	Course Code	Number of Study Hours				Year	Level	Prerequisites
		Theo.	Lab.	Credit	ECTS			
Statistical Mechanics	**PHYS604**	**3**	**-**	**3**	**8**	**1st**	**2nd**	**-**

Student's workload				
In-class activities	**Contact Hours**		**Self-learning/study**	**Hours**
Lectures	**45**		**Preparation for classes**	**106**
Laboratory	**-**		**Case studies**	**-**
Exams and quizzes	**5**		**Working on lab experiment**	**-**
Lab demo	**-**		**HW/Assignments**	**25**
			Study for exam	**48**
Total	**50**		**Total**	**179**
Total Learning Hours = 229			**Equivalent ECTS points = Total LH/28 = 8**	

BRIEF COURSE DESCRIPTION

- This course covers topics such as Review of classical physics: basic idea of statistics and thermodynamics; Kinetic theory of gas: phase space representation, Liouville's theorem, statistical ensembles, relation with thermodynamics, partition function, application of partition function, equipartition theorem; Quantum statistical mechanics: density matrix, expectation value, statistical ensembles, quantum statistical formulations, Maxwell-Boltzmann, Bose-Einstein and Fermi-Dirac statistics, idea gas (ideal Bose and ideal Fermi), relation with statistics.

COURSE OBJECTIVES

1. **The main objectives of this course are focused on the following:**
2. Apply the basic relation of statistical and thermodynamic concepts in both classical and quantum regimes.
3. Distinguish between the interpretations in terms of classical and quantum statistical mechanics.
4. Perform relevant parameters using the methods of statistical mechanics.
5. Describe the theoretical and mathematical background of statistical mechanics.
6. Apply methods of statistical mechanics to study physical systems.

COURSE CONTENTS

- Short review of statistical physics: Review of preliminary concepts and description of systems in statistical mechanics, correlations, central limit theorem.
- Kinetic theory of gas: Kinetic theory, phase space, Liouville's theorem, the Boltzmann equation, transport phenomena; Classical statistical mechanics, phase space dynamics and entropy, the micro-canonical ensemble, canonical and grand-canonical ensembles, equi-partition theorem, Maxwell-Boltzmann distribution.
- Quantum statistical physics: Quantum statistical Mechanics, quantization effects, Bose-Einstein and Fermi-Dirac statistics, density matrix formulation, quantum gases, Fermi liquids, Bose condensation.

ASSESSMENT CRITERIA

- Mid-Term exams: 30 %
- Assignments, classroom activities: 20 %
- Final Exam: 50%

COURSE TEACHING STRATEGIES

- Lectures, Discussion, Tutorial, Expository and Discovery, and Interactive Discussions.

TEXT BOOK

- R. K. Pathria and P. D. Beale, Statistical Mechanics, (Butterworth-Heinemann, 2011).

REFERENCE BOOKS

- M. Kardar, Statistical Physics of Particles (Cambridge University Press, 2007).
- D. A. McQuarrie, Statistical Thermodynamics (University Science Book 2000).
- K. Huang, Statistical Mechanics, 2nd edition (John Wiley and Sons, 1987).

Course Title	Course Code	Number of Study Hours				Year	Level	Prerequisites
		Theo.	Lab.	Credit	ECTS			
Computational Physics	**PHYS610**	**2**	**2**	**3**	**11**	**1st/ 2nd**	**2nd/ 3rd**	**-**

Student's workload			
In-class activities	**Contact Hours**	**Self-learning/study**	**Hours**
Lectures	**30**	**Preparation for classes**	**90**
Laboratory	**30**	**Case studies**	**-**
Exams and quizzes	**5**	**Working on lab experiment**	**126**
Lab demo	**-**	**HW/Assignments**	**12**
		Study for exam	**25**
Total	**65**	**Total**	**253**
Total Learning Hours = 318		**Equivalent ECTS points = Total LH/28 = 11**	

BRIEF COURSE DESCRIPTION

- The course is designed to use the computer as a powerful tool to solve and understand some physical problems as well as in other related fields using both numerical methods. Numerical methods such as Fortran language and MATLAB software will be applied. Also, the simulation and modeling programs (as free NWChem package and free Hyper Chem modeler) are used to model, and predict the properties of real materials at different energy levels: Density-functional theory, Hartree-Fock, Monte Carlo sampling and molecular dynamics simulations.

COURSE OBJECTIVES

The main objectives of this course are focused on the following:

1. Investigate some physical phenomena using numerical program language such as Fortran language.
2. Investigate some physical phenomena using numerical program software such as MATLAB software.
3. Apply modeling program to solve some physical problems.
4. Apply simulation program to solve some physical problems.
5. Obtain and Predict properties of some real materials.

COURSE CONTENTS

- **Theoretical part**
- Review on basic numerical methods; Interpolation and extrapolation, numerical integration and differentiation, Random numbers, Ordinary differential equations.
- Introduction to numerical methods (Fortran language and MATLAB software).
- Introduction to modelling and simulation programs (as free NWChem and free Hyper Chem modeler).
- **Simulation part**
- Apply numerical methods (Fortran language and MATLAB software) to solve some physical problems such as non-linear equation, eigenvalues problems and ordinary differential equation.
- Apply modeling and simulation programs (as free NWChem package and free Hyper Chem modeler) at different levels of theories (Density-functional theory, Hartree- Fock, Monte Carlo and Molecular dynamics simulations) to obtain some physical properties as energy gap, transition states, density of states.

ASSESSMENT CRITERIA

- Mid -Term exam and Quizzes: 20 %
- Assignments and classroom activities: 10%
- Laboratory Work: 20%
- Final Exam: 50%

COURSE TEACHING STRATEGIES

- Lectures, Discussion, Tutorial, Expository and Discovery, and Interactive Discussions.

TEXT BOOK

- B. A. Stickler and E. Schachinger, Basic Concepts in Computational Physics, 2ndedition, (Springer 2016).

REFERENCE BOOKS

- J. M. Thijssen, Computational Physics, 2nd edition, (Cambridge University Press, 2007).
- W. H. Press et. al., Numerical Recipes, The Art of Scientific Computing, 3rd edition, (Cambridge University Press, 2007)
- H. Gould, J. Tobocnik, and W. Christian, Introduction to Computer Simulation Methods, (Addison Wesley 2007).

Course Title	Course Code	Number of Study Hours				Year	Level	Prerequisites
		Theo.	Lab.	Credit	ECTS			
Physics Laboratory	**PHYS611**	-	6	3	13	1st/ 2nd	2nd/ 3rd	-

Student's workload				
In-class activities	**Contact Hours**		**Self-learning/study**	**Hours**
Lectures	-		Preparation for classes	-
Laboratory	90		Case studies	-
Exams and quizzes	5		Working on lab experiment	240
Lab demo	-		HW/Assignments	12
			Study for exam	11
Total	95		Total	263
Total Learning Hours = 358			Equivalent ECTS points = Total LH/28 =13	

BRIEF COURSE DESCRIPTION

- This course is designed to provide graduate level experimental experience for research in physics. This includes learning how to conduct experiments, mastering experimental instrumentation and methods, analyzing data and presenting results in a scientific manner. The course contains experiments covering a wide range of fields in Physics

COURSE OBJECTIVES

The main objectives of this course are focused on the following:

1. Use some of the equipment commonly used in research.
2. Perform experiments in different fields of physics.
3. Analyze measurements data considering error calculations.
4. Interpret measurements data considering error calculations.
5. Assess the experimental results and write lab. reports.
6. Analyze the data using a computer.

COURSE CONTENTS

Atomic and Modern lab:

- Zeeman effect (transverse and longitudinal– Zeeman splitting– optical pumping). Frank Hertz experiment (Mercury and Neon). X-rays: (Bragg's reflection–spectroscopy–absorption-Moseley's Law). Helium-Neon laser (wavelength–polarization -beam diameter inside the resonator).

Solid State Physics lab:

- Hall Effect for different metals and different semiconductors. Electrical conductivity and photoconductivity of solids. (temperature dependence of metals and semiconductor resistors– current-voltage characteristics of photo-resistors). Scanning-tunneling microscope (surface analysis of gold and graphite samples).

Nuclear and Particle Physics lab:

- Radioactivity (attenuation of beta and gamma radiation – radioactive decay and half-time). Gamma-ray Spectroscopy (detection – recording and calibrating – absorption – activity). Compton Scattering (quantitative observation of Compton effect). X-ray Tomography .

Plasma Lab:

- Nanoparticles fabrication using Micro plasma. Analysis of nanoparticles using DLS and UV-VIS

Ultra-Low Level Quantum Measurements (JURLQM):

- Time domain, real-time, voltage and current measurement and analysis with high speed Digital storage oscilloscope and DAQ. Frequency domain FFT-based real time signal analysis. Data acquisition using DAQ hardware and analysis.

ASSESSMENT CRITERIA

- Lab Report: 40 %
- Assignments and student activities: 20%
- Final Lab Exam: 40%

COURSE TEACHING STRATEGIES

- Self-learning, Open discussion, interactive comparisons, Question-answer method, demonstrations of laboratory equipment and experiments, Interactive Discussion, Case study, and individual presentation.

TEXT BOOK	REFERENCE BOOKS
• Equipment manuals	• J. W. Hammer, Advanced Lab Manual prepared by the department. • Advanced Physics Laboratory Manual by University of Notre Dame, 2008. • D. W. Preston and Eric R. Dietz, The Art of Experimental Physics, (John Wiley and Sons, 1991). • A. C. Mellissinos and Jim Napolitano, Experiments in Modern Physics, 2nd edition, (Academic Press, 2003). • R. A. Dunlap, Experimental Physics-Modern Methods, (Oxford University Press).

Course Title	Course Code	Number of Study Hours				Year	Level	Prerequisites
		Theo.	Lab.	Credit	ECTS			
Atomic and Molecular Physics	PHYS620	3	-	3	9	1st/ 2nd	2nd/ 3rd	-

Student's workload				
In-class activities	Contact Hours		Self-learning/study	Hours
Lectures	45		Preparation for classes	129
Laboratory	-		Case studies	-
Exams and quizzes	5		Working on lab experiment	-
Lab demo	-		HW/Assignments	26
			Study for exam	36
Total	50		Total	191
Total Learning Hours = 241			Equivalent ECTS points = Total LH/28 = 9	

BRIEF COURSE DESCRIPTION

- This course is designed to provide full understanding of macroscopic properties of matter based on its microscopic composition of the constituent atoms. The course includes: The hydrogen like atoms, atoms with more than one electron, emission and absorption of electromagnetic radiation by atoms, and modern developments in atomic and molecular Physics.

COURSE OBJECTIVES

The main objectives of this course are focused on the following:

1. Review the hydrogen atom and atoms with more than one electron system.
2. Provide the basics of emission and absorption of radiation by atoms.
3. Provide the basics of emission and absorption of radiation by atoms.
4. Explain electronic states and spectra of polyatomic molecules.
5. Explore different experimental techniques in atomic and molecular physics.
6. Discuss a brief account on modern developments in atomic and molecular physics.

COURSE CONTENTS

- Review of hydrogen atom.
- Atoms with more than one electron: Helium atom, principle of the electron shell for larger atoms, alkali atoms, excited atomic states, exotic atoms, emission and absorption of radiation by atoms.
- Diatomic molecules: H_2 Molecule, Electronic states, Molecular binding, Rotation and vibration states.
- Polyatomic molecules: Electronic states, rotation and vibrations, spectra, Clusters and chemical reactions, Molecular dynamics and wave packets.
- Experimental techniques in atomic and molecular physics: Microwave spectroscopy, Infrared spectroscopy, Raman spectroscopy, Spectroscopy with synchrotron radiation, Electron spectroscopy, Modern developments in atomic and molecular physics.

ASSESSMENT CRITERIA

- Mid-Term exam and Quizzes: 30 %
- Assignments and classroom activities: 20 %
- Final Exam: 50%

COURSE TEACHING STRATEGIES

- Lectures, blackboard and visualization, brainstorming, group and interactive discussion, Interactive illustration – Problem based learning

TEXT BOOK

- Wolfgang Demtröder, Atoms, Molecules and Photons, 2nd edition, (Springer, 2010).

REFERENCE BOOKS

- H. Haken and H.C.Wolf, The Physics of Atoms and Quanta, (Springer,2005).
- B. Bransden and C. Joachain, Physics of Atoms and Molecules, (Longman Scientific and Technical 1990).

Course Title	Course Code	Number of Study Hours				Year	Level	Prerequisites
		Theo.	Lab.	Credit	ECTS			
Quantum Optics	PHYS621	3	-	3	9	1st/ 2nd	2nd/ 3rd	-

Student's workload			
In-class activities	Contact Hours	Self-learning/study	Hours
Lectures	45	Preparation for classes	120
Laboratory	-	Case studies	-
Exams and quizzes	5	Working on lab experiment	-
Lab demo	-	HW/Assignments	40
		Study for exam	36
Total	50	Total	196
Total Learning Hours = 246		Equivalent ECTS points = Total LH/28 = 9	

BRIEF COURSE DESCRIPTION

- This course is designed to provide the semiclassical description of EM field as well as its quantum mechanical quantization. It treats the optical cavity, optical coherence, interferometry and photo detection using quantum mechanical operators. It also considers atom-field interaction, Jaynes-Cummings model, analyses of open quantum mechanical systems as well as discrete system.

COURSE OBJECTIVES

The main objectives of this course are focused on the following:

1. Analyze some semiclassical descriptions as well as quantization of EM.
2. Discuss the basics of mixed and pure optical quantum states and their calculation.
3. Formulate mathematical derivation of quantum states and their representations as well as their measurements.
4. Analyze the atom-light interaction using semi-classical and quantum mechanical approaches.
5. Describe various quantum systems, optical processes and quantum electrodynamics.
6. Solve problems related to quantum state and quantum electrodynamics.

COURSE CONTENTS

- Field quantization
- Coherent states
- Atom-field interactions
- Quantum coherence functions
- Beam splitters and interferometers
- Nonclassical light
- Dissipative interactions and decoherence.
- Optical test of quantum mechanics
- Experiments with trapped ions and atoms

ASSESSMENT CRITERIA

- Mid-Term exam and Quizzes: 30 %
- Assignments and classroom activities: 20 %
- Final Exam: 50%

COURSE TEACHING STRATEGIES

- Lectures, Problem Based Teaching, Interactive Discussions, tutorials, Expository and Discovery, and Interactive Discussions.

TEXT BOOK

- C. C. Gerry and P.L. Knight, Introductory Quantum Optics, 2nd ed. Cambridge University Press; 2023

REFERENCE BOOKS

- M. O. Scully and M. S. Zubairy, Quantum Optics, (Cambridge University Press, 1997).
- R. Loudon, The Quantum Theory of Light, 3rd edition, (Oxford Science Publications,2000).
- G. Grynberg, A. Aspect, C. Fabre, Introduction to Quantum Optics, (Cambridge Univ. Press, 2010).
- Z. Ficek and S. Swain, Quantum Interference and Coherence, Theory and Experiments, (Springer, New York, 2005)
- P. Rice, an introduction to Quantum Optics, IOP Publishing Ltd, 2020.

Course Title	Course Code	Number of Study Hours				Year	Level	Prerequisites
		Theo.	Lab.	Credit	ECTS			
Plasma Physics	**PHYS622**	**3**	**-**	**3**	**9**	**1st/ 2nd**	**2nd/ 3rd**	**-**

Student's workload			
In-class activities	**Contact Hours**	**Self-learning/study**	**Hours**
Lectures	45	Preparation for classes	120
Laboratory	-	Case studies	-
Exams and quizzes	5	Working on lab experiment	-
Lab demo	-	HW/Assignments	16
		Study for exam	56
Total	50	Total	192
Total Learning Hours = 242		Equivalent ECTS points = Total LH/28 = 9	

BRIEF COURSE DESCRIPTION

- This course is designed to cover the advanced topics in plasma physics with a focus on waves in plasma and plasma technology. It discusses connected fundamental physics and up to date knowledge of plasma theory and applications. The course will prepare the students to do research in plasma and nanotechnology areas.

COURSE OBJECTIVES

The main objectives of this course are focused on the following:

1. Discuss the fundament of plasma.
2. Investigate the Fluid model and waves in plasma.
3. Discuss the fundamentals and principles operation of plasma sources and selected diagnostics.
4. Examine the concept of collision processes, plasma chemistry and plasma dynamics.
5. Investigate fundamental interactions of particles in the plasma with the surface.
6. Outline the Plasma applications.

COURSE CONTENTS

- Review of plasma fundamentals: Plasma parameters, Plasma criteria, Debye shielding, Collective behavior, Quasi-neutrality, Degree of ionization, and Electron temperature, Basic plasma Equations and equilibrium, Plasma Collisions.
- Fluid model of plasma, Waves in plasma, Waves in plasma for constant electric and/or magnetic field, Waves in plasma for space and/or time variable electric and/or magnetic field.
- Plasma Sources: Electric breakdown, DC plasma sheaths, DC and RF discharges, Capacitive coupled plasma discharges, Inductive coupled plasma discharges, High Pressure Plasma Sources.
- Plasma Chemistry and Surface Interactions: Plasma collisions, Plasma dynamics, Plasma chemistry, Plasma surface interactions.
- Plasma applications: Plasma etching, Plasma enhanced chemical vapor deposition (PECVD), Plasma implantation, Plasma polymerization, Plasma catalysis.

ASSESSMENT CRITERIA

- Mid-Term exam and Quizzes: 30 %
- Assignments and classroom activities: 20 %
- Final Exam: 50%

COURSE TEACHING STRATEGIES

- Lectures, blackboard and visualization, brainstorming, Interactive illustration – Problem based learning, Interactive and Group discussion, expository and discovery teaching.

TEXT BOOK

- M. A. Lieberman and A. J. Lichtenberg, Principles of Plasma Discharges and Materials Processing, 2nd edition, (Wiley Interscience 2005).

REFERENCE BOOKS

- F. F. Chen Introduction to Plasma Physics and controlled Fusion, 3rd Edition Springer (2015)
- T. Makabe, and Z. L. Petrovic; Plasma Electronics: Applications in Microelectronic Device Fabrication, (Taylor & Francis 2006).
- P. Chabert and N .Braithwaite, Physics of Radio-Frequency Plasmas, (Cambridge University Press 2011).
- Fridman and L. A. Kennedy, Plasma Physics and Engineering, 2nd edition (Taylor &Francis 2011)

Course Title	Course Code	Number of Study Hours				Year	Level	Prerequisites
		Theo.	Lab.	Credit	ECTS			
Solid State Physics	PHYS640	3	-	3	9	1st/ 2nd	2nd/ 3rd	-

Student's workload			
In-class activities	Contact Hours	Self-learning/study	Hours
Lectures	45	Preparation for classes	120
Laboratory	-	Case studies	-
Exams and quizzes	5	Working on lab experiment	-
Lab demo	-	HW/Assignments	22
		Study for exam	48
Total	50	Total	190
Total Learning Hours = 240		Equivalent ECTS points = Total LH/28 = 9	

BRIEF COURSE DESCRIPTION

- This course is designed to provide a framework for graduate students to understand at an "advanced" level some of the important aspects of solid-state physics and is designed to introduce crystal structures and symmetries, electron levels in periodic, weak periodic and tight binding potential, classification of solids, dielectric properties of insulators, homogeneous semiconductors and inhomogeneous semiconductors.

COURSE OBJECTIVES

The main objectives of this course are focused on the following:

1. Review the crystal structure and crystal symmetries.
2. Explore Electron Levels in periodic potential.
3. Analyze the electrons in a weak periodic potential and tight binding potential.
4. Discuss the classification of solids.
5. Explain the dielectric properties of insulators.
6. Discuss the homogeneous and inhomogeneous semiconductors.

COURSE CONTENTS

- Crystal Structure and Crystal Symmetries: Review of crystal lattices, the reciprocal lattice, Brillouin zone, Miller indices, and symmetry operations, classification of lattices, crystallographic point groups and space groups.
- Electron Levels in a Periodic Potential: Review of Sommerfeld theory of metals, the periodic potential and Bloch's theorem, Boundary condition, Fermi surface, Density of levels.
- Electrons in a Weak Periodic Potential and the Tight-binding method: Energy levels near a single Bragg plane, extended and repeated zone schemes in one dimension, Fermi surface and Brillouin zone, general features of tight binding levels.
- Classification of Solids: The spatial distribution of valance electrons, ionic crystals, covalent crystals, molecular crystals, metals and hydrogen–bonded solids.
- Dielectric Properties of Insulators: Review of Macroscopic electrostatic Maxwell's equation, theory of local field, theory of polarizability, optical properties of ionic crystal, covalent insulators. Pyroelectricity and Ferroelectricity.
- Homogeneous Semiconductors: Review of general properties of semiconductors, Band structure, carrier statistics in thermale equilibrium, intrinsic and extrinsic semiconductors, and statistics of impurity levels in thermal equilibrium, carrier densities, impurity band conduction, and transport in nondegenerate semiconductors.
- Inhomogeneous Semiconductors: Fields and carrier densities in the equilibrium p-n junction, drift and diffusion currents, collision and recombination times, carrier densities and currents in the nonequilibrium p-n junction.

ASSESSMENT CRITERIA

- Mid Term exam and Quizzes: 30 %
- Assignments and classroom activities: 20 %
- Final Exam: 50%

COURSE TEACHING STRATEGIES

- Lectures, Tutorials, Seminars, Interactive Discussions, Expository and Discovery, and Interactive Discussions.

TEXT BOOK

- N. Ashcroft and N. Mermin, Solid State Physics, (Brooks / Cole Publishing 1976)

REFERENCE BOOKS

- C. Kittel, Introduction to Solid State Physics, 8th edition, (Wiley Charles 2005).
- D. A. Neamen, Semiconductor physics and devices, (McGraw-Hill, 2011).
- S. M. Sze and M. K. Lee, Semiconductor Devices-Physics and Technology, 3rd Edition, John Wiley.

Course Title	Course Code	Number of Study Hours				Year	Level	Prerequisites
		Theo.	Lab.	Credit	ECTS			
Materials Science	PHYS641	3	-	3	9	1st/ 2nd	2nd/ 3rd	-

Student's workload			
In-class activities	Contact Hours	Self-learning/study	Hours
Lectures	45	Preparation for classes	135
Laboratory	-	Case studies	-
Exams and quizzes	5	Working on lab experiment	-
Lab demo	-	HW/Assignments	24
		Study for exam	52
Total	50	Total	211
Total Learning Hours = 261		Equivalent ECTS points = Total LH/28 = 9	

BRIEF COURSE DESCRIPTION

- This course covers basic knowledge about crystalline and amorphous materials, polymer, ceramics, metals and alloys, glasses, semiconductors, luminescent and optoelectronic materials. It also covers topics including synthesis, processing, characterization and properties of the different materials.

COURSE OBJECTIVES

The main objectives of this course are focused on the following:

1. Discuss the importance of materials physics in determining the properties of materials according to its structure, composition and performance.
2. Explore the different techniques used for materials characterization to deduce the suitable technique for each type of materials.
3. Correlate between structure, processing and properties for a given material.
4. Differentiate between different materials in terms of their microstructures, characteristics and properties.
5. Investigate the relations between composition, temperature and phase fractions applied to the equilibrium phase diagrams for a given material system.

COURSE CONTENTS

STRUCTURE OF MATERIALS:

- Structure of Crystals: Introduction to Lattices, Local Atomic Bonding Units and Crystal Structures
- Bonding in Solids: Bonding in Elemental Solids, Bonding in Multi element Crystals, Some Atomic Properties and Parameters
- Order and Disorder in Solids: Order and Disorder, Defects in Solids

2.PHYSICAL PROPERTIES OF MATERIALS

- Phonons: Excitations of the Lattice: Phonons, Lattice Specific Heat of Solids, Anharmonic Effects.
- Electrons in Solids: Electrical and Thermal Properties, Classical Theory of Electrical Conduction, Free-Electron Gases, Transport Theory, Conduction in Insulators, Metal– Insulator Transition, Conductivity of Reduced-Dimensional Systems,
- Optical Properties of Materials: AC Conductivity of Metals, Optical Properties of Semiconductors, Excitons
- Magnetic Properties of Materials: Origins of Magnetism in Solids, Types of Magnetism and Magnetic Behavior in Materials,
- Mechanical Properties of Materials: Stress, Strain, and Elastic Constants, Elastic Properties of Materials, Anelastic Properties of Materials.

3.CLASSES OF MATERIALS:

- Semiconductors: Properties of Semiconductors, Macroscopic Properties, Applications of Semiconductors,
- Metals and Alloys: Three Classes of Metals, Examples and Applications of Metallic Alloys
- Polymers: Structure of Polymers, Mechanical Properties, Thermal Properties, Applications
- Magnetic Materials: Characteristic Propertiesof Magnetic Materials, Effects in Magnetic Materials, Applications of Magnetic Materials
- Optical Materials : Propagation of Light, Generation of Light, Recording of Light.

4.SURFACES, THIN FILMS, INTERFACES, AND MULTILAYERS

- Surfaces: Real Surfaces, Electronic Properties of Surfaces, Surface Modification.
- Thin Films, Interfaces, and Multilayers: Thin Films, Interfaces, Multilayers

5. SYNTHESIS AND PROCESSING OF MATERIALS

- Synthesis and Processing of Materials: Synthesis and Processing of Semiconductors, Metals, Ceramics, Glasses and Polymers.

6.CHARACTERIZATION OF MATERIALS

- Diffraction Techniques, Optical Spectroscopy, Electron Microscopy, Transport Measurements, Magnetic Measurements, Resonance Techniques, Elementary Particles.

ASSESSMENT CRITERIA	COURSE TEACHING STRATEGIES
• Mid-Term exam and Quizzes: 30 % • Assignments and classroom activities: 20 % • Final Exam: 50%	• Lectures, Discussion, presentation, Group activities.

TEXT BOOK	REFERENCE BOOKS
• J. Gersten, F. W. Smith, The Physics and Chemistry of Materials, John Wiley & Sons, Inc., 2000.	• W. D. Callister, Materials Science and Engineering Introduction, John Wiley & Sons, 2007

Course Title	Course Code	Number of Study Hours				Year	Level	Prerequisites
		Theo.	Lab.	Credit	ECTS			
Magnetism and Super conductivity	PHYS642	3	-	3	9	1st/ 2nd	2nd/ 3rd	-

Student's workload			
In-class activities	Contact Hours	Self-learning/study	Hours
Lectures	45	Preparation for classes	120
Laboratory	-	Case studies	-
Exams and quizzes	5	Working on lab experiment	-
Lab demo	-	HW/Assignments	32
		Study for exam	60
Total	50	Total	212
Total Learning Hours = 262		Equivalent ECTS points = Total LH/28 = 9	

BRIEF COURSE DESCRIPTION

- This course covers the principles of magnetism and superconductivity. The first part gives a general overview of magnetism of materials. The second part discusses superconductivity, the Meissner effect, type I and II superconductors, and the superconducting transition. London equations, as well as the details of the BCS theory will be given. Unconventional high TC superconductivity and super fluidity phenomena and their gap symmetry are illustrated.

COURSE OBJECTIVES

The main objectives of this course are focused on the following:

1. Discuss the basics of magnetism and superconductivity
2. Distinguish between Para magnetism, ant magnetism and ferromagnetism
3. Solve problems related to Spin orbit coupling, Para magnetism, diamagnetism, ferromagnetism, direct, indirect and super exchange,
4. Analyze the phase transitions that cause unusual physical phenomena.
5. Explain other unconventional phenomena of advanced materials.

COURSE CONTENTS

- General introduction to magnetism: Magnetism of electrons in solids, Magnetic moments, Spin, and orbital moments.
- Spin orbit coupling, Paramagnetism, Diamagnetism, Ferromagnetism, Direct, indirect and super exchange,
- Magnetic structures: ferro-, antiferro-, ferromagnetic, Heisenberg model and magnetic excitations, Magnetic phase transitions.
- Introduction to properties of superconductors: thermodynamics, and electrodynamics of superconductors, Meissner effect, type I and II superconductors
- Flux lattice, Superconducting phase transitions, London equations, Isotope effect, Cooper pairs, BCS theory, High Tc superfluidity.
- Applications for Superconductivity, Josephson and its Applications

ASSESSMENT CRITERIA

- Mid-Term exam and Quizzes: 30 %
- Assignments and classroom activities: 20 %
- Final Exam: 50%

COURSE TEACHING STRATEGIES

- Lectures , blackboard and diagram illustration, Case study, interactive demonstration, guided discussion, Interactive and Group discussion expository and discovery teaching.

TEXT BOOK

- L. P. Levy, Magnetism and superconductivity, (Springer Verlag,2000) (English Version).

REFERENCE BOOKS

- S. Blundell, Magnetism in Condensed Matter (Oxford University Press 2001).
- W. Buckel, R. Kleiner Superconductivity: Fundamentals and Applications, 2nd edition, by Wiley-VCH 2004 .
- C. Timm, Theory of Superconductivity, Wintersemester 2011/2012 (Technische Universität Dresden, Germany.

Course Title	Course Code	Number of Study Hours				Year	Level	Prerequisites
		Theo.	Lab.	Credit	ECTS			
Nuclear Structure and Spectroscopy	PHYS650	3	-	3	9	1st/ 2nd	2nd/ 3rd	-

Student's workload			
In-class activities	Contact Hours	Self-learning/study	Hours
Lectures	45	Preparation for classes	90
Laboratory	-	Case studies	-
Exams and quizzes	5	Working on lab experiment	-
Lab demo	-	HW/Assignments	32
		Study for exam	70
Total	50	Total	192
Total Learning Hours = 242		Equivalent ECTS points = Total LH/28 = 9	

BRIEF COURSE DESCRIPTION

- This course is designed to provide knowledge and understanding of the properties of nuclei and current experimental techniques at a level appropriate to postgraduate research.

COURSE OBJECTIVES

The main objectives of this course are focused on the following:

1. Outline the single-particle aspects of the properties of nuclei.
2. Describe the experimental techniques used to measure the properties of nuclei.
3. Discuss the collective properties of nuclei
4. Explain the nuclear structure under the different nuclear models and especially the shell model.
5. Evaluate the importance of laser spectroscopy, γ-ray spectroscopy and the experimental techniques.

COURSE CONTENTS

- Review of the properties of nuclei: Describe some introductory terminology, Use a nuclear symbol to express the composition of an atomic nucleus, Review nuclear properties.
- Nuclear models: Liquid drop model, Fermi gas, deviance of the nuclear structure, Shell model (in more details). Single-particle aspects. The nuclear potential and single-particle levels.
- The filling of shells: ground state spins and parities; pairing.
- Nuclear magnetic moments and nuclear quadrupole moments : single-particle model and experiment, Nuclear quadrupole moments of single-particle states and experimentally observed deviations, Multi-particle configurations and residual interactions.
- Collective states.
- Spectroscopy and analysis techniques :Vibrations of spherical nuclei. Residual interactions correlations- deformation. Rotations and vibrations of deformed even-even nuclei. Nilsson model. Rapidly rotating nuclei: moments of inertia, pairing, alignment, super deformation. Laser spectroscopy, γ-ray spectroscopy. Gedetectors; γ-ray arrays; coincidence techniques. The measurement of excited state life times. Internal conversion.

ASSESSMENT CRITERIA

- Mid-Term exam and Quizzes: 30 %
- Assignments and classroom activities: 20 %
- Final Exam: 50%

COURSE TEACHING STRATEGIES

- Lectures, Discussion and group activity.

TEXT BOOK

- K. S. Krane, Introductory Nuclear Physics, 3rd Edition, ISBN: 978-0-471-80553-3, November1987, ©1987
- R. F. Casten, Nuclear Structure From A Simple Perspective, ISBN 0-19-504599-8Published by Oxford University Press, Inc., 1990
- G. F. Knoll, Radiation detection and measurement, 4th Edition, ISBN: 978-0-470-13148-0, Publisher: John Wiley & Sons, Inc., 2010

REFERENCE BOOKS

- J. Lilley, Nuclear Physics: Principles and Applications, 3rd Edition, ISBN: 978-0-471-97935-7, April 2001
- D.J. Bennet, J. R. Thomson, The elements of Nuclear Power, ISBN 13:9780582022249, Publisher: Longman, 1989.

Course Title	Course Code	Number of Study Hours				Year	Level	Prerequisites
		Theo.	Lab.	Credit	ECTS			
Radiation Physics	PHYS651	3	-	3	9	1st/ 2nd	2nd/ 3rd	-

Student's workload			
In-class activities	Contact Hours	Self-learning/study	Hours
Lectures	45	Preparation for classes	90
Laboratory	-	Case studies	-
Exams and quizzes	5	Working on lab experiment	-
Lab demo	-	HW/Assignments	32
		Study for exam	70
Total	50	Total	192
Total Learning Hours = 242		Equivalent ECTS points = Total LH/28 = 9	

BRIEF COURSE DESCRIPTION

- This course is designed to provide an understanding of radiation physics and dosimetry. Knowing the international standard radiation standards, and effective use of radiation doses and materials. Developing scientific research skills in the field of radiation physics.

COURSE OBJECTIVES

The main objectives of this course are focused on the following:

1. Describe the radiation and dosimetry.
2. Outline the international standards.
3. Discuss the proper usage of radioactive doses and materials.
4. Solve problem related to the radiation and dosimetry.
5. Illustrate the important radiation detections and instruments

COURSE CONTENTS

- Naturally Occurring Radiation and Radioactivity : Discovery and Interpretation, Background Radiation, Cosmic Radiation, Cosmogenic Radio nuclides, Naturally Radioactive Series, Singly Occurring, Primordial Radio nuclides, Radio activity Dating, Radon and its Progeny (Radon Subseries, Working, Level for Radon Progeny, Measurements of Radon
- Interaction of radiations with matter: Radiation Dose and Units, Radiation Dose Calculations, Interaction Processes, Interactions of Alpha Particles and Heavy Nuclei, Beta Particle Interactions and Dose, Photon Interactions, Photon Attenuation and Absorption, Energy Transfer and Absorption by Photons, Particle and energy flux and fluence, absorbed dose, Biological effectiveness, weighting factors, Equivalent and effective dose, Primary and secondary dosimeters, Different types of dosimeters, Clinical and calorimetric devices, Radiation survey meter for area monitoring,
- Radiation detection and instrumentation: -Solid state nuclear track detectors, Detectors, Organic& Inorganic scintillators, Semiconductor Detectors Biological effects of radiation, Radiation

ASSESSMENT CRITERIA

- Mid-Term exam and Quizzes: 30 %
- Assignments and classroom activities: 20 %
- Final Exam: 50%

COURSE TEACHING STRATEGIES

- Lectures, Discussion and group activity.

TEXT BOOK

- J. E. Martin, Physics for Radiation Protection, A Handbook. ISBN: 3-527-40611-5 (2006)
- L. Munro, Basic of radiation protection for everyday use – How to achieve ALARA working tips and Guidelines, , 2004.

REFERENCE BOOKS

- G. F. Knoll, Radiation detection and measurement, (John Wiley & sons, New York, 2000).
- K. Thayalan, Basic radiological physics, (Jaypee brothers medical Publishers, New Delhi2003).
- G. C. Lowenthal and P. L. Airey, Practical applications of radioactivity and nuclear radiation sources (Cambridge University Press 2005).
- M. A. S. Sherer, P.J. Visconti, E. R. Ritenour, Radiation Protection in medical radiography, Mosbey, (Elsevier 2006).

Course Title	Course Code	Number of Study Hours				Year	Level	Prerequisites
		Theo.	Lab.	Credit	ECTS			
Quantum Field Theory	**PHYS660**	**3**	**-**	**3**	**9**	**1st/ 2nd**	**2nd/ 3rd**	**-**

Student's workload			
In-class activities	**Contact Hours**	**Self-learning/study**	**Hours**
Lectures	45	Preparation for classes	120
Laboratory	-	Case studies	-
Exams and quizzes	5	Working on lab experiment	-
Lab demo	-	HW/Assignments	32
		Study for exam	38
Total	50	Total	190
Total Learning Hours = 240		**Equivalent ECTS points = Total LH/28 = 9**	

BRIEF COURSE DESCRIPTION

- This course is designed to give the basic concepts and techniques of quantum field theory, with applications to elementary particle physics, Quantum Electrodynamics (QED), with special emphasis to Quantum Chromodynamics (QCD).

COURSE OBJECTIVES

The main objectives of this course are focused on the following:

1. Outline the basic concepts and techniques of quantum field theory
2. Discuss the applications to elementary particle physics, Quantum Electrodynamics (QED), with special emphasis to Quantum Chromodynamics (QCD).
3. Apply the Lagrangian formulation for the canonical quantization of free fields.
4. Apply the perturbation theory for interacting fields and Feynman diagram methods for Quantum Electrodynamics.
5. Investigate path integral methods in quantum field theory.
6. Identify the quantization of gauge theories and forms an essential tool for the understanding and development of the 'standard model' of particle physics.

COURSE CONTENTS

- The Klein-Gordon Field
- The Necessity of the Field Viewpoint
- Elements of Classical Field Theory (Lagrangian Field Theory; Hamiltonian Field Theory; Noether's Theorem)
- The Klein-Gordon Field as Harmonic Oscillators
- The Klein-Gordon Field in Space-Time
- Causality; The Klein-Gordon
- Propagator; Particle Creation by a Classical Source
- The Dirac Field
- Lorentz Invariance in Wave Equations
- The Dirac Equation
- Free-Particle Solutions of the Dirac Equation (Spin Sums)
- Dirac Matrices and Dirac Field Bilinears
- Quantization of the Dirac Field (Spin and Statistics; The Dirac Propagator)
- Discrete Symmetries of the Dirac Theory (Parity; Time Reversal; Charge Conjugation)
- Interacting Fields and Feynman Diagrams
- Perturbation Theory
- Perturbation Expansion of Correlation Functions
- Wick's Theorem
- Feynman Diagrams
- Cross Sections and the S-Matrix
- Computing S-Matrix Elements from Feynman Diagrams
- Feynman Rules for Fermions
- Feynman Rules for Quantum Electrodynamics
- Functional Method
- Path Integrals in Quantum Mechanics
- Functional Quantization of Scalar Fields (Correlation Functions; Feynman Rules; Functional Derivatives and the Generating Functional)
- Introduction to renormalization
- Renormalized Perturbation Theory
- Renormalization of Quantum Electrodynamic

ASSESSMENT CRITERIA

- Mid-Term exam and Quizzes: 30 %
- Assignments and classroom activities: 20 %
- Final Exam: 50%

COURSE TEACHING STRATEGIES

- Lectures, active learning: research articles, web of science, previous thesis.

TEXT BOOK	REFERENCE BOOKS
• M. E. Peskin and D. V. Schroeder, An Introductionto Quantum Field Theory, (West view Press 1995).	• F. Mandl, G. Shaw, Quantum Field Theory " (2nd Edition), (Wiley, 2010) • C. Itzykson and J-BZuber, Quantum Field Theory, (McGraw-Hill, 1980). • M. Srednicki, Quantum Field Theory, (Cambridge, 2007). • M. Magguore, A Modern Introduction to Quantum Field Theory, Oxford, 2005

Course Title	Course Code	Number of Study Hours				Year	Level	Prerequisites
		Theo.	Lab.	Credit	ECTS			
Particle Physics	**PHYS661**	**3**	**-**	**3**	**9**	**1st/ 2nd**	**2nd/ 3rd**	**-**

Student's workload				
In-class activities	**Contact Hours**		**Self-learning/study**	**Hours**
Lectures	45		**Preparation for classes**	**90**
Laboratory	-		**Case studies**	**-**
Exams and quizzes	**5**		**Working on lab experiment**	**-**
Lab demo	-		**HW/Assignments**	**64**
			Study for exam	**41**
Total	**50**		**Total**	**195**
Total Learning Hours = 245			**Equivalent ECTS points = Total LH/28 = 9**	

BRIEF COURSE DESCRIPTION

- This course is designed to provide advanced training for students in particle physics phenomenology and experimental methods, to enable them to take part in theoretical particle physics research.

COURSE OBJECTIVES

The main objectives of this course are focused on the following:

1. Outline the symmetries of gauge field theory.
2. Evaluate the interaction between cross-sections and energy losses in media.
3. Describe the difference between weak and electroweak interaction.
4. Identify the foundations of the Standard Model and physics beyond it.
5. Describe the Lagrangian of the Standard Model.

COURSE CONTENTS

- Gauge Symmetries and Quarks: Symmetries in Physics, Symmetries and Groups, SU(2) and SU(3) Gauge Groups, Isospin, Quark States, Hadron Masses, Color Factors,The Lagrangian and Single-Particle Wave Equations, Noether's Theorem,U(1) LocalGauge Invariance, Non-Abelian Gauge Invariance, Spontaneous Symmetry Breaking.
- The Structure of Hadrons: Electron-Proton Scattering, Inelastic Electron-Proton Scattering, Inelastic Electron-Proton Scattering. Partons: Bjorken Scaling, Partons and Bjorken Scaling, Quarks within Patrons, Gluons
- QCD: QCD Lagrangian, Gluon Emission CrossSection, QCD and e^+ e^- annihilation
- Weak Interactions: Parity Violation, Interpretation of Coupling, Beta Decay, Muon Decay, Pion Decay, Neutrino-Electron Scattering, Neutrino-Quark Scattering, Cabibbo Angle, Weak Mixing Angles, CP Invariance, CP Violation.
- Electro weak Interactions: Weak Isospin and Hypercharge, Basic Electroweak Interaction, Effective Current-Current Interaction, Feynman Rules for Electroweak Interaction, Electroweak Interference of electron-electron Annihilation.
- Standard Model and Beyond: Higgs Field, Masses of the Gauge Bosons, Masses of the Fermions, Lagrangian of the Standard Model, Grand Unification, Dark matter.

ASSESSMENT CRITERIA

- Mid-Term exams : 20 %
- Assignments and classroom activities: 30 %
- Final Exam: 50%

COURSE TEACHING STRATEGIES

- Lectures, Discussions, Seminar, Group discussions.

TEXT BOOK

- F.Halzen and A.D.Martin ,Quarks and Leptons: An Introductory Course in Modern Particle Physics, Wiley,1984.

REFERENCE BOOKS

- D. Griffiths, Introduction to Elementary Particles, 2nd edition, Wiley-VCH, 2008.
- I. Aitchison and A. Hey, Gauge Theories in Particle Physics V1,IOP, 2003.
- I. Aitchison and A. Hey, Gauge Theories in Particle Physics V2,IOP, 2004.
- B. R. Martin and G. Shaw, Particle Physics, Manchester, 2008.

Course Title	Course Code	Number of Study Hours				Year	Level	Prerequisites
		Theo.	Lab.	Credit	ECTS			
Special Topics in Physics	PHYS665	3	-	3	12	1st/ 2nd	2nd/ 3rd	-

Student's workload			
In-class activities	Contact Hours	Self-learning/study	Hours
Lectures	45	Preparation for classes	118
Laboratory	-	Case studies	-
Exams and quizzes	5	Working on lab experiment	-
Lab demo	-	HW/Assignments	86
		Study for exam	74
Total	50	Total	277
Total Learning Hours = 327		Equivalent ECTS points = Total LH/28 = 12	

BRIEF COURSE DESCRIPTION

- This course is designed to cover topics not included in the program courses. Course specifications will be prepared by the professors who will teach it.

COURSE OBJECTIVES

- To be written by the professors who will teach it.

COURSE CONTENTS

- To be written by the professors who will teach it.

ASSESSMENT CRITERIA	COURSE TEACHING STRATEGIES
• Mid-Term exam and Quizzes: 20 % • Assignments and classroom activities: 30 % • Final Exam: 50% •	• To be written by the professors who will teach it.

TEXT BOOK	REFERENCE BOOKS
To be written by the professors who will teach it.	To be written by the professors who will teach it.

- **Examples of Special Topics were taught in Physics are shown here**

Course Title	Course Code	Number of Study Hours				Year	Level	Prerequisites
		Theo.	Lab.	Credit	ECTS			
Research Seminar	**PHYS695**	**3**	**-**	**3**	**15**	**2nd**	**3rd**	**-**

Student's workload				
In-class activities	Contact Hours		Self-learning/study	Hours
Lectures	**45**		**Preparation for classes**	**136**
Laboratory	**-**		**Case studies**	**172**
Exams and quizzes	**5**		**Working on lab experiment**	**-**
Lab demo	**-**		**HW/Assignments**	**-**
	-		**Study for exam**	**63**
Total	**50**		**Total**	**371**
Total Learning Hours = 421			**Equivalent ECTS points = Total LH/28 = 15**	

BRIEF COURSE DESCRIPTION

- This course is a precursor and prerequisite to the master's thesis. It is designed to help students start their master's research program at an early stage to save time and reduce the time spent to produce thesis which usually takes more than is needed. In their third semester along with specialized courses this seminar option will prepare the student for the final requirement of the Master's program which is the thesis so that by the time the student completes the seminar and passes to fourth semester where they need to start their thesis she/she will immediately start on the main part of the project calculations without wasting time in the thesis topic selection or literature review (this is part of the seminar).

COURSE OBJECTIVES

The main objectives of this course are focused on the following:

1. Identify the basic principles and skills to identify and formulate research problems based on analysis of relevant previous studies.
2. Analyze literature survey in similar research areas to prepare gap analysis.
3. Report on preliminary findings using reference and presentation software.
4. Report on the chosen research methodology with justification.
5. Present findings and recommendations orally.

COURSE CONTENTS

- Survey of the subject area of research. Search and selection of a personal area of interest. Review of sources in the subject area of research
- Presentation of the results of the analytical review in the selected area of interest. Collective discussion of the research topic.
- Development of a research plan. Discussion of the main idea for the practical implementation of the research results. Collective brainstorming to shape the proposed scientific novelty of the research
- Preparation of the theses of the report and overview presentation of the project
- Development of a dissertation plan, formation of a list of the main sources used and design of the first section of the dissertation
- Preparation of an article based on the results of the work. Project presentation for collective discussion.
- Preparation of an article based on the results of practical development of the technical solutions obtained.
- Complex presentation of dissertation work.

ASSESSMENT CRITERIA

- Writing a literature review: 30 %
- Participation / discussion / set up of small research project: 20 %
- Writing a brief proposal and giving a seminar for a graduation project: 50%

COURSE TEACHING STRATEGIES

- Discovery learning , expository learning, demonstration, case study, problem-based learning, guided discussion, interactive discussion, and orientation sessions.

TEXT BOOK	REFERENCE BOOKS
• M. Cargill and P. O'Connor, Writing Scientific Research Articles: Strategy and Steps, 2nd Edition, ISBN-13: 978-1118570708. 2013. Wiley-Black Well Press. • E. M. Fisher and R. C. Thompson, Enjoy Writing Your Science Thesis or Dissertation: A Step by Step Guide to Planning and Writing a Thesis or Dissertation for Undergraduate and Graduate Science Students, 2nd Edition, ISBN-13: 978-1783264216. 2014. Imperial College Press	• Y. N. Bui, How to Write a Master's Thesis. Third Edition. SAGE publications, Inc. 2020. p.298. ISBN-13: 978-1506336091, ISBN-10: 1506336094. • D. Hitchcock. Patent searching made easy: how to do patent searches on the internet & in the library. Sixth edition. Berkeley, CA: Nolo, 2013 p.257. ISBNs: 9781413318722, 141331872X, 9781413318739.

Course Title	Course Code	Number of Study Hours				Year	Level	Prerequisites
		Theo.	Lab.	Credit	ECTS			
Thesis	PHYS699	6	-	6	30	2nd	4th	-

Student's workload			
In-class activities	Contact Hours	Self-learning/study	Hours
Lectures	90	Preparation for classes	67
Laboratory	-	Case studies	562
Exams and quizzes	5	Working on lab experiment	-
Lab demo	-	HW/Assignments	-
		Study for exam	105
Total	95	Total	734
Total Learning Hours = 829		Equivalent ECTS points = Total LH/28 = 30	

BRIEF COURSE DESCRIPTION

- Thesis is a compulsory requirement for the master's degree in physics. It is designed to get the students prepared to work in certain important physics fields and practice all the research steps to come up with unique and systematic outcomes of research results and hence write a comprehensive thesis to report all findings in a well-structured arrangement to represent a reference to other researchers in the field. The student will also get practiced the competencies of writing, preparing presentations, defending their own results and finding scientific justification.

COURSE OBJECTIVES

The main objectives of Thesis are focused to:

1. Analyze previous studies in the literature using justified gap analysis.
2. Apply methodologies.
3. Follow the research line from beginning to end (results).
4. Write the thesis.
5. Present and defend the results (thesis).
6. Produce some contributions in the fields of physics and science.

COURSE CONTENTS

1. Introduction and orientation to the course and course outline
2. Research ethics
3. How to define your research problem
4. Academic legal writing and annotated bibliography
5. Research Proposal
6. Background
7. Literature Review
8. Theoretical Framework
9. Methodology and Analysis Conclusions
10. Presentation of research proposals
11. The research process

Thesis presentation

ASSESSMENT CRITERIA

- Class participation:15%
- Research proposal:15%
- Presentation of research proposal: 15 %
- Thesis presentation: 5 %
- Thesis defense: 50%

COURSE TEACHING STRATEGIES

- Discovery learning, expository learning, demonstration, case study, guided discussion, orientation sessions, problem-based learning, interactive discussion,

TEXT BOOK	REFERENCE BOOKS
• K. L.Turabian , W.C. Booth, G.G. Colomb, and J.M. Williams, A manual for writers of research papers, theses, and dissertations. 8th ed. Chicago, IL: University of Chicago Press, 2013.	• Y. N. Bui, How to Write a Master's Thesis. Third Edition. SAGE publications, Inc. 2020. p.298. ISBN-13: 978-1506336091, ISBN-10: 1506336094. • D. Hitchcock. Patent searching made easy: how to do patent searches on the internet & in the library. Sixth edition. Berkeley, CA: Nolo, 2013 p.257. ISBNs: 9781413318722, 141331872X, 9781413318739.

Special Topics in Physics

Advanced Luminescence and Material Characterization Techniques

BRIEF COURSE DESCRIPTION

- This course is designed to provide students with an in-depth understanding of advanced theoretical concepts in physics, focusing on the principles of luminescence and their significance in material sciences. It covers photoluminescence and thermoluminescence phenomena, the application of structural analysis techniques such as X-ray diffraction (XRD) and Fourier-transform infrared (FTIR) spectroscopy, and the theoretical foundations of phosphor synthesis methods, including sol-gel, hydrothermal, and microwave-assisted approaches.
- Students will critically analyse how these processes influence the luminescent and structural properties of materials and explore their practical applications in industries such as lighting, radiation dosimetry, and optoelectronics. Additionally, the course delves into recent advancements in the field, enabling students to engage with cutting-edge research and emerging developments. Ethical considerations, sustainability, and the broader implications of luminescent material applications will also be addressed, fostering a comprehensive and well-rounded understanding of this specialized area of physics.

COURSE OBJECTIVES

The main objectives of this course are focused on the following:

1. Discuss comprehensive knowledge of structural analysis techniques such as X-ray diffraction (XRD) and Fourier-transform infrared (FTIR) spectroscopy, and their applications in analyzing material properties.
2. Explore and critically evaluate various phosphor synthesis techniques, including sol-gel and microwave-assisted methods, and their influence on luminescence efficiency and structural integrity.
3. Analyse recent research trends in luminescence and phosphor technology, emphasizing innovative applications in industries such as lighting, medical imaging, and radiation safety.
4. Develop an appreciation for ethical and sustainable practices in the production and application of luminescent materials, particularly with regard to environmental impact and radiation safety.
5. Synthesize theoretical concepts into actionable insights for understanding the relationship between material structure and its luminescent properties.
6. Apply advanced theoretical concepts in physics to solve real-world challenges in optoelectronic materials.

COURSE CONTENTS

- Introduction to Luminescence.
- Structural Properties: XRD and FTIR Analysis.
- Photoluminescence (PL) Mechanisms and Applications.
- Phosphor Synthesis Techniques (Solid-State, Sol-Gel, etc.
- Thermoluminescence (TL) and Energy Transfer Dynamics.
- High-Temperature and Negative Thermal Quenching Behavior.
- Sustainability and Ethical Considerations in Material Applications.

ASSESSMENT CRITERIA

- Mid-Term exam and Quizzes: 20 %
- Assignments and classroom activities: 30 %
- Final Exam: 50%

COURSE TEACHING STRATEGIES

- Lectures, Discussions,presentation, Group discussions.

TEXT BOOK

Yen, W. M., & Weber, M. J. (2004). Inorganic Phosphors: Compositions, Preparation, and Optical Properties. CRC Press.

REFERENCE BOOKS

- Blasse, G., & Grabmaier, B. C. (1994). Luminescent Materials. Springer-Verlag.
- Relevant articles from Journal of Luminescence (accessible via university subscription).

Hydrogen Energy: Challenges, Solutions and Sustainble for a Cleaner Energy Future

BRIEF COURSE DESCRIPTION

This course is designed to provide students with how hydrogen benefits our daily lives and how this clean source of energy also plays a huge role when it comes to being a new renewable energy source as well as helping to promote the decarbonization of our environment, given the fact that populations are growing at a rapid pace all over the world.

COURSE OBJECTIVES

The main objectives of this course are focused on the following:

1. Provide a basic understanding of the element of hydrogen from both a chemical and physical properties point of view.
2. Explain the current challenges faced by energy utilities in meeting the increasing demand for electricity as well as the need to immediately address environmental concerns such as climate change and decrease the pollution produced by transportation vehicles burning gasoline.
3. Provide general information about hydrogen as the element driving the search for a renewable source of energy.
4. Discuss nuclear hydrogen production plants, where hydrogen is an environmentally friendly energy carrier that, unlike electricity, can be stored in large quantities.
5. Analyze approaches of large-scale production of hydrogen, so the demand by industry can be met for this, the simplest and most abundant element on Earth.
6. Explore the innovative approaches regarding hydrogen storage processes and technologies.

- The Element Hydrogen.
- Hydrogen-Powered Fuel Cell.
- Hydrogen: Driving Thermonuclear Fusion Energy.
- Hydrogen: Driving Renewable Energy.
- Nuclear Hydrogen Production Plants.
- Large-Scale Hydrogen Production.
- Hydrogen Storage Processes and Technologies.

ASSESSMENT CRITERIA	COURSE TEACHING STRATEGIES
• Mid-Term exam and Quizzes: 20 % • Assignments and classroom activities: 30 % • Final Exam: 50%	• Lectures, blackboard, visualization, brainstorming discussion, presentation, Interactive illustration, Problem based learning.

TEXT BOOK	REFERENCE BOOKS
B. Zohuri, Hydrogen Energy: Challenges and Solutions for a Cleaner Future, Springer International Publishing AG, part of Springer Nature 2019.	• M. Alverà, The Hydrogen Revolution: A Blueprint for the Future of Clean Energy, Basic Books, New York, 2021 • Articles from journals of energy (Digtial Library).

Special Topics in Physics

Introduction to Relativistic Quantum Mechanics and Elementary Particlese

BRIEF COURSE DESCRIPTION

- This course is designed to bridge the foundational principles of quantum mechanics and particle physics, offering students a basic understanding of how the two fields intersect. The course covers key topics such as decay rates, cross-sections, relativistic quantum mechanics, and particle interactions via Feynman diagrams and quantum electrodynamics (QED). Students will gain a deeper insight into both the theoretical framework and practical calculations related to particle decays, interactions, and the role of spin and helicity in particle physics.

COURSE OBJECTIVES

The main objectives of this course are focused on the following:

1. Describe the principles of particle physics units and special relativity.
2. Discuss Quantum mechanical descriptions of decays and interaction cross-sections.
3. Apply the formulation and solutions of the Dirac and Klein-Gordon equations.
4. Explain the particle interactions via perturbation theory and Feynman diagrams.
5. Explain the mechanics of electron–positron annihilation and QED.

COURSE CONTENTS

- The Standard Model of particle physics, Interactions of particles with matter Collider experiments, Measurements at particle accelerators.
- Units in particle Physics, Special relativity, non-relativistic quantum mechanics.
- Fermi's golden rule, Phase space and wavefunction normalization, Particle decays, Interaction cross sections, Differential cross sections.
- The Klein–Gordon equation, The Dirac equation, Probability density and probability current, Spin and the Dirac equation, Covariant form of the Dirac equation , Solutions to the Dirac equation, Antiparticles , Spin and helicity states, Intrinsic parity of Dirac fermions.
- First- and second-order perturbation theory, Feynman diagrams and virtual particles, Introduction to QED, Feynman rules for QED.
- Calculations in perturbation theory, Electron–positron annihilation, Spin in electron–positron annihilation, Chirality, Trace techniques.

ASSESSMENT CRITERIA	COURSE TEACHING STRATEGIE
• Mid-Term exam and Quizzes: 20 % • Assignments and classroom activities: 30 % • Final Exam: 50%	• Lectures, reports and essay assignments, homework, and web-based assignments.

TEXT BOOK	REFERENCE BOOKS
• Particle Physics Author: Mark Thomson ISBN: 9781107034266 Published by Cambridge University Press, 2013.	• D. Griffiths, Introduction to Elementary Particles, 2nd edition, Wiley-VCH, 2008. • F. Halzen and A. D. Martin Quarks and Leptones: An Introductory Course in Modern Particle Physics, published by Wiley, 1991 • D. H. Perkins , Introductory High Energy Physics, 4th edition, Cambridge University Press, 2000 • B. R. Martin and G. Shaw, Particle Physics, Manchester, 2008.

Special Topics in Physics

Selected Topics in High Energy of Particle

BRIEF COURSE DESCRIPTION

- This course provides an in-depth exploration of high-energy particle detectors, including fundamental principles, design, and application in particle physics. It covers key detector types, operational mechanisms, and the interpretation of particle interactions through Feynman diagrams and phenomenological approaches.

COURSE OBJECTIVES

The main objectives of this course are focused on the following:

1. This course has been designed to provide students with the following concepts:
2. Provide an understanding of various high-energy particle detectors and their applications.
3. Interpret particle interactions using Feynman diagrams.
4. Analyse of particle interactions using Feynman diagrams
5. Outline the phenomenology in particle detection processes.
6. Apply theoretical concepts to practical detector designs.

COURSE CONTENTS

- Introduction to Particle Detectors.
- Detector Types.
- Applications of Feynman Diagrams.
- Phenomenology in Particle Detection.
- Advanced Detection Technologies.
- Data Interpretation and Analysis Techniques .

ASSESSMENT CRITERIA	COURSE TEACHING STRATEGIES
• Mid-Term exam and Quizzes: 20 % • Assignments and classroom activities: 30 % • Final Exam: 50%	• Lectures, Interactive, Group discussion, expository and discovery teaching.

TEXT BOOK	REFERENCE BOOKS
• D. H. Perkins, Introduction to High Energy Physics, (4th ed.). Cambridge: Cambridge University Press, 2000, SBN: 9780521621960. • Grupen, Claus, and Boris Shwartz. Particle Detectors. 2nd ed., Cambridge University Press, 2008. ISBN: 9781009401531.	• Advanced Particle Physics Volume I: Particles, Fields, and Quantum Electrodynamics, 2011.