قسم الفيزياء
Physics Department
Jazan University

جامعة جازان
JAZAN UNIVERSITY

# Curriculum overview

# &

# Study Plan

## Bachelor Degree

# PHYSICS PROGRAM

## College of Science

## JAZAN UNIVERSITY

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# Table of Contents

# 1. About the program:

## 1.1 Program Establishment

Physics Department at JU was established as per the decree of **The Council of Higher Education, No 12/37/1426H, dated 8/8/1426H.**

The Undergraduate Physics Program as one of the planned programs (for both undergraduate and undergraduate programs). As the undergraduate Physics Program is the only one available currently so mention program or Physics Department is the same. Physics Department is managed by the Chair of the Department with an assistant from female side. They are both assisted by various committees handling various related activities. The quality committee is the committee responsible for quality assurance aspects with all their related documentations and recently the committee of accreditation was formed to handle some activities such as the self-study coordination and KPIs with analysis.

The Department of Physics with the current Physics Undergraduate Program is also connected with the college of science and all vice deanships. The quality assurance on a college level for all programs is administered by the Vice Dean of Development and Physics Department is in a continuous coordination with it.

Physics Program at JU is a teaching & research program in fields of Physics and provide community service to various sectors in Jazan Province.

The program is running with adequate academic and supporting staff from various countries

**Major functions of Physics Program:**

- To provide and maintain educational services in Physics;
- To conduct research and consultancy services;
- To produce academic publications; and
- To provide various services to the community

## 1.2 Vision

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 Physics Program is committed to provide high quality education, research and innovation in the field of physics to contribute to the development of a dynamic society.

### 1.4 Goals

1. Provide distinct and high quality education and training for Bachelor of Physics
2. Establish and maintain high-impact research infrastructure and environment in physics and related fields
3. Provide outstanding community services that contributes to the development of society.

### 1.5 Objectives

2. To provide students with a solid scientific foundation in various fields of Physics and their related problem solving skills.
3. To train students with adequate physics breadth as to comprehend, research, analyze, design solutions for various scientific problems.
4. To inculcate in student's professional and ethical attitude, effective communication skills, teamwork skills, multidisciplinary approach, life-long learning skills and an ability to relate Physics principles to social context.
5. To provide standard facilities and academic environment with awareness of excellence, leadership, needed for both significant research production and successful professional careers that serve the community with significant development

### 1.6 Degree offered:

**Bachelor of Science in Physics**

## 2. Program General Information

### 2.1 Branches and locations

The program is provided in two campuses; i.e. the main Campus for males and Girls Campus for female. There two branches for the program one in AlArdha University College and the Other in Samtah University College. There is a coordination between all branches especially for quality assurance managements.

| | |
|---|---|
| **Main Location:** | **City Campus**<br>https://goo.gl/maps/j9F8a3nnMACzcUZ66 |
| **Branches offering the Program:** | • **Samtah University College**<br>https://goo.gl/maps/A5TmiC27xe5tf9qP9<br>• **Ardha University College**<br>https://goo.gl/maps/BEnJcY2s5UnjwAtTA |

### 2.2 Resources & Teaching Facilities:

Learning resources play a significant role in offering students for both sexes and for people with disabilities a high-quality educational environment that shape their views about themselves and the world and for all physics department staff a good environment for working. These learning resources include classrooms, labs, library services, IT, audiovisual teaching materials, portals, cafeteria, parking and gymnasium etc.

### 2.2.1 Research

As for research activities in the physics department, in research, our mission is to advice fundamental scientific explorations as well as applications of the related technologies. We seek both external prominence and internal cohesiveness of departmental research clusters in key areas of the physics that have been identified as important and challenging, while gaining the flexibility to exploit unforeseen breakthroughs that will open new fields. Our research productivity is getting higher together with the number of referred papers, the number of citations per year, and critically, the impact, the number of citations per paper. In addition, our colleagues contributed international and national conferences. Physics program has strengths in atom and molecules physics, condensed matter physics, nuclear and particle physics, and theoretical physics. Yet, a focus limited to these areas of research, today, is too narrow to allow for continued excellence. The research interest of the staff members are listed according to their specialties in the appendix. Despite the fact that faculty members have intensive teaching and administrative duties, the faculty

members conduct excellent research with many impacted publications. One of the most valuable educational experiences offered by the department is the opportunity to participate in research projects under the supervision of a faculty members. Projects can involve laboratory work, data analysis, or computational research or other research areas. The under graduation Project's aim is to ensure that students have gained the requisite skills, experience, and principles to do well as they graduate. In order to produce highly skilled graduates, which it achieves by commitments to high standards of education and science and to meet the demands of the labor market locally and internationally. Each student can use educational resources to expand his or her awareness on a self-selected subject relevant to a local or global problem.

All active faculty member in research are required to supervise one or more for 2 credits hour per week area. Supervisors should be available to help their graduate students at every stage, from formulation of their research projects through establishing methodologies and discussing results, to presentation and possible publication of dissertations. Graduate supervisors must also ensure that their students‟ work meets the standards of the University and the academic discipline. The attached guide contains all the instructions and outline to help the student with respect to the undergraduate research project. An example of the undergraduate research projects (URP) for the first semester and second semester of the academic year 2021 can be found in the attached file

However, in order to strengthen the sharing of scientific knowledge within the department, researchers from our department as well as from abroad and domestically are invited to give seminars as online. The regular seminar series is a cornerstone of departmental life for many institutions. Every week (or occasionally more/less frequently), a member of the department, or more often a visiting researcher, is invited to give an hour-long seminar about their research. But depending on the culture of the department, this can either be an incredibly enriching experience, especially for grad students, or one of the most pointless exercises in graduate education. There‟s no magic bullet that can turn an ailing seminar series around and make it standing-room only, but there are some things that we can all do to put it on that path, from grad students up to department chairs and faculty deans.

Jazan University has set new regulation for promotion approval: to recognize the advancement of faculty members promoted by other universities, such promotion should be approved by the department and the applicant should give a presentation on his contribution**.** The applicant should then be recommended by the department. Therefore, the research development committee were assigned for evaluation for promotion application.

One of the great strengths of the Physics department is its ability to address the significant challenges that face today's KSA, through the research activities of its faculty and students in many areas, ranging from solar and, to materials science as well quantum optics and plasma. Research at the physics department has contributed significantly to Jazan University ranking.
Moreover, considerable efforts were made in the previous years to acquire research grants from Jazan University Research Deanship for various fields of Physics. Many research projects were funded from the research deanship of from KACST for one year duration. Further details regarding the funded projects between the academic years 2009-2016 by faculty members of Physics Department can be found in this reference.

Learning resources especially the teaching environment plays a significant role in offering Faculty members a good environment for teaching and for students for both sexes and people with disabilities a high-quality educational environment that shape their views about themselves and the world. These resources includes classrooms, labs, library, cafeteria, parking and gymnasium etc… The suitability of these facilities and equipment for all stakeholders, including students, faculty, and personnel, should be evaluated on a regular basis and routinely maintained. The successful use of these resources allows students to take responsibility for their own learning.

The Science College is responsible for the institutional environment for teaching and research. The Dean of the College is responsible for the resources needed in teaching. The heads of the Departments are responsible for managing, evaluating and developing the degree programs including all learning resources needed for the program and for any required resources for the program the head of the physics department makes a proposal to the Deanship of the college that in his turn submit the this proposal to the Rector of the university.

The Academic Complex of Science College consists of several major buildings. The facilities available include the academic buildings that comprise classrooms, seminar rooms, teaching and research laboratories and offices, the Library, and the supporting facilities that include theatre, Nursing room, Mosque, Gymnasium, cafeteria and car parking for students and faculty. Moreover these resources must be maintained in regular basis to ensure a continuity of services with the same efficiency and effectiveness, bearing in mind the safety of all staff (faculty, students and lab technicians) who are in the Physics department.

The Department of Physics is committed to providing resources to help ensure that every student male and female in all branches has the best possible chance for success in their courses.

## 2.2.2 Teaching Facilities

### 2.2.2.1 Classrooms

Classrooms play an important role in physics department teaching where the students spend the majority of their day to acquire new knowledge. The physics department offers access to world-classrooms for all students male and female enrolled in the physics program. Theses classrooms are well-equipped in Science College for male and female section with an average capacity of 30 students and are equipped with air-conditioning, projector, smart board, white board, instructor‟s desk and students‟ chairs. The distribution of the classrooms in all branches is shown in table 4.4 and

| Item | Male Campus | Female Campus | Ardha Campus | Samtha Campus |
|---|---|---|---|---|
| **Number of Classrooms** | **9** | **13** | **11** | **7** |
| **Laboratories for undergraduate students** | **10** | **12** | **5** | **2** |
| **Research Laboratories** | **1** | **1** | **0** | **0** |
| **Computer Lab** | **1** | **3** | **2** | **1** |

### 2.2.2.2 Laboratories

The Physics Department has well-equipped undergraduate laboratories with an average capacity of 20 students for male and female students. The labs are equipped with air-conditioning, projector, smart board, white board, lab chairs, and world class physical equipment offering to students a good environment to carry out scientific investigations or experiments during physics laboratory lectures.

There are 9 specialized laboratories for student of physics:

| Laboratory | |
|---|---|
| **General Physics** | The General Physics Lab is a teaching lab catering to freshers joining the B. Physics offered by the college. The lab has a set of ten experiments mainly in the areas of mechanics, wave mechanics, electricity and magnetism, and thermodynamics. |
| **Geometrical Optics** | The Geometrical optics lab is for B. physics. We have regularly ten experiments in every semester. These experiments are based on basic geometrical optics. |
| **Physical Optics** | The Physical optics lab is for B. physics. We have regularly ten |

| | |
|---|---|
| | experiments in every semester. These experiments are based on light diffraction and interference and light polarization. |
| **Electricity and magnetism** | The Electricity and magnetism lab is for B. physics. We have regularly ten experiments in every semester in which students explore basic elements of electric circuits and magnetic fields through inductance. |
| **Heat and properties of matter** | The Heat and properties of matter lab is for B. physics. We have regularly ten experiments in every semester in which students explore basic elements of heat transfer and the motion of solids. |
| **Electronics** | The Electronics lab is for B. physics. We have regularly ten experiments in every semester in which students explore the essential component in any electronics diodes, BJT and MOSFET transistors. |
| **Nuclear Physics** | The Nuclear Physics lab is for B. physics. We have regularly ten experiments in every semester in which students explore the basic of nuclear physics including Geiger Tube Efficiency, Absorption of Gamma Rays, Determining the half-life of Ba-137 , calibrating a γ spectrum |
| **Atomic and Molecular Physics** | Atomic and Molecular Physics laboratory is for B. physics. We have regularly five experiments in every semester in which students explore Balmer series of hydrogen and Hg visible spectrum Experiment, Grating spectrometer (Hg, Na) Experiment, X–ray Emission Experiment, Frank–Hertz experiment, Zeeman effect Experiment. |
| **Modern Physics** | Atomic and Molecular Physics laboratory is for B. physics. We have regularly ten experiments in every semester in which students explore Millikan"s Oil-Drop, Deflection of Electrons in Thomson Tube, Photoelectric Effect, energy spectrum of an X-ray tube as a function and others experiments. |
| **Solid State Physics** | The solid state physics lab is mainly for the B. Physics. The lab is equipped with experimental set ups related to electrical and magnetic measurements for experiments related to hall effect, light absorption and photovoltaic effect etc… |

Students in the physics department male and female should complete all these experiments during their Bachelor program since the same course specification is followed by labs instructors in all branches, Moreover the laboratory manuals for all courses can found easily by students in the physics website.

The department has a well-equipped and enough undergraduate physics laboratory which gives basic knowledge and understanding the different concepts in Physics to the students except of Ardha College that they has shortening of rooms so, they use one room for at least two lab courses.

The Physics Department has one research laboratory in the male campus and one in the female campus that offers the opportunities for undergraduates and faculty in the areas of experimental physics. The number of laboratories in each branch are shown in tale 4.7.

| **Item** | Male Campus | Female Campus | Ardha Campus | Samtha Campus |
|---|---|---|---|---|
| **Laboratories for undergraduate students** | **10** | **12** | **5** | **2** |
| **Research Laboratories** | **1** | **1** | **0** | **0** |
| **Computer Lab** | **1** | **3** | **2** | **1** |

### 2.2.3 .2 Computer Labs

The University offers laptop, desktop computers and printers for all staffs. The computers are equipped with all necessary programs used in teaching purposes and with special program for smart boards and research are available.

Students can use the computers that are in common use in the library area, or in the computer laboratory that is equipped with 27 PCs computers, and with cutting-edge technologies and a variety of software packages for the benefit of the students that are well trained in different operating systems like Windows and are also trained in programming languages and packages like C, C++.

Furthermore, each Faculty member in the department has an office desktop and personal laptops, they also have wireless access (Wi-Fi hotspot) and printing facilities. Table 4.9 shows the percentage of laptops, desktops and printers for faculty members in difference branches.

| **Statistics of computers, laptops and printers for faculty** | Male Campus | Female Campus | Ardha Campus | Samtha Campus |
|---|---|---|---|---|
| **Laptops** | **97%** | **24.1%** | **55%** | **50%** |
| **Computers** | **40%** | **13%** | **11%** | **7%** |
| **Printers** | **24%** | **13%** | **27%** | **7%** |

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### 2.2.4 Library

Students in the physics department have access to a variety of textbooks in the science college library male branch. For female branch they have their own library equipped with

approximately the same number and same variety of textbooks as shown in table 4.10. All libraries are well equipped with internet, computers, scanner and printer. The library follows the library Deanship guidelines for borrowing textbooks and for the working hours. These information are accessible for all users in the entrance of the library or online. In addition, the registered beneficiaries in the physics department have free access to library services library by personally visiting the library, phoning the library services or accessing to the „Library Catalog" through social networking sites or through „Library Catalog'

**Table 4.10: Number of textbooks for the program in the library of each branch**

| **Academic year 20/21** | Male Branch | Female Branch | Ardha Branch | Samtha Branch |
|---|---|---|---|---|
| Number textbooks/References | **269** | **182** | **249** | **260** |

In order to meet the beneficiary"s needs concerning the text books and journals every academic year, the head of the physics department officially corresponds to library Deanship through the college science to request the needed textbooks and journals for the physics program. The Beneficiaries in the physics department can also benefit from the Saudi digital library (SDL) that offers an efficient services including many databases, which include numerous full-text and bibliographic, which compensate the scarcity in the hard copy books in the physical library. Moreover, to spread knowledge and overcome all the difficulties facing access to the Saudi Digital Library, the department of training and Information at library Deanship launched its electronic training programs for this academic year 1441 AH through the virtual platform "Zoom".

## 2.3 Teaching strategies

Physics Program adopt various teaching strategies depending on the learning domains and type of the course. The following strategies are adopted:

**Lecturing- Problem based teaching- Interactive discussion- discussion-expository and discovery teaching - Hands-on practice- expository and discovery - Interactive discussion- Guided discovery teaching-Expository and discovery teaching- interactive discussion- problem based learning - guided discovery teaching**

See program specification for tabulating PLOs with suitable teaching strategies

## 2.4 Other Facilities

### 2.4.1 Email

All faculty and students are provided with an email account. IT Department actively promotes the use of email for the communication.

### 2.4.2 Printing

The Physics Department provides network printers in the secretariat office, and personal printers to some staff and faculty for the educational purposes.

### 2.4.3 IT Support

IT support center provides technical assistance for various staff and student activities such as Blackboard, laptops and audio-visual setups

### 2.4.4 Information technology & Networking

IT Department provides a robust, secure and high performance network for educational, research, and administrative needs and services. All faculty offices, administrative staff offices, classrooms and labs are connected to the network. The distribution level of the network is fast-Ethernet switches. Moreover, students and faculty can connect to the network through the Wi-Fi everywhere on the college.

### 2.4.5 infrastructure facilites

The coleges building euiped with various infrastrcuture facilites such as cafterias, reading halls, Toilets in adequate number, Jem and sport room, theater hall, parking lots for both staff and students, etc. all building are prepared with required means for special needs staff and students.

### 2.4.6 Safety in the Physics Department

The Physics Department is committed to providing a safe and healthy environment for students, staff, and faculty. We strive to teach appropriate respect for safety while engaging in scientific teaching. The labs committee in the physics department works very hard to ensure that of all laboratories and classrooms are compliant with Jazan University safety requirements.

For that the physics department has implemented some safety policies through the mentioned points: (i) the evacuation plans for the college building have been clearly prepared; (ii) Wall

posters for labs rules are displayed in the entrance of physics laboratories; (iii) Safety policies are displayed in all lab benches; (iv) The lab instruments and apparatuses are upgraded with safety data sheets(v) fire extinguishers are kept updated and are present with emergency kit in all laboratories (vi) The student ratio in the laboratory is improved for male and female branches (vii) the risk management for the ionizing radiation and lasers was improved.

All staff working in the Physics Department laboratories are required to read and understand (i) the Safety and Health Policy, (ii) the Physics General Safety Requirements and (iii) the evacuation plans for the college building.
In addition to the general Physics Departments policies, each laboratory is required to have a set of specific safety policies and to have the specific operating procedure that details safety protocol associated with each potentially hazardous material or process.

The inventory, management storage and disposal of physics laboratory wastes (i.e., chemical waste, radioactive) is regulated according to the safety and health administration at Jazan University.

The policy for waste materials is very clear and consists first to perform a complete inventory of all chemicals and for the radioactive sources, and secondly to send it to the safety and health administration at Jazan University to take decision about it. However, for the waste radioactive sources the policy still not clear and we recommend to improve it.

## 2.5 Student advising Policy

The Academic Guidance and Counseling services provided at the physics department at the level of Science faculty of Jazan University include academic advising, career, educational and personal counseling services. Its objective is to guide students to obtain the best results, adapt with the university environment and take advantage of the opportunities available to them.

Guidance and counseling services provided by the physics department at the level of Science faculty of Jazan University in the psychological, social, functional and academic fields aim to help students understand themselves and encourage them to achieve excellence and creativity.

The Academic Advisement Office will:

**a)** Provide overall administrative support for provision of academic advisement toall undergraduate students from the time of admission to the

time of graduation.

**b)** Develop the university Academic Advisement Policy guidelines and best practices.

**c)** Develop a Faculty Advisor Handbook.

**d)** Develop and conduct student and parent orientation at the time of admissions.

**e)** Operationally, student assignment to faculty advisors should be as follows.

**f)** Assignment to faculty advisors should happen at the time of orientation.

**g)** In the third semester students should be re-assigned to relevant faculty advisors in accordance with the Major chosen by the student.

**h)** Establish an anonymous system of student feedback on the Academic Advisement Office and Faculty Advisors.

**i)** Develop transparent rules and mechanisms to address student complaints about a faculty advisor or the Academic Advisement Office.

**j)** Organize brief refreshers for office personnel and faculty advisors.

**k)** Maintain complete records.

An individual faculty will have a group of advisees as assigned by the Academic Advisement Office.

### 2.5.1 Abilities

Facilitate student decision-making on their academic journeys without imposing personal preferences.

**a)** Remain mindful of the diverse backgrounds of students and tailor advice accordingly.

**b)** Practice empathy and a helping attitude.

**c)** Be knowledgeable about the latest university policies, rules, and regulations.

**d)** Maintain familiarity with international best practices for Academic Advisement.

### 2.5.2 Roles and Responsibilities

***Faculty members***

- Meet regularly with advisees.
- Facilitate students in making informed decisions in choosing Major/s (and Minor/s, ifany), and help them explore probable outcomes of different combinations.
- Advise students how best to fulfil the Distribution course requirements.
- Advise students how best to fulfil the Practical Learning requirements.

- Advise and supervise students in the Internship requirement.
- Mediate between students and administration.
- Inform students about learning opportunities related to their fields both inside and outsidethe university.
- Facilitate students in career development by staying up-to-date with the latest opportunities.
- Refer students at risk of any mental health problems in a timely manner to the concerneduniversity or other facility.
- Maintain full records of advisory activities.
- Follow reporting protocols to the Academic Advisement Office in a timely manner.

***Students***

a) Student participation in Group Advisory Meetings with the Advisor will be mandatory.
b) Student participation in Individual Advisory Meetings with the Faculty Advisor at least three times a semester will be mandatory. Students will get appointments for individual advisory

More details are available on https://www.jazanu.edu.sa/ar/administration/deanships/deanship-student-affairs

## 2.6 Attendance and exam policies

Examinations are an extremely important and integral element of academic activity and reflect upon the quality, effectiveness and breadth of teaching and assessment methods of the students and then reflect the program and students efficiency. The Deanship of Admission and Registration Jazan university issued Statutes for undergraduate study and examinations and implementing executive rules at the university which pointed the general rules and regulation of the study and examination of B.Sc. level programs at the university. Physics Department at Jazan University fulfills the university rules and regulations.

Student's achievements and success are based on different evaluation in which exam are the key point to assess the learning outcomes of each courses in the program which are precisely adopted to perceive their goals by the course instructor and clearly written in the courses specifications and approved by the department council. Success in a course is usually based on the combination of grades awarded to term work and final examination. Each course has a total of 100 points. Out of this, as per our courses descriptions the instructor may allocate 50% to the term work consisting of quizzes, homework, practical laboratory work , mid-term or other periodic assessments while the remaining 50% is allocated to the final examination. There are two kinds of courses in the department, the courses which have an experiment or

practical (lab-work) component and those with purely a theoretical content. The 50% of the term work grading scheme distributions is slightly different. For a course with a purely theoretical component, with total credit hours are 2 or 3, the term work or semester work grade (50%) is assigned for the two mid-term exams and among the quizzes, presentations and homework assignments depending upon the nature of the course and fully distributed in the courses descriptions. The rest fifty percent is assigned to the final examination.

For a course with both theoretical and experimental (laboratory) components, the total credit hours are either 3 or 4 as per the curriculum study plan for the department , the two or three credit hours is for the theoretical component and one credit hour for the laboratory element. Fifty percent of the total grade is assigned to the final examination, whereas the rest fifty percent is divided into lab work and term activities (two mid-term exams, quizzes, presentations and homework assignments) In higher level (level 7 and Level 8) courses the practical contact hours are 3 and in such course the 50% of the term work is divided into laboratory marks 25% and term activity work 25%, whereas, in some other courses in the lower levels the practical contact hours are 2 and the 50 % of the term work is divided into laboratory marks 20 % and term activity work 30 %. Course specifications and descriptions of the physics specialization courses in the program are attached in the indices

### 2.6.1 Grade Points

The grading scheme adopted by the physics program is as per university policies and is roughly the same as standard institutions of higher education across the world, as given in Jazan university statutes for undergraduate study and examinations (Appendix S3.2). The instructor awards the grade as marks out of 100. The marks are converted to a letter grade and grade points as shown in Table 3.1(a). Table (3.1 b) gives the other grade codes used to describe the student status.

**The Grading system at Jazan University**

| Marks out of 100 | Letter Grade | Description | Grade Points |
|---|---|---|---|
| **95-100** | A+ | Exceptional | 5 |
| **90-less than 95** | A | Excellent | 4.75 |
| **85-less than 90** | B+ | Superior | 4.5 |
| **80-less than 85** | B | Very Good | 4.0 |
| **75-less than 80** | C+ | Above Average | 3.5 |
| **70-less than 75** | C | Good | 3.0 |
| **65-less than 70** | D+ | High Pass | 2.5 |

| | | | |
|---|---|---|---|
| **60-less than 65** | D | Pass | 2.0 |
| **Below 60** | F | Failure | 1.0 |

**Other Grade Codes used by Jazan University**

| Grade Code | Mark limits | Points | Status |
|---|---|---|---|
| **IC** | | | Incomplete |
| **IP** | | | In Progress |
| **DN** | | 1.00 | Denied |
| **NP** | Above 60 | | No Grade Pass |
| **NF** | Less than 60 | | No Grade Fail |
| **W** | | | Withdrawal with excuse |

The general assessment of the cumulative average at the graduation of the student based on the cumulative average is as follows:

Excellent: if the cumulative GPA is no less than 4.50 out of 5.00,

Very good: if the cumulative GPA is 3.75 or higher but less than 4.50 (out of 5.00). Good: if the cumulative GPA is 2.75 or higher but less than 3.75 (out of 5.00).

Pass: if the cumulative GPA is 2.00 or higher but less than 2.75 (out of 5.00).

A grade of "Incomplete (IC)" is given to the student if the course requirements are not completed by the student. This is usually allowed in courses that require a project to be completed by the students. It is awarded only on the recommendation of the instructor and approval of the Department Council. The student getting IC must complete the requirements during the next semester otherwise the IC automatically changes to F".

A grade of "Withdrawal (W)" is awarded to students who have voluntarily withdrawn from continuing study for a semester. A student may withdraw and is entitled to, without being considered failed, if he/she presents an acceptable excuse to the authorized body specified by the university council within a time period specified by the university council executive regulations. The student is given a (W) grade and his semester will be included in the period required for completion of the graduation requirements.

Samples of final students grade sheets of some courses is provided in the appendix These grade sheets is from Jazan university academic unified system where the instructor record the term work grades and final exam grades

As per the article 9 of the Statutes of Study and Exams regular students are required to attend all lectures and laboratory sessions. If her/his attendance is less than the limit determined by the University Council (75 %of the lectures and laboratory sessions assigned for each course), the student will be barred from continuing the course and will be denied entrance to the

respective final examination, and is considered to have failed that course and is given the grade (DN) in the course. Similarly, as per the articles 11 and 12, students, who are absent from the final exam, will be given a zero marks for that examination. Her/his grade in the course will be calculated on the basis of the class work score he/she obtained over the semester. If a student fails to attend a final examination in any course but offers a compelling excuse, the College Council may choose to accept her/his excuse and allow him/her to take alterative examination.

Students can see their obtained grades through student website on Edugate Jazan University website data system ((https://edugate.jazanu.edu.sa/jazan/init).

### 2.6.2 Calculating Semester and Cumulative Grades:

Based upon the performance of a student in individual courses, a Grade Point Average (GPA) is assigned to the student every semester. Table 3.2 summarizes an example of GPA calculation for an arbitrary student for first semester:

**GPA (Grade Point Average) Calculation Method for First Semester**

| S. No. | Course | 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.) |
|---|---|---|---|---|---|---|
| **1** | 351PHYS | 3 | 96 | A+ | 5 | 15 |
| **2** | 221PHYS | 4 | 91 | A | 4.75 | 19 |
| **3** | 211PHYS | 3 | 81 | B | 4.0 | 12 |
| **4** | 353PHYS | 2 | 85 | B+ | 4.5 | 9 |
| **5** | 222PHYS | 3 | 70 | C | 3 | 9 |
| **6** | 101CHEM | 4 | 62 | D | 2 | 8 |
| **Total** | | 19 | | | | 72 |
| **Computed GPA for the First Semester = Computed Quality Points / Credit Hours = 72/19 = 3.79 (out of 5.00)** | | | | | | |

| S. No. | Course | 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.) |
|---|---|---|---|---|---|---|
| **1** | 312PHYS | 4 | 68 | D+ | 2.5 | 10 |
| **2** | 352PHYS | 3 | 62 | D | 2 | 6 |
| **3** | 341PHYS | 3 | 76 | C+ | 3.5 | 10.5 |
| **4** | 371 PHYS | 3 | 85 | B+ | 4.5 | 13.5 |

| | | | | | | |
|---|---|---|---|---|---|---|
| **5** | 411PHYS | 4 | 53 | F | 1 | 4 |
| **Total** | | 17 | | | | 44 |
| **Computed GPA for the Second Semester= Computed Quality Points / Credit Hours = 44/17 = 2.588 (out of 5.00)** | | | | | | |
| **Cumulative Grade (CGPA) = Sum of the total computed Quality Points/ Sum of the total Credit Hours = 72+44 /19+17 = 3.22 (out of 5.00)** | | | | | | |

Upon successful completion of coursework required for the degree, at the time of graduation, a Cumulative GPA (CGPA) is awarded to the student, which is an average of the total GPA obtained by the student and calculated as shown in table 3.3.

First honors are granted to the student who has earned a cumulative GPA between 4.75 and 5.00 (out of 5.00) at the time of her/his graduation. Second honors are granted to the student who has earned a cumulative GPA of 4.25 or higher but less than 4.75 (out of 5.00).

Jazan University requires that students do not miss more than 25% of the total number of lectures, labs and tutorials. Students failing to meet this requirement in any of the courses are prohibited from attending the final examination of that course and earn a DN (Denied) grade in that course. A student who is absent in the final examination of a course(s) for a valid reason accepted by the department council and the Dean of the faculty is allowed to take alternative examination at a later date.

The university places a stringent emphasis on minimum grade requirement and there is no compromise on this. Students are required to maintain a grade point average of at least 2.0 out of 5.0. A student failing to maintain the GPA of 2.0 will be placed on “academic probation” and is given two semesters to improve. After this period the student may be removed from the program

### 2.6.3 Academic Probation

At the beginning of each term, the Deanship of Admission and Registration provides each student with his full academic advising record showing the results of all the courses that have been studied from the study plan as well as the number of academic warnings that have been issued. The student gets a warning if his GPA is below 2 .0 out of 5.0 in a term. The student is suspended if he gets a maximum of three (3) such consecutive warnings. After the third warning, being suspended for one term, Faculty Council, in coordination with the Deanship of Admission and Registration, may recommend to the University Council to give a fourth chance to those students who can raise their GPA by taking courses according to the rules of registration. The student will also be suspended if he is not able to complete the graduation

requirements within a period of 16 terms. The academic suspension is governed by the Policy on Statutes of Study and Exams

### *2.6.3.1 Duties of a member of the examination supervisory committee*

• Follow up the progress of the exam.

• Follow up the attendance and work of the members of the exam committee.

• Passing through the examination halls periodically and ensuring the conduct of the exams.

• Solve the problems that students may face during the course exam.

• Baptism and receipt of fraud reports and all relevant documents.

• Receipt of the exam progress records for each hall (form A) from the exam committee.

• Communicate with the head of the examination committee and the relevant authorities in the college when necessary.

• Preparing and signing the minutes of the progress of the probationary period (form B), which includes the following:

• Submitting the minutes of the progress of the examination period (Form - B) to the chairman of the examinations committee.

### *2.6.3.2 Duties of the invigilator*

- Each invigilator must come to the examination committee headquarters twenty minutes before the start of the exam to sign the attendance and take the students' attendance sheet and the exam progress report (Form - A).
- Receiving the exam questions & answers envelope from the course professor.
- The student's identity card must be confirmed before distributing the exam sheet.
- Alert students to the guidelines of the exam.
- Not to take students' mobile phones under any circumstances.
- Not allowing the auxiliary tools in the exam (calculator - ruler - pen .... etc.) to be circulated among students.
- Not allowing the student to enter the exam after half an hour from the exam start time.
- Not allowing the course professor to enter the exam room during the exam.
- It is forbidden to enter any student whose name is not recorded in the attendance sheet in the hall, and it is not allowed to enter the deprived student.
- Making sure that the student wrote all the required information on the cover page of the answer sheet
- Signing the student's attendance sheet after filling in all the required information.
- Counting the present and absent students and recording the absent students' data in the exam progress report (form A).
- In the cheating case, a report of cheating is issued on the form prepared for this, signed by invigilators and one of the members of the exam committee, then submitted it with all documents documenting the case of cheating (if any) and the student‟s answer sheet

to the supervisor of the day. The student is removed from the examination hall and must This is also recorded in the test progress report (form A).

- Handing over the answer sheets and a statement of students' attendance to the course professor immediately after the exam.

### *2.6.3.3 Duties of the course professor*

- Preparing of envelopes of the exam sheets. The following information must be written on the envelope: -the course name, - course code, - the number of exam sheets - the professor's name and phone and his office number.
- Attending the examination committee headquarters to sign the attendance sheet ten minutes to exam start time
- Writing all the instructions for the exam on the exam sheet.
- Not to enter the examination hall during the exam.
- Receipt of the answer sheets and the attendance sheet of the students from the invigilator immediately after the end of the exam.

# 3 Employment outlook

## 3.1 Graduate attributes

## JU graduate attributes

| |
|---|
| **Research and knowledge inquisitiveness and practical application of knowledge:**<br><br>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. |
| **The ability to solve problems and make decisions**:<br><br>Identifying problems by critical analytical thinking and solutions using creative thinking, and is able to evaluate opinions and make informed decisions. |
| **Commitment to values, ethics and responsibility:**<br><br>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 |
| **Effective communication:**<br><br>Graduates can communicate effectively verbally and in writing. |
| **Digital communication:**<br><br>The graduate is able to access, evaluate and use information effectively and efficiently and creatively in sustainable learning, scientific research, and effective communication. |
| **Leadership and teamwork:**<br><br>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. |
| **Professional Scientific ethics**<br><br>Graduates are aware of all scientific ethics |

## Physics Program graduate attribute

- **IN-DEPTH KNOWLEDGE OF PHYSICS**:

  A comprehensive and well-founded knowledge of Physics. An understanding of how other disciplines relate to it. An international perspective on the field of Physics.

- **EFFECTIVE COMMUNICATION:**

  The ability to collect, analyze and organize information and ideas and to convey those ideas clearly and fluently, in both written and spoken forms. The ability to interact effectively with others in order to work towards a common outcome. The ability to select and use the appropriate level, style and means of communication. The ability to engage effectively and appropriately with information and communication technologies.

- **INDEPENDENCE AND CREATIVITY**:

  The ability to work and learn independently. The ability to generate ideas and adapt innovatively to changing environments. The ability to identify problems, create solutions, innovate and improve current practices.

- **CRITICAL THINKING & JUDGMENT**:

  The ability to define and analyze problems. The ability to apply critical reasoning to issues through independent thought and informed judgment. The ability to evaluate opinions, make decisions and to reflect critically on the justifications for decisions.

- **ETHICAL AND SOCIAL UNDERSTANDING:**

  An understanding of social and civic responsibility. An appreciation of the philosophical and social contexts. A knowledge and respect of Islamic values and ethical standards. A knowledge of other cultures and times and an appreciation of cultural diversity.

### 3.2 Consistency of program and JU graduates and attributes

| JU → / Physics ↓ | Research and knowledge inquisitiveness and practical application of knowledge: | The ability to solve problems and make decisions: | Commitment to values, ethics and responsibility: | Effective communication: | Digital communication | Leadership and teamwork | Professional Scientific ethics |
|---|---|---|---|---|---|---|---|
| **In-depth knowledge of physics** | √ | | | | | | |
| **Effective communication** | | | | √ | √ | | |
| **Independence and creativity** | | | | | | √ | |
| **Critical thinking & judgment:** | | √ | | | | | |
| **Ethical and social understanding** | | | √ | | | | √ |

# 4 Learning Outcomes

## 4.1 Program Learning Outcomes (PLO's)

| P# | PLO's in various domains | Teaching strategies |
|---|---|---|
| 1.0 | **Knowledge and Understanding** | |
| 1.1 | **Describe** various fundamental concepts and theories of physics and their effect in different fields of science and technology | Lecturing- interactive discussion |
| 1.2 | **Discuss** physics phenomena using physics principles and scientific reasoning | Lecturing - interactive discussion |
| 2.0 | **Skills** | |
| 2.1 | **Apply** mathematical concepts, strategies and procedures to solve problems in various fields of physics. | Lecturing- Problem based teaching- Interactive discussion |
| 2.2 | **Demonstrate** analytical skills and competencies to formulate, drive and analyze physics concepts. | Lecturing- discussion-expository and discovery teaching |
| 2.3 | **Perform** experiments in various fields of Physics and analyzing their related data for various Physics parameters and quantities | Hands-on practice- expository and discovery - Interactive discussion- Guided discovery teaching |
| 2.4 | **Develop** competencies in critical thinking, delivering scientific information, reporting and data analysis. | Expository and discovery teaching- interactive discussion- problem based learning |
| 3.0 | **Values** | |
| 3.1 | **Develop** abilities of team work, bear individual responsibilities on assigned tasks | Expository and discovery - interactive discussion |
| 3.2 | **Apply** practices of life-long learning in various physics and scientific disciplines with ethical and social responsibilities for their professional career | Expository and discovery - interactive discussion |
| 3.3 | **Demonstrate** awareness of safety and risk assessment when dealing with various materials and equipment | Hands-on practice- expository and discovery - guided discovery teaching |

## 4.2 JU learning Outcomes

| |
|---|
| 1. analyze and explain theories, concepts, principles, skills and practices in different disciplines. (Knowledge and understanding) |
| 2. Apply the skills and ethics of scientific research, innovation and creativity efficiently. (Skills) |
| 3. Apply knowledge by accomplishing practical skills brilliantly (practical skills) |
| 4. Apply independent and critical thinking innovatively to solve complex problems (skills). |
| 5. demonstrate leadership qualities and skills needed to communicate effectively with others orally and in writing in a sound language (skills and values) |
| 6. Apply sustainable learning skills in all scientific and community aspects on environmental, economic and social issues (values) |
| 7. Promote the concept of community responsibility towards scientific and life issues. (Values) |
| 8. Commit to professional and ethical behaviors and show team spirit (values) |

## 4.3 Consistency of PLO's with JU learning outcome

| JU → / Physics ↓ | JU-LO1 | 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 Course and program learning Outcome Mapping

| Program Learning Outcomes (PLO's) | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| Level | Course Code | Knowledge | | Skills | | | | Values | | |
| | | K1 | K2 | S1 | S2 | S3 | S4 | V1 | V2 | V3 |
| Level-1 | 101SLM-2 | | | | | | | I | | |
| | 105ENG-6 | I | | | | | I | | | |
| | 101BIO-4 | I | | | | | | | | I |
| | 101MATH-3 | I | | I | | I | | | | |
| | 101CSC-3 | | | | | I | I | | | |
| Level-2 | 102SLM-2 | | | | | | | I | I | |
| | 101ARB-2 | | | | | | I | I | I | |
| | 101PHYS-4 | I | I | I | | I | I | I | | I |
| | 101CHEM-4 | I | | | | | | | | I |
| | 106ENG-3 | I | | | | I | I | | | |
| Level-3 | 102ARB-2 | | | | | | I | | I | |
| | 221PHYS-4 | I | | I | I | I | I | I | | I |
| | 231PHYS-4 | I | I | I | I | I | I | I | | I |
| | 251PHYS-3 | I | I | I | I | | I | I | | |
| | 201MATH-3 | | | I | I | I | | | | |
| Level-4 | 103SLM-2 | | | | | | | I | I | |
| | 202MATH-3 | | | I | I | I | I | | | |
| | 211PHYS-3 | I | | I | I | I | I | I | | I |
| | 212PHYS-2 | I | I | I | I | | I | I | | |
| | 222PHYS-3 | I | I | I | I | | I | I | | |
| | 252PHYS-3 | I | I | I | I | | I | I | | |
| Level-5 | 301STAT-2 | | | I | | I | I | | | |
| | 311PHYS-3 | P | P | P | I | | I | I | | |
| | 312PHYS-4 | P | P | P | P | P | P | P | | P |
| | 331PHYS-3 | P | P | P | P | | P | P | | |
| | 341PHYS-3 | I | I | P | P | | P | P | | |
| | 351PHYS-3 | P | P | P | P | | | P | | |
| Level-6 | 104SLM-2 | | | | | | | I | I | |
| | 301CSC-3 | | | | I | | I | | I | |
| | 342PHYS-4 | M | M | M | M | M | M | M | | M |
| | 352PHYS-3 | P | P | P | P | | | P | | |
| | 353PHYS-2 | P | M | M | M | | P | P | | |
| | 371PHYS-3 | P | M | M | P | | | M | | |
| Level-7 | 411PHYS-4 | M* | M* | M* | M* | M* | M* | M* | | M* |
| | 412PHYS-3 | M* | M* | M* | M* | | M* | M* | M* | |
| | 451PHYS-3 | M* | M* | M* | M* | | M* | M* | | |
| | 461PHYS-3 | M* | M* | M* | M* | | M* | M* | | |
| | 491PHYS-2 | M* | M* | M* | M* | M* | M* | M* | M* | M* |
| Level-8 | 441PHYS-4 | M* | M* | M* | M* | M* | M* | M* | | M* |
| | 452PHYS-3 | M* | M* | M* | M* | | M* | M* | M* | |
| | 462PHYS-4 | M* | M* | M* | M* | M* | M* | M* | | M* |
| | 471PHYS-4 | M* | M* | M* | M* | M* | M* | M* | | M* |

## 4.5 Assessment of PLO's

Assessment is an ongoing process in the Physics Department. NCAAA regulations and forms are implemented for all documentations. These generally include reviews of departmental offerings, course content, textbooks, and examinations.

Faculty share and review examinations, regularly collect student evaluations of teaching, assessment of learning outcomes for each course and report the scores of CLOs each semester from various exams. Physics Department also plans to get feedback from alumni and employers in a periodic manner.

**PLOs Assessment Plan using CLOs**: The data are collected and evaluated every semester for PLOs assessment. An improvement plan report including a list of minor and major changes is then prepared according the evaluation results of PLOs and their corresponding CLOs.

Minor changes can be implemented during the assessment cycle while the major changes can be implemented by the end of the assessment cycle timeline.

**Target: for courses ( 2.5 out of 5 to the attained score and > 60% to the attained % of exceeded 60)**

**For Program (3 out of 5 the attained score and 70% the attained %)**

### ASSESSMENT BASED ON CURRICULUM MAPPING

All requirements and characteristics of Mapping CLOs to PLOs: After the development of CLOs, they were mapped to PLOs in order to ensure that CLOs have certain contribution to the PLOs at different levels in the program.

- **Conducting assessment and collecting data**: The performance of students are collected through exams, assignments, projects, etc. at the course level. More specifically, their performance in questions related to CLOs were targeted, measured and analyzed in every course.

- **Evaluation of Results**: The grades of students for each CLO are reported out. By the end of the semester, the instructor prepares CLOs analysis using the provided excel template which is provided to all instructors to make the process straightforward and it includes the analysis of data for all kind of exams and activities to get the scores and achievements of students in all CLOs with graphical depiction.

**Based on our context, our target is defined as: A CLO is considered as Exemplary(E) if scored >=4, Satisfactory (S) ) if scored >=3, Adequate(A) ) if scored >=2.5, Unsatisfactory (U)) if scored <2.5.**

**The % of students achievement (the % of students who get or exceeded 60%) is considered as Exemplary if >=90, Satisfactory (S) if >=80, Adequate(A) if >=70, Meet the criteria if>=60, and Unsatisfactory(U) if <60**

Furthermore, the achievements of corresponding PLO's at the course level are calculated by using the mapping of CLOs to PLOs and the CLOs Achievements Report.

Finally, the achievements of the program's PLOs are calculated using students' performances in CLOs. Physics Program has implemented the following methods:

1- Method of equal contributions of all courses (crude analysis): this is done every Semester
2- Method of factoring contribution of all courses (Wight % to course based on the level of learning domain and level of the program): it is the somehow accurate and consistent with % of learning domains in the program but it is not much reliable as the performance of students in earlier stage course is not based on deep knowledge and skills

3- Method of selective contribution from some high level course (specifically final year course) (which is the most reliable (as all courses are also based on some prerequisite course in previous years

**Note:** PLO is achieved if the average of the overall achievements score is **3** and the % of students who exceeded **60% is 70%** and above.

## FREQUENCY OF ASSESSMENT

| Assessment type | Frequency (when to collect data) | Stakeholder involved (Students- Faculty- Almni- Employers] | Performance Targets | How data is collected | Evaluation results (analysis) |
|---|---|---|---|---|---|
| **CLOs** | **Every Semester** | **Students - Faculty** | **2.5/5 with 60% exceeding the level of 60%** | **Course reports- CLOs excel file** | **Quality Committee** |
| **PLOs** | **Every year- every assessment cycle** | **Students- Faculty- Alumni- Employer** | **2.5/5 with 60% exceeding the level of 60%** | **Course files- Rubrics- embedded questions- surveys** | **Quality Committee** |

# 5 Program Structure

## 5.1 General outlines

**Fulfillment of the degree of B.Sc. in Physics requires 130 Credit Units with grade of "Pass" (cumulative grade 2 of 5).**

## 5.2 European Credit Transfer and Accumulation System (ECTS)

**Students complete 249.4 ECTS points after completing the program**

ECTS is a standard for comparing the study attainment and performance of students across the European Higher Education Area (EHEA) and making studies and courses more transparent. It helps students to move between countries and to have their academic qualifications and study periods abroad recognized.

**ECTS credits** express the accumulated load based on the defined learning outcomes and their associated Workload. 60 ECTS credits are allocated to the learning outcomes and associated Workload of a full-time academic year or its equivalent, which normally comprises a number of educational components to which credits (on the basis of the learning outcomes and Workload) are allocated. ECTS credits are generally expressed in whole numbers.

**Workload** is an estimation of the time the individual typically needs to complete all learning activities such as lectures, seminars, projects, practical work, work placements and individual study required to achieve the defined learning outcomes in formal learning environments. The correspondence of the full-time Workload of an academic year to 60 credits is often formalized by national legal provisions. In most cases, Workload ranges from 1,500 to 1,800 hours for an academic year, which means that one credit corresponds to 25 to 30 hours of work. It should be recognized that this represents the typical Workload and that for individual students the actual time to achieve the learning outcomes will vary.

**Awarding credits** in ECTS is the act of formally granting students and other learners the credits that are assigned to the qualification and/or its components if they achieve the defined learning outcomes. National authorities should indicate which institutions have the right to award ECTS

**Accumulation of credits** in ECTS is the process of collecting credits awarded for achieving the learning outcomes of educational components in formal contexts and for other learning activities carried out in informal and non-formal contexts. A student2 can accumulate credits in order to:

- Obtain qualifications, as required by the degree-awarding institution;

- Document personal achievements for lifelong learning purposes.

### Approach to allocating credit in Science Programs

1. Based on learning outcomes of each program component, teaching staff describes the learning activities, and estimates the Workload typically needed for a student to complete these activities. Proposals are collected, analyzed, and synthesized and the estimated Workload is expressed in credits.
2. Faculty may decide from the start to standardize the size of educational components, giving each one the same credit value.
3. Considering the average of each ECTS credit is equal to 28 learning hour.

**Self-Learning Calculation**

**For University Requirements**

ECTS for all university requirement courses were calculated **based on opinion of students through survey** and found to be in consistent with standard ECTS calculation equation as

**No. of ECTS points = {credit unit *60 (ECTS for 2 Semesters)* 4 years}/ 130 (total credit of the program)**

**For Program Requirements**

1. Each CH will be multiplied by 15 (official week number of a semester) to get the contact Hours
2. Every contact Hour is considered as 50 Min as per the University rule
3. For all program courses, it has been found **through surveying students opinion** that each Contact Hours requires a minimum of **two** Learning Hour.
4. Add all together the contact hours with preparation times for exam, HWs, lab reporting and case studies, etc. to get the total Hours of Learning that the student spend for the course
5. Divide the Learning Hours(Workload) by 28 to get the ECTS points:

**Equivalent ECTS points=Total Workload/28**

### 5.3 Overall curriculum picture of Physics Program

### 5.3.1 Overall curriculum distribution

| # | Course Title | Lectures/ Week | Practical/ Week | Credit Units | Workload | ECTS |
|---|---|---|---|---|---|---|
| 1 | University Requirements | 14 | 2 | 15 | 775.6 | 27.7 |
| 2 | College Requirements | 27 | 9 | 24 | 1237.6 | 44.2 |
| 3 | Department Requirements | 82 | 28 | 93 | 4969.8 | 177.5 |
| | Total | 123 | 37 | 132 | 6983 | 249.4 |

### 5.3.2 University Requirements

| # | Course Number | Course Title | Lectures/ Week | Practical/ Week | Credit Units | Workload | ECTS | Pre-requisite |
|---|---|---|---|---|---|---|---|---|
| 1 | 101SLM-2 | Islamic Culture I | 2 | - | 2 | 103.6 | 3.7 | - |
| 2 | 102SLM-2 | Islamic Culture II | 2 | - | 2 | 103.6 | 3.7 | - |
| 3 | 103SLM-2 | Islamic Culture III | 2 | - | 2 | 103.6 | 3.7 | - |
| 4 | 104SLM-2 | Islamic Culture IV | 2 | - | 2 | 103.6 | 3.7 | - |
| 5 | 101ARB-2 | Arabic Language Skills | 2 | - | 2 | 103.6 | 3.7 | - |
| 6 | 102ARB-2 | Arabic Writing | 2 | - | 2 | 103.6 | 3.7 | - |
| 7 | 101CSC-3 | Computer Science | 2 | 2 | 3 | 154 | 5.5 | |
| Total | | | 14 | 2 | 15 | 775.6 | 27.7 | |

### 5.3.3 College Requirements

| # | Course code | Course Title | Lectures/ Week | Practical/ Week | Credit Units | Workload | ECTS | Pre-requisite |
|---|---|---|---|---|---|---|---|---|
| 1 | 101MATH-3 | General Mathematics | 3 | - | 3 | 154 | 5.5 | - |
| 2 | 101BIO-4 | General Biology | 3 | 2 | 4 | 207.2 | 7.4 | - |
| 3 | 101CHEM-4 | General Chemistry | 3 | 2 | 4 | 207.2 | 7.4 | - |
| 4 | 101PHYS-4 | General Physics | 3 | 2 | 4 | 207.2 | 7.4 | - |
| 5 | 105ENGL-6 | Intensive course for English Language | 15 | 3 | 6 | 308 | 11 | - |
| 6 | 106ENGL-3 | English for Science | 10 | - | 3 | 154 | 5.5 | 105ENGL-6 |
| Total | | | 37 | 9 | 24 | 1237.6 | 44.2 | |

### 5.3.4 Program Requirements

| # | Course Code | Course Title | Lectures / Week | Practical / Week | Credit Units | Workload | ECTS | Pre-requisite |
|---|---|---|---|---|---|---|---|---|
| 1 | 211PHYS-3 | Geometrical Optics | 2 | 2 | 3 | 168 | 6 | - |
| 2 | 212PHYS-2 | Waves & Vibration | 2 | -- | 2 | 105 | 3.75 | 251PHYS |
| 3 | 221PHYS-4 | Properties of Matter & Heat | 3 | 2 | 4 | 204.4 | 7.3 | - |
| 4 | 222PHYS-3 | Thermodynamics | 3 | -- | 3 | 154 | 5.5 | 221PHYS |
| 5 | 231PHYS-4 | Electricity & Magnetism | 3 | 2 | 4 | 204.4 | 7.3 | - |
| 6 | 251PHYS-3 | Classical Mechanics | 3 | -- | 3 | 154 | 5.5 | - |
| 7 | 252PHYS-3 | Mathematical Physics | 3 | -- | 3 | 154 | 5.5 | 201MATH |
| 8 | 311PHYS-3 | Electronics 1 | 3 | -- | 3 | 154 | 5.5 | 231PHYS |
| 9 | 312PHYS-4 | Physical Optics | 3 | 2 | 4 | 217 | 7.75 | 211PHYS |
| 10 | 331PHYS-3 | Electrodynamics | 3 | -- | 3 | 156.8 | 5.6 | 231PHYS |
| 11 | 341PHYS-3 | Modern Physics 1 | 3 | -- | 3 | 156.8 | 5.6 | - |
| 12 | 342PHYS-4 | Atomic Physics & Spectroscopy | 3 | 2 | 4 | 207.2 | 7.4 | 312PHYS |
| 13 | 351PHYS-3 | Analytical Mechanics | 3 | -- | 3 | 156.8 | 5.6 | 251PHYS |
| 14 | 352PHYS-3 | Quantum Mechanics 1 | 3 | -- | 3 | 168 | 6 | 252PHYS |
| 15 | 353PHYS-2 | Statistical Physics | 2 | -- | 2 | 106.4 | 3.8 | 222PHYS/301STAT |
| 16 | 371PHYS-3 | Solid State Physics 1 | 3 | -- | 3 | 159.6 | 5.7 | 311PHYS |
| 17 | 411PHYS-4 | Electronics 2 | 3 | 3 | 4 | 224 | 8 | 311PHYS |
| 18 | 412PHYS-3 | Laser & Its Applications | 3 | -- | 3 | 159.6 | 5.7 | 312PHYS |
| 19 | 441PHYS-4 | Modern Physics 2 | 3 | 3 | 4 | 224 | 8 | 342PHYS |
| 20 | 451PHYS-3 | Quantum Mechanics 2 | 3 | -- | 3 | 168 | 6 | 352PHYS |
| 21 | 452PHYS-3 | Plasma Physics | 3 | -- | 3 | 159.6 | 5.7 | 353PHYS |
| 22 | 461PHYS-3 | Nuclear Physics 1 | 3 | -- | 3 | 159.6 | 5.7 | 352PHYS |
| 23 | 462PHYS-4 | Nuclear Physics 2 | 3 | 3 | 4 | 224 | 8 | 461PHYS |
| 24 | 471PHYS-4 | Solid State Physics 2 | 3 | 3 | 4 | 224 | 8 | 371PHYS |
| 25 | 201MATH-3 | Differentiation & Integration | 3 | -- | 3 | 154 | 5.5 | - |
| 26 | 202MATH-3 | Differential Equations | 3 | -- | 3 | 154 | 5.5 | 201MATH |
| 27 | 301STAT-2 | Statistics | 2 | -- | 2 | 103.6 | 3.7 | - |
| 28 | 301CSC-3 | Computer Programming | 2 | 2 | 3 | 154 | 5.5 | 101CSC-3 |

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| 29 | 491PHYS-4 | Graduation Project | 2 | 2 | 4 | 235.2 | 8.4 | Dept.t Approval |
| | | Total | 80 | 26 | 93 | 4969.8 | 177.5 | |

**Total Workload=6983** **Total ECTS=249.4**

# 6. Program Study plan

## 6.1 complete study plan with credits and ECTS

| Year | Course Code | Course Name | * Pre-Requisite | Contact Hours | | Credit | Workload | ECTS | Type of requirement |
|---|---|---|---|---|---|---|---|---|---|
| | | | | Lect. | Prac | | | | |
| Level 1 | 101SLM-2 | Islamic Culture 1 | ---- | 2 | - | 2 | 103.6 | 3.7 | Institution |
| | 105ENG-6 | Intensive Course in English Language | ---- | 15 | 3 | 6 | 308 | 11 | College |
| | 101BIO-4 | General Biology | ---- | 3 | 1 (2) | 4 | 207.2 | 7.4 | College |
| | 101MATH-3 | General Mathematics | ---- | 3 | - | 3 | 154 | 5.5 | College |
| | 101CSC-3 | Introduction Comp. Sci. | ---- | 2 | 1(2) | 3 | 154 | 5.5 | Institution |
| Level 2 | 102SLM-2 | Islamic Culture 2 | ---- | 2 | - | 2 | 103.6 | 3.7 | Institution |
| | 101ARB-2 | Linguistic Skills | ---- | 2 | - | 2 | 103.6 | 3.7 | Institution |
| | 101PHYS-4 | General Physics | ---- | 3 | 1(2) | 4 | 207.2 | 7.4 | College |
| | 101CHEM-4 | General Chemistry | ---- | 3 | 1(2) | 4 | 207.2 | 7.4 | College |
| | 106ENG-3 | English for Science | 105 ENGL-6 | 10 | 0 | 3 | 154 | 5.5 | College |
| Level 3 | 102ARB-2 | Arabic Editing | ---- | 2 | - | 2 | 103.6 | 3.7 | Institution |
| | 221PHYS-4 | Properties of Matter and Heat | ---- | 3 | 1(2) | 4 | 204.4 | 7.3 | Department |
| | 231PHYS-4 | Electricity and Magnetism | ---- | 3 | 1(2) | 4 | 204.4 | 7.3 | Department |
| | 251PHYS-3 | Classical Mechanics | ---- | 3 | - | 3 | 154 | 5.5 | Department |
| | 201MATH-3 | Differentiation and Integration | ---- | 3 | - | 3 | 154 | 5.5 | Department |
| Level 4 | 103SLM-2 | Islamic Culture 3 | ---- | 2 | - | 2 | 103.6 | 3.7 | Institution |
| | 202MATH-3 | Differential Equation | 201MATH-3 | 3 | - | 3 | 154 | 5.5 | Department |
| | 211PHYS-3 | Geometrical Optics | ---- | 2 | 1(2) | 3 | 168 | 6 | Department |
| | 212PHYS-2 | Waves and Vibrations | 251 PHYS-3 | 2 | - | 2 | 105 | 3.75 | Department |
| | 222PHYS-3 | Thermodynamic | 221 PHYS-4 | 3 | - | 3 | 154 | 5.5 | Department |
| | 252PHYS-3 | Mathematical Physics | 201MATH-3 | 3 | - | 3 | 154 | 5.5 | Department |
| Level5 | 301STAT-2 | Statistics | ---- | 2 | - | 2 | 103.6 | 3.7 | Department |
| | 311PHYS-3 | Electronics (1) | 231 PHYS-4 | 3 | - | 3 | 154 | 5.5 | Department |
| | 312PHYS-4 | Physical Optics | 211 PHYS-3 | 3 | 1(2) | 4 | 217 | 7.75 | Department |
| | 331PHYS-3 | Electrodynamics | 231 PHYS-4 | 3 | - | 3 | 156.8 | 5.6 | Department |
| | 341PHYS-3 | Modern Physics (1) | ---- | 3 | - | 3 | 156.8 | 5.6 | Department |
| | 351PHYS-3 | Analytical Mechanics | 251 PHYS-3 | 3 | - | 3 | 156.8 | 5.6 | Department |
| Level 6 | 104SLM-2 | Islamic Culture 4 | ---- | 2 | - | 2 | 103.6 | 3.7 | Institution |
| | 301CSC-3 | Computer Programming | 101 COM-3 | 2 | 1(2) | 3 | 154 | 5.5 | Department |
| | 342PHYS-4 | Atomic Physics & Spectroscopy | 312 PHYS-4 | 3 | 1(2) | 4 | 207.2 | 7.4 | Department |
| | 352PHYS-3 | Quantum Mechanics (1) | 252 PHYS-3 | 3 | - | 3 | 168 | 6 | Department |
| | 353PHYS-2 | Statistical Physics | 222 PHYS-3 & 301 STAT-2 | 2 | - | 2 | 106.4 | 3.8 | Department |
| | 371PHYS-3 | Solid State Physics (1) | 311 PHYS-3 | 3 | - | 3 | 159.6 | 5.7 | Department |
| Level 7 | 411PHYS-4 | Electronics (2) | 311 PHYS-3 | 3 | 1(3) | 4 | 224 | 8 | Department |
| | 412PHYS-3 | Laser & Its Applications | 312 PHYS-4 | 3 | - | 3 | 159.6 | 5.7 | Department |
| | 451PHYS-3 | Quantum Mechanics (2) | 352 PHYS-3 | 3 | - | 3 | 168 | 6 | Department |
| | 461PHYS-3 | Nuclear Physics (1) | 352 PHYS-3 | 3 | - | 3 | 159.6 | 5.7 | Department |
| | 491PHYS-2 | Graduation Project | Dept. Appr | 2 | 2 | 4 | 235 | 8.4 | Department |
| Level 8 | 441PHYS-4 | Modern Physics (2) | 342 PHYS-4 | 3 | 1(3) | 4 | 224 | 8 | Department |
| | 452PHYS-3 | Plasma Physics | 353 PHYS-2 | 3 | - | 3 | 159.6 | 5.7 | Department |
| | 462PHYS-4 | Nuclear Physics (2) | 461 PHYS-3 | 3 | 1(3) | 4 | 224 | 8 | Department |
| | 471PHYS-4 | Solid State Physics (2) | 371 PHYS-3 | 3 | 1(3) | 4 | 224 | 8 | Department |

**Total Credit =132 Total Workload=6983 Total ECTS=249.4**

# 7. Course descriptions

## With

## Workload and ECTS

| Course Title | Course Code | Credit Hours | | | | Year | Level | Pre-req |
|---|---|---|---|---|---|---|---|---|
| | | Theoretical | Lab | Credit | ECTS | | | |
| General Physics | 101PHYS-4 | 3 | 2 | 4 | 7.4 | 1st | 2nd | ---- |

**Student's Workload**

| In-class activities | Contact Hours | Self-learning/study | Hours |
|---|---|---|---|
| Lectures | 45 | Preparation for classes | 75 |
| Laboratory | 30 | Working on lab experiment | 40 |
| Exams and quizzes | 5 | HW/Assignments | 10 |
| | | Study for exam | 15 |
| Total | **80~=68** | Total | **140** |

| Total Learning Hours(Workload) | **208** | Equivalent **ECTS**=Total Workload/28=**7.4** |
|---|---|---|

**(1) Brief Course Description**

The course provides Principles of dimensions and units, vectors, motion in one-dimension, projectile motion, work, power and energy. The course covers concepts of linear momentum and collisions, pressure, buoyant force, electric current, and specific resistance, speed of sound and Doppler Effect. The course discusses the applications of Newton's laws of motion, Archimedes' principle and Ohm's law. Some practical experiments are included to demonstrate the principles involved.

**(2) Course Objectives**

**This course is designed to provide students with:**

- Principles of dimensions and units, vectors, motion in one-dimension, projectile motion, work, power and energy.
- Concepts of linear momentum and collisions, pressure, buoyant force, electric current, and specific resistance, speed of sound and Doppler Effect.
- Applications of Newton's laws of motion, Archimedes' principle and Ohm's law.
- Skills to solve problems regarding the physical principles included.
- Physical experiments to be performed and analyzed.

**(3) Course Contents**

**Theoretical Part:**

- Dimensions and units (dimensional analysis and conversion of units).
- Vectors (addition, subtraction, multiplication and components of a vector).
- Motion in one dimension (one dimensional motion with constant acceleration).
- Newton's laws of motion and solve problems regarding their applications.
- Motion in two dimensions (projectile motion).
- The work, the power and the energy.
- Linear momentum and collisions.
- Pressure, buoyant force and Archimedes' principle.
- Electric current, Ohm's law and specific resistance.
- Speed of sound in solids, speed of sound in fluids and Doppler's effect.

**Experimental Part:**

- Determination of the speed of sound in air.

- Verification of Ohm's law and series and parallel connections of resistors.
- Verification of Archimedes principle.
- Verification of the gravitational free fall law.
- Study of the resultant of forces.
- Study of the projectile motion.
- Determination of the viscosity of liquids.
- Determination of the surface tension of liquids.
- Verification of Hook's law.
- Determination of the acceleration due to gravity using simple pendulum.

**(4) Assessment Criteria**

- Periodic Exams: 20%
- Oral, Student Activity and Essay: 10%
- Laboratory Work: 20%
- Final Exam: 50%

**(5) Course Teaching Strategies**

- Lectures, Reports and Essay Assignments, Homework, and Web-based Assignments.

**(6) Text Book**

- Physics for Scientists& Engineers with Modern Physics; 7th edition, Serway, Saunders Golden Sunburst Series, 2007.

**(7) Reference Books**

- University Physics; H. Young and R. Freedman, Addison-Wesley Publishing Company, Inc., 11th edition, 2004.
- Fundamentals of Physics; Halliday, Resnik and Walker, John Wiley and Sons Inc., 2007.

| Course Title | Course Code | Credit Hours | | | | Year | Level | Pre-req |
|---|---|---|---|---|---|---|---|---|
| | | Theoretical | Lab | Credit | ECTS | | | |
| Geometrical Optics | 211PHYS-3 | 2 | 2 | 3 | 6 | 2nd | 4th | 101PHYS |

**Student's Workload**

| In-class activities | Contact Hours | Self-learning/study | Hours |
|---|---|---|---|
| Lectures | 30 | Preparation for classes | 50 |
| Laboratory | 30 | Working on lab experiment | 40 |
| Exams and quizzes | 5 | HW/Assignments | 10 |
| | | Study for exam | 15 |
| Total | **65~=55** | Total | **115** |
| | | | |
| Total Learning Hours(Workload) | **170** | Equivalent **ECTS**=Total Workload/28=**6** | |

**(1) Breif Course Description**

This course provides the basic principal of geometrical optics covering reflection/refraction, plane surfaces, prisms, spherical surfaces, lenses, and mirrors for use in optical systems. Special topics include optical instruments; like human eyes, telescopes, microscopes. The laboratory explores optics through some experiments in refraction, prism, converging and divering lenses, convex and concave mirrors and some optical instruments.

**(2) Course Objectives**

**This course is designed to provide students with:**

- The concept of light
- The foundations of Geometrical optical
- The principal of elementary optical systems
- The concept of image in optical instruments
- The laboratory work and hands-on activities in geometrical optics.

**(3) Course Contents**

**Theortical Part:**

- Nature of Light
- Refelctionm Refraction and dispersion of light
- Total and Internal reflection of light
- Fiber optics and their applications
- Prisms, resolution of light
- Refraction through spherical systems
- Thin lenses, Mirrors, Vision, human eye, and Optical instruments (Camera, Light microscope and Telescope)

**Expeimental Part:**

- Color Addition
- Snell's Law
- Refractive Index and Critical angle of Glass
- Convex mirror
- Concave mirror
- The focal Length for a convex (converging) lens
- The Focal Length for a Concave Lens
- The equivalent focal length of two convex lenses
- The refractive index of prism using the spectrometer
- Measuring a glasses prescription

**(4) Assessment Criteria**

- Periodic Exams: 15%
- Oral, Student Activity and Essay: 5%
- Laboratory Work: 30%
- Final Exam: 50%

**(5) Course Teaching Strategies**

- Lectures, Reports and Essay Assignments, Homework, and Web-based Assignments

**(6) Text Book**

- Introduction to Optics (3rd Edition), Pedrotti, Frank L; Pedrotti, Leno M; Pedrotti, Leno S, 2006.

**(7) Reference Books**

- Modern Optics; Robert D. Guenther, John Wiley &Sons. Inc., 1990.
- Optics (4th Edition)Hecht, Eugene. 2001.

| Course Title | Course Code | Credit Hours | | | | Year | Level | Pre-req |
|---|---|---|---|---|---|---|---|---|
| | | Theoretical | Lab | Credit | ECTS | | | |
| Waves & Vibrations | 212PHYS -2 | 2 | -- | 2 | 3.8 | 2nd | 4th | 251PHYS |

**Student's Workload**

| In-class activities | Contact Hours | | Self-learning/study | Hours |
|---|---|---|---|---|
| Lectures | 30 | | Preparation for classes | 50 |
| Laboratory | --- | | Working on lab experiment | -- |
| Exams and quizzes | 5 | | HW/Assignments | 10 |
| | | | Study for exam | 15 |
| Total | **35~=30** | | Total | **75** |

| Total Learning Hours(Workload) | **105** | Equivalent **ECTS**=Total Workload/28=**3.8** |
|---|---|---|

**(5) Brief Course Description**

The course provides fundamental concepts of vibrations and waves including oscillatory motion, wave motion, sound waves, and superposition of standing waves.

**(6) Course Objectives**

**The course is designed to provide students with**:

- The physics of systems move in simple harmonic motion (SHM).
- Velocity, acceleration, and kinetic, potential, and mechanical energies of SHM systems.
- Damped oscillations.
- Wave motion and sound waves.
- Waves Interference
- Superposition of standing waves.

**(7) Course Contents**

- **Simple harmonic motion:** Simple harmonic motion, The block–spring system, linear velocity of a particle undergoing simple harmonic motion, frequency and periodic time, energy function of the simple harmonic oscillator, The simple pendulum, the physical pendulum, the torsional pendulum, comparing simple harmonic motion with uniform circular motion.
- **Damped and forced oscillation:** underdamped, critically damped, overdamped oscillations, and forced oscillation.
- **Wave Motion:** basic variables of wave motion, travelling waves, transverse wave, longitudinal waves, superposition and interference, the speed of waves in a string, sinusoidal waves, rate of energy transfer in a sinusoidal wave, the linear wave equation.
- **Sound Waves**: speed of sound waves, the relationship between wave speed and medium temperature, periodic sound waves and their intensities, sound level, the Doppler Effect.
- **Superposition and Standing Waves:** superposition and interference of sinusoidal waves, interference of sound waves, standing Waves, standing waves in a string fixed at both ends, and resonance.

**(4) Assessment Criteria**

- Periodic Exams: 40%
- Oral, Student Activity and Essay: 10%
- Final Exam: 50%

**(5) Course Teaching Strategies**

- Lectures, Reports and Essay Assignments, Homework, and Web-based Assignments

**(6) Text Book**

- Vibrations and Waves (The M.I.T. Introductory Physics Series), A. P. French, W. W. Norton & Company; 1 edition (January 17, 1971).

**(7) Reference Books**

- Physics for Scientists and Engineers, Raymond A. Serway, John W. Jewett, 5th Edition, 2000.
- Fundamentals of Physics; Halliday, Resnik and Walker, John Wiley and Sons Inc., 2007.

| Course Title | Course Code | Credit Hours | | | | Year | Level | Pre-req |
|---|---|---|---|---|---|---|---|---|
| | | Theoretical | Lab | Credit | ECTS | | | |
| **Properties of Matter and Heat** | **221PHYS-4** | **3** | **2** | **4** | **7.3** | **2nd** | **3rd** | **--** |

**Student's Workload**

| In-class activities | Contact Hours | Self-learning/study | Hours |
|---|---|---|---|
| Lectures | 45 | Preparation for classes | 75 |
| Laboratory | 30 | Working on lab experiment | 32 |
| Exams and quizzes | 5 | HW/Assignments | 15 |
| | | Study for exam | 15 |
| Total | **80~=68** | Total | **137** |
| | | | |
| Total Learning Hours(Workload) | **205** | Equivalent **ECTS**=Total Workload/28=**7.3** | |

**(1)Brief Course Description**

This course provides an introduction of basic properties of solids and liquids, including some properties of gases. In addition, we'll take a brief look at surface tension, viscosity, and diffusion. The course covers an introduction of thermal physics, including the study of temperature, heat, and how they affect matter. Within normal temperature ranges, a gas acts like a large collection of non-interacting point particles, called an ideal gas. Such gases will be studied on either a macroscopic or microscopic scale. Concepts of internal heat, specific heat and latent heat will be introduced. Some of the processes of energy transfer between a system and its surroundings will be discussed.

**(2) Course Objectives**

**This course is designed to provide students with:**

- An introduction of states of matter
- The concept of Hooke's law and solid deformation

- Archimedes's Principle and floating condition
- An introduction to fluid dynamics
- Introducing some concepts such as surface tension, viscosity and transport phenomena.
- The fundamental of thermometers and the effect of heat on solid and liquid.
- Macroscopic and microscopic description of ideal gas.

**(3) Course Contents**

**Theoretical Part:**

- **Solids and Fluids:** States of Matter , and The Deformation of Solids, Density and Pressure, Variation of Pressure with Depth, Pressure Measurements, Buoyant Forces and Archimedes's Principle, Fluids in Motion, Surface Tension, Capillary Action, and Viscous Fluid Flow, and Transport Phenomena
- **Thermal Physics**: Temperature and the Zeroth Law of Thermodynamics, Thermometers and Temperature Scales, Thermal Expansion of Solids and Liquids, Macroscopic Description of an Ideal Gas and The Kinetic Theory of Gases
- **Energy in Thermal Processes**: Heat and Internal Energy, Specific Heat, Calorimetry, Latent Heat and Phase Change, and Energy Transfer

**Experimental Part:**

- Moment of Inertia and Body Shape.
- Compound Pendulum.
- Young's Modulus.
- Speed of Sound in Liquids.
- Boyle's law.
- Thermal Conductivity of solids.
- Thermal Expansion in Solids.
- Specific Heat of Solids.
- Joule's law of Heat.

**(4) Assessment Criteria**

- Periodic Exams: 20%
- Oral, Student Activity and Essay: 10%
- Laboratory Work: 20%
- Final Exam: 50%

**(5) Course Teaching Strategies**

- Lectures, Reports and Essay Assignments, Homeworks, and Web-based Assignments.

**(6) Text Book**

- College Physics 7th edition, R. A. Serway, J. S. Faughn and C.Vuille, Brooks/Cole Publishing Co. 2005.

**(7) Reference Books**

- Physics for Scientists and Engineers with Modern Physics; 7th edition, Serway, Saunders Golden Sunburst Series, 2007.
- Fundamentals of Physics; Halliday, Resnik and Walker , John Wiley and Sons Inc., 2007.

| Course Title | Course Code | Credit Hours | | | | Year | Level | Pre-req |
|---|---|---|---|---|---|---|---|---|
| | | Theoretical | Lab | Credit | ECTS | | | |
| Thermodynamics | 222PHYS-3 | 3 | -- | 3 | 5.25 | 2nd | 7th | 221PHYS |

**Student's Workload**

| In-class activities | Contact Hours | Self-learning/study | Hours |
|---|---|---|---|
| Lectures | 45 | Preparation for classes | 75 |
| Laboratory | -- | Working on lab experiment | -- |
| Exams and quizzes | 5 | HW/Assignments | 18 |
| | | Study for exam | 18 |
| Total | **50~=43** | Total | **111** |

| Total Learning Hours(Workload) | **154** | Equivalent **ECTS**=Total Workload/28=**5.5** |
|---|---|---|

**(2) Brief Course Description**

The course is dealing with the basic properties of steam and gases. The course discusses different processes in thermodynamics and their applications.

**(2) Course Objectives**

**This course is designed to provide students with:**

- Concepts of a system, heat, work, Process, a cycle, internal energy, enthalpy and entropy.
- Fundamentals of water vapour, steam tables and perfect gasses.
- Applications of the first law of thermodynamics, general law of ideal gases and the second law of thermodynamics.
- Skills to solve problems regarding the physical principles included.

**(3) Course Contents**

- Concepts of a system, heat, work and the cycle.
- Calculation of work in different processes and cycle problems.
- First law of thermodynamics.
- Curves of water vapour and use of steam tables.
- The general law of ideal gases, the internal energy and enthalpy of gases.
- Important processes in thermodynamics for both steam and perfect gases and problems.
- The second law of thermodynamics and the concept of entropy.
- Entropy calculations for both steam and perfect gases and cycle problems.
- The heat engine and the Carnot cycle.

**(4) Assessment Criteria**

- Periodic Exams: 20%
- Oral, Student Activity and Essay: 30%
- Final Exam: 50%

**(5) Course Teaching Strategies**

- Lectures, Reports and Essay Assignments, Homework, and Web-based Assignments.

**(6) Text Book**

- Applied thermodynamics for Engineering Technologist; T.D Eastop and A. Mcconky, 5th Edition Amazon. Com. 1996.

**(7) Reference Books**

- Thermodynamics, an Engineering Approach; Yunus A.Cengel and Michael A. Boles, McGraw-Hill Inc, 2006.
- Thermodynamics, Kinetic theory and Statistical thermodynamics; F.W. Sears and G.L.Sainger, John Wiley and Sons Inc., 1975.

| Course Title | Course Code | Credit Hours | | | | Year | Level | Pre-req |
|---|---|---|---|---|---|---|---|---|
| | | Theoretical | Lab | Credit | ECTS | | | |
| **Electricity and Magnetism** | **231PHYS-4** | **3** | **2** | **4** | **7.3** | **2nd** | **3rd** | **--** |

**Student's Workload**

| In-class activities | Contact Hours | Self-learning/study | Hours |
|---|---|---|---|
| Lectures | 45 | Preparation for classes | 75 |
| Laboratory | 30 | Working on lab experiment | 32 |
| Exams and quizzes | 5 | HW/Assignments | 15 |
| | | Study for exam | 15 |
| Total | **80~=68** | Total | **137** |
| | | | |
| Total Learning Hours(Workload) | **205** | Equivalent **ECTS**=Total Workload/28=**7.3** | |

**(1)Brief Course Description**

This course discusses basic concepts in some topics of electricity and magnetism. The topics includes; electrostatic charges, Coulomb's law, electrostatic field, Gauss's law and its applications, electrostatic potential, capacitance and dielectrics, magnetic forces, magnetic field and its applications, and electromagnetic induction.

**(2) Course Objectives**

**This course is designed to provide students with:**

- The concepts of electrostatic charges, electrostatic field, electrostatic potential, capacitance and dielectrics, magnetic forces, magnetic field, and electromagnetic induction.
- Coulomb's law, Gauss's law, Biot-Savart law, Ampere's law, Faraday's law and Lenz's law.
- Problems relating to the above topics.
- Laboratory experiments to understand the related concepts.

**(3) Course Contents**

**Theoretical Part:**

- **Electric Fields**: **Electric Fields**: Properties of electric charges, Coulomb's law, the electric field, electric field of a continuous charge distribution, the electric field lines, motion of charged particles in a uniform

electric field.

- **Gauss's Law**: Electric flux, Gauss's law, application of Gauss's law to various charge distributions, Conductors in electrostatic equilibrium.
- **Electric Potential**: Potential difference and electric potential, potential difference in a uniform electric field, electric potential and potential energy due to point charges, obtaining the value of electric field from the electric potential, electric potential due to continuous charge distributions.
- **Capacitance and Dielectrics**: Definition of capacitance, calculating capacitance, combinations of capacitors, energy stored in charged capacitor, capacitors with dielectrics, an atomic description of dielectrics.
- **Magnetic Fields:** magnetic fields and forces, magnetic forces acting on a current carrying conductor, torque in a current loop in a uniform magnetic field, motion of charged particle in a uniform magnetic field.
- **Sources of the Magnetic Field:** Biot–Savart law, magnetic forces between two parallel conductors, Ampere's law, magnetic field of a solenoid, magnetic flux, Gauss's law in magnetism, magnetism in matter.
- **Faraday's Law:** Faraday's law of induction, motional e.m.f, Lenz law, generators and motors, Maxwell's equations.

**Experimental Part:**

- Determination of unknown resistance using Meter Bridge.
- Determination of the internal resistance of a battery.
- Determination of the electrical resistivity of a wire conductor.
- Verification of series and parallel connections of capacitors.
- Determination of the magnetic force acting on a current carrying conductor in a magnetic field.
- Determination of the magnetic field due to short and long solenoids.
- Studying the charge-time curve through charging and discharging capacitors.

**(4) Assessment Criteria**

- Periodic Exams: 20%
- Oral, Student Activity and Essay: 10%
- Laboratory Work: 20 %
- Final Exam: 50 %

**(5) Course Teaching Strategies**

- Lectures, Reports and Essay Assignments, Homework, and Web-based Assignments.

**(6) Text Book**

- Physics for Scientists& Engineers with Modern Physics; 7th edition, Serway, Saunders Golden Sunburst Series, 2007.

**(7) Reference Books**

- University Physics; H. Young and R. Freedman, Addison-Wesley Publishing Company, Inc., 11th edition, 2004.
- Fundamentals of Physics; Halliday, Resnik and Walker, John Wiley and Sons Inc., 2007.
- Electricity and magnetism, Berkeley Physics Course Volume 2, Edward M. Purcell 1990.

| Course Title | Course Code | Credit Hours | | | | Year | Level | Pre-req |
|---|---|---|---|---|---|---|---|---|
| | | Theoretical | Lab | Credit | ECTS | | | |
| Classical Mechanics | 251PHYS-3 | 3 | --- | 3 | 5.25 | 2nd | 5th | -- |

| Student's Workload | | | | |
|---|---|---|---|---|
| **In-class activities** | **Contact Hours** | | **Self-learning/study** | **Hours** |
| Lectures | 45 | | Preparation for classes | 75 |
| Laboratory | --- | | Working on lab experiment | -- |

| | | | | |
|---|---|---|---|---|
| Exams and quizzes | 5 | | HW/Assignments | 18 |
| | | | Study for exam | 18 |
| Total | **50~=43** | | Total | **110** |
| | | | | |
| Total Learning Hours(Workload) | **154** | Equivalent **ECTS**=Total Workload/28=**5.5** | | |

**(1) Brief Course Description**

This course is a rigorous introduction to classical mechanics, which is the study of forces and motion. The emphasize will be the Newtonian formalism and the application of its principles in one dimension as well as in higher dimensions. The concepts of work and energy will be covered and used to solve dynamic problems. The course will also review Kepler's laws and will provide the underlying physics which explain these laws based on Newton's principles. The classical mechanics course is calculus based, and hence will start with a review of the necessary mathematical background

**(2) Course Objectives**

**The course is designed to provide students with:**

- The fundamentals of calculus
- Newton laws and principles.
- Application of Newton's laws in one dimension as well as in higher dimensions
- The concepts of work and energy and their application for dynamic problems
- The essential concepts of circular and rotational motion
- The physics of planetary motion.

**(3) Course Contents**

- **Vectors**: Equality of vectors, vector addition, multiplication by a scalar, vector subtraction, commutative law, associative law, distributive law, magnitude of a vector, Scalar product, cross product, physical examples of products, triple product, derivative of a vector, position vector, velocity and acceleration.
- **Newtonian Mechanics**: Newton laws of motion: first, second, and third law. Linear momentum, motion of a particle, rectilinear motion: uniform acceleration under a constant force. Derivation of Newton equations of motion, motion on inclined surface, forces that depend on position: the concepts of kinetic and potential energy. Motion of a body with variable mass: rocket motion
- **Energy**: Kinetic and potential energy, dynamic systems and the laws of conservation of energy
- **Circular and Rotational Motion:** Angular displacement, angular velocity, angular acceleration, rotational kinematics: Rotational motion with constant angular acceleration, rotational acceleration, rotational energy, moment of inertia, angular momentum and torque.
- **Newton Gravitation:** Newton's law of gravitation, Kepler's Laws: Newton's law of universal gravitation, Kepler's Laws of Planetary Motion: Kepler's First Law: The Law of Ellipses, Kepler's Second Law: Equal Areas and Conservation of Angular Momentum, Kepler's Third Law: The Harmonic Law and their mathematical derivations.

**(4) Assessment Criteria**

- Periodic Exams: 20%
- Oral, Student Activity and Essay: 30%
- Final Exam: 50%

**(5) Course Teaching Strategies**

- Lectures, Reports and Essay Assignments, Homework, and Web-based Assignments.

**(6) Text Book**

- Analytical Mechanics; Grant R. Fowles and George L. Cassiday – 7th edition, Brooks, Cole, publishing, (2004).

**(7) Reference Books**

- Classical Mechanics; Vernon D. Barger and Martin G. Olsson, McGraw Hill (1994).
- Classical Mechanics; Tai L. Chow, CRC Press; 2nd edition (2013).

| Course Title | Course Code | Credit Hours | | | | Year | Level | Pre-req |
|---|---|---|---|---|---|---|---|---|
| | | Theoretical | Lab | Credit | ECTS | | | |
| Mathematical Physics | 251PHYS-3 | 3 | --- | 3 | 5.6 | 2nd | 4th | 201MATH |

**Student's Workload**

| In-class activities | Contact Hours | Self-learning/study | Hours |
|---|---|---|---|
| Lectures | 45 | Preparation for classes | 75 |
| Laboratory | --- | Working on lab experiment | -- |
| Exams and quizzes | 5 | HW/Assignments | 18 |
| | | Study for exam | 18 |
| Total | **50~=43** | Total | **111** |
| | | | |
| Total Learning Hours(Workload) | **154** | Equivalent **ECTS**=Total Workload/28=**5.5** | |

**(8) Brief Course Description**

The objective of this course is to provide the students with necessary mathematical tools for formulating physics problems. Acquiring these tools is a must for any physics students.

**(9) Course Objectives**

**This course is designed to provide students with:**

- The fundamental of the complex numbers including;
- The essential concepts of linear algebra including;
- The basic concepts of Fourier series and Fourier transforms.
- An introduction to special functions such as the Gamma and Beta functions.

**(10) Course Contents**

- **Complex numbers:** Complex plane, Complex algebra, Complex conjugate and absolute value of complex numbers, Complex equations, Graphs and physical applications of complex numbers, Elementary functions of complex numbers, and Exponential and trigonometric functions.
- **Linear Algebra**: The fundamental operation of matrices, Relation between matrices and linear equations, Cramer's rule, Vectors, lines and planes, Linear combination, linear functions and linear operators, Eigenvalue and eigenvector of a transformations.

- **Fourier series and Fourier integrals**: Periodic and non-periodic functions, Average value of a function, Fourier series, Complex form of Fourier series, Even and odd functions, Fourier transforms and Laplace transforms.
- **Special functions:** The factorial function, The Gamma function and recursion relation., The Beta function, and The relation between the Gamma and Beta functions.

**(4) Assessment Criteria**

- Periodic Exams: 30%
- Oral, student activity and Essay: 20%
- Final Exam: 50%

**(5) Course Teaching Strategies**

- Lectures, Reports and Essay Assignments, Homework, and Web-based Assignments.

**(6) Text Book**

- Mary L. Boas (2006) Mathematical Methods in the Physical Sciences; 3rd edition, John Wiley& Sons, USA.

**(7) Reference Books**

- G. B.Arfken and H.J.Weber (2001),"Mathematical Methods For Physicists"Academic Press, Oxford.
- Chaun Wan Wong (1991),"Introduction to Mathematical Physics";Oxford University Press, Oxford.

| Course Title | Course Code | Credit Hours | | | | Year | Level | Pre-req |
|---|---|---|---|---|---|---|---|---|
| | | Theoretical | Lab | Credit | ECTS | | | |
| **Electronics 1** | **311PHYS-3** | **3** | **---** | **3** | **5.5** | **3rd** | **5th** | **231PHYS** |

**Student's Workload**

| In-class activities | Contact Hours | Self-learning/study | Hours |
|---|---|---|---|
| Lectures | 45 | Preparation for classes | 75 |
| Laboratory | --- | Working on lab experiment | -- |
| Exams and quizzes | 5 | HW/Assignments | 20 |
| | | Study for exam | 16 |
| Total | **50~=42** | Total | **111** |
| | | | |
| Total Learning Hours(Workload) | **153** | Equivalent **ECTS**=Total Workload/28=**5.5** | |

**(1) Brief Course Description**

This course provides fundamental knowledge in electronic aspects including resistors, capacitors, and inductors with direct current (DC) and alternating current (AC) sources, the analysis of circuits and semiconductor devices. The course covers basic electronic components, DC circuits, AC circuits, Kirchhoff's law, transient response of RL, RC and RLC circuits, properties of semiconductor materials, p-n junctions, diodes and their applications in rectifiers, filters, and multiplier circuits, and basic structure and configurations of bipolar junction transistors (BJT). The use of test equipment and troubleshooting

of components/devices are included.

**(2) Course Objectives**

**This course is designed to provide students with:**

- Principles and circuit analysis of direct current (DC) and alternating current (AC) electrical circuits.
- Basic properties and characteristics of semiconductor materials and devices.
- Various types of diodes and their applications.
- Structures, operational principles, modes and characteristics of bipolar junction transistor (BJT).
- Basic principles of electrical test equipment and troubleshooting of components and devices.

**(3) Course Contents**

- **Basic components of electronics**: Resistor, capacitor and inductor (Series and parallel connections).
- **Kirchhoff's laws**
- **Direct current (DC) circuits:** Electromotive force (emf), Internal resistances, Electronic components in DC source, Series circuits, Parallel circuits, Electrical measuring instruments.
- **Alternating current (AC) circuits**: AC source, Resistors in AC circuit, Inductors in AC circuit, Capacitors in AC circuit.
- **The RLC circuits**: RLC series circuits, Phasor diagram, Resonance frequency, Rectifiers and filters, Power in AC circuit, Transformer and power transmission.
- **Electronic structure of atoms:** Atom model, Atomic number and electron shell.
- **Properties of semiconductor materials:** Category of solid materials, Semiconductors, Covalent bond, P-type semiconductors, and N-type semiconductors.
- **P-N junctions:** Depletion region, Current flow in p- & n-type semiconductors.
- **The diodes,** The physics of diodes, Biasing of a diode, Characteristics of a diode, Diode models, Testing a diode.
- **Application of diodes:** Diode as a rectifier, Diode as a filter, and Diode data sheet
- **Special purpose of diodes**: Zener diodes, Light emitting diodes (LED), Photodiodes, Laser diodes.
- **Bipolar junction transistors (BJTs):** Transistor structure, Operation modes, Circuit configurations, Characteristics, and BJT applications.

**(4) Assessment Criteria**

- Periodic Exams: 40%
- Oral, Student Activity and Essay: 10%
- Final Exam: 50%

**(5) Course Teaching Strategies**

- Lectures, Reports and Essay Assignments, Homework, and Web-based Assignments.

**(6) Text Book**

- James W. Nilsson and Susan Riedel, Electric Circuits, Addison-Wesely Publishing Company Inc., 2007.
- Thomas L. Floyd, Electronic Devices, Pearson Prentice Hall, Inc., 7th Edition, 2005.

**(7) Reference Books**

- College Physics, Raymond A. Serway, Jerry S. Faughn, Chris Vuille; Brooks/Cole, 9th Edition 2009.
- Electronics: Circuits and Devices; Ralph J. Smith, John-Willey and Sons, Inc., 3rd Edition, 1987.
- Basic Electronics for Scientists; James J. Brophy, McGraw-Hill Kogakusha Ltd., 1990

| Course Title | Course Code | Credit Hours | | | | Year | Level | Pre-req |
|---|---|---|---|---|---|---|---|---|
| | | Theoretical | Lab | Credit | ECTS | | | |
| **Physical Optics** | **312PHYS-4** | **3** | **2** | **4** | **5.75** | **3rd** | **5th** | **211PHYS** |

**Student's Workload**

| In-class activities | Contact Hours | Self-learning/study | Hours |
|---|---|---|---|
| Lectures | 45 | Preparation for classes | 75 |
| Laboratory | 30 | Working on lab experiment | 40 |
| Exams and quizzes | 5 | HW/Assignments | 20 |
| | | Study for exam | 15 |
| Total | **80~=67** | Total | **150** |

| | | |
|---|---|---|
| Total Learning Hours(Workload) | **201** | Equivalent **ECTS**=Total Workload/28=**5.75** |

**(3) Brief Course Description**

The course provides background knowledge of several optics phenomena with an emphasis on the light as electromagnetic waves. It covers the concepts of superposition, interference, diffraction and polarization of light. The course also covers applications and experiments related to these concepts. The course material will be covered in traditional lecture format as well as laboratory demonstrations and hands-on activities.

**(2) Course Objectives**

**This course is designed to provide students with:**

- The concept of the nature of light and wave theory of light.
- The concept of superposition of light
- The interference of light and related experiments.
- The concept of the diffraction of light.
- The concept of polarization of light.
- Hands on experience with the laboratory experiments to understand the related concepts.

**(3) Course Contents**

**Theoretical Part:**

- **Nature of light and wave theory of light:** Concept of light as a particle**,** Concept of light as a wave **and** Concept of light as an electromagnetic wave
- **Vibrations and waves:** Simple harmonic motion (SHM)**,** Transverse wave and Wave velocity
- **Superposition of waves:** Addition of SHM**,** Superposition of two waves, Superposition of many waves**, and** Group velocity

- **Interference of light:** Huygen's principle, Young's experiment, Thin film interference, Film thickness by interference, Newton's ring, and Others interferometers apparatuses
- **Diffraction of light:** Single slit diffraction, Resolving power, Diffraction grating, Rayleigh's criterion, Fraunhofer diffraction, Double slit diffraction, Diffraction from many slits. Diffraction grating, and Fresnel diffraction
- **Polarization of light:** State of polarization and polarizer, Malus' law, Dichorism, Birefringence, Brewster's angle, and Polarization by reflection

**Experimental Part:**

- The dispersion and the resolving power of a prism.
- Interferences of light using
- Young's double-slit experiment.
- Diffraction of light through a single-slit.
- Newton's interference rings.
- Malus' law of polarization.
- Optical activity and polarization.
- Diffraction grating spectrometer.
- Kerr effect.
- Michelson interferometer.

**(4) Assessment Criteria**

- Periodic Exams: 15%
- Oral, Student Activity and Essay: 5%
- Laboratory Work: 30%
- Final Exam: 50%

**(5) Course Teaching Strategies**

- Lectures, Reports and Essay Assignments, Homeworks, and Web-based Assignments.

**(6) Text Book:**

- Introduction to Optics by Frank L Pedrotti, Leno M Pedrotti , Leno S Pedrotti . Addison-Wesley; 3rd edition (April 17, 2006)

**(7) Reference Books:**

- Fundamental of Optics; F. A. Jenkins and H. S. White, McGraw-Hill Priml Custom Publishing, 2001.
- Optics; Eugene Hecht, 4th Edition, Addison- Wesley, 2001.

| Course Title | Course Code | Credit Hours | | | | Year | Level | Pre-req |
|---|---|---|---|---|---|---|---|---|
| | | Theoretical | Lab | Credit | ECTS | | | |
| Electrodynamics | 331PHYS-3 | 3 | --- | 3 | 5.6 | 3rd | 4th | 231PHYS |

**Student's Workload**

| In-class activities | Contact Hours | Self-learning/study | Hours |
|---|---|---|---|
| Lectures | 45 | Preparation for classes | 75 |
| Laboratory | --- | Working on lab experiment | -- |
| Exams and quizzes | 5 | HW/Assignments | 20 |
| | | Study for exam | 20 |
| Total | **50~=42** | Total | **115** |

| | | |
|---|---|---|
| Total Learning Hours(Workload) | **157** | Equivalent **ECTS**=Total Workload/28=**5.6** |

**(1) Brief Course Description**

This course includes the discussion on electric phenomena when the charge is assumed to be at rest (electrostatics), magnetic phenomena under steady state consideration (magnetostatics) and some special techniques. It mainly focuses on establishing the notion of electrodynamics based on the time and spatial dependence of the electric and magnetic fields. It also encompasses Maxwell's equations and derivation of electromagnetic wave equation for vacuum and material medium.

**(2) Course Objectives**

**This course is designed to provide the students with:**

- The differential and integral calucus that required to understand electrodynamics.
- Calculataion of electric and magnetic fields for simple system, to describe properties of electric and magnetic fields using divergence, curl and gradient .
- Solve some problems using the method of images.
- Maxwell's equations and subsequent discussion on electromagnetic wave theory.

**(3) Course Contents**

- Vector calculus (differentiation and integration).
- Electrostatics.
- Special Techniques.
- Magnetostatic.
- Electromagnetic induction.
- Maxwell's equations.
- Electromagnetic waves theory in vacuum and material medium

**(4) Assessment Criteria**

- Periodic Exams: 40%
- Oral, Student Activity and Essay: 10%
- Final Exam: 50%

**(5) Course Teaching Strategies**

- Lectures, Reports and Essay Assignments, Homework, and Web-based Assignments.

**(6) Text Book**

- Introduction To Electrodynamics, 3rd Edition, Dived J. Griffiths, Prentice-Hall-, Inc., Englewood Cliffs, 1991.

**(7) Reference Books**

- Foundations of Electromagnetic Theory, 4th Edition, John R. Reitz, Frederick J. Milford, Robert W. Christy, Addison-Wesley Publishing Company, Inc., 2008.

| Course Title | Course Code | Credit Hours | | | | Year | Level | Pre-req |
|---|---|---|---|---|---|---|---|---|
| | | Theoretical | Lab | Credit | ECTS | | | |

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **Modern Physics 1** | **341PHYS -3** | **3** | **---** | **3** | **5.6** | **3rd** | **5th** | **---** |

**Student's Workload**

| **In-class activities** | **Contact Hours** | **Self-learning/study** | **Hours** |
|---|---|---|---|
| Lectures | 45 | Preparation for classes | 75 |
| Laboratory | --- | Working on lab experiment | -- |
| Exams and quizzes | 5 | HW/Assignments | 20 |
| | | Study for exam | 20 |
| Total | **50~=42** | Total | **111** |

| | | |
|---|---|---|
| Total Learning Hours(Workload) | **157** | Equivalent **ECTS**=Total Workload/28=**5.6** |

**(4) Brief Course Description**

Modern Physics involves the extremes of very small distances and velocities close to the speed of light. These extremes demanded new theories in the early part of the 20th century and yielded the weird and wonderful results of Einstein's relativity theory and Schrodinger's equation in quantum mechanics. The course covers the birth of modern physics before launching into Einstein's theory of special relativity, and introducing quantum mechanics for the description of atomic physics.

**(5) Course Objectives**

**This course is designed to provide students with**:

- The changes in physics that took place near the end of 19th century.
- Special Theory of Relativity.
- Experimental Basis of Quantum Physics.
- Solve problems related to the main physical concepts and theories of the 20th century.
- Structure of the Atom and Wave Properties of Matter.

**(3) Course Contents**

- **The Birth of Modern Physics:** Classical Physics of the 1890s **(**Mechanics, Electromagnetism, Thermodynamics**),** The Kinetic theory of gases**,** Waves and Particles**,** Conversation Laws and Fundamental Forces**.**
- **Special Theory of Relativity:** The Michelson-Morley Experiments**,** Einstein's postulates**,** The Lorentz Transformation**,** Space – time**,** Doppler Effect**,** Relativistic Momentum**,** and Relativistic Energy**.**
- **Experimental Basis of Quantum Physics:** Discovery of the X ray and the Electron**,** Blackbody Radiation**,** Photoelectric Effect (*Experimental results of Photoelectric effect*, *Classical Interpretation*, and *Quantum Interpretation*), X-Ray Production, Compton Effect, and Pair Production and Annihilation**.**
- **Structure of the Atom:** The Atomic Models of Thomson and Rutherford**,** The Classical Atom Model**,** The Bohr Model of the Hydrogen Atom**,** and Success and Failures of the Bohr Model.
- **Wave Properties of Matter and Quantum Mechanics:** X-Ray Scattering**,** De Broglie Waves**,** Wave Motion**,** Uncertainty principle**,** The Schrodinger Wave Equation**,** Application of Schrodinger Equation to the Hydrogen Atom**.**

**(4) Assessment Criteria**

- Periodic Exams: 30%

- Oral, Student Activity and Essay: 20%
- Final Exam: 50%

**(5) Course Teaching Strategies**

Lectures, Reports and Essay Assignments, Homeworks, Web-based assignments.

**(6) Text Book**

- Modern Physics for Scientists and Engineers, Stephen & Andrew Brooks/Cole, Cengane Learning, 2013.

**(7) Reference Books**

- Modern Physics, P. A. Tipler, and R. A. Llewellyn, Freeman, 4th edition 2002.
- Modern Physics; K. S. Krane, Wiley, John & Sons, Inc., 1995.
- Concepts of Modern Physics; Arthur Beiser, McGraw-Hill Book Co., 1987.

| Course Title | Course Code | Credit Hours | | | | Year | Level | Pre-req |
|---|---|---|---|---|---|---|---|---|
| | | Theoretical | Lab | Credit | ECTS | | | |
| **Electronics 2** | **411PHYS-4** | **3** | **2** | **4** | **8** | **4th** | **7th** | **311PHYS** |

**Student's Workload**

| In-class activities | Contact Hours | Self-learning/study | Hours |
|---|---|---|---|
| Lectures | 45 | Preparation for classes | 76 |
| Laboratory | 30 | Working on lab experiment | 40 |
| Exams and quizzes | 5 | HW/Assignments | 10 |
| | | Study for exam | 15 |
| Total | **80~=67** | Total | **141** |
| | | | |
| Total Learning Hours(Workload) | **208** | Equivalent **ECTS**=Total Workload/28=**7.4** | |

**(6) Brief Course Description**

The course provides background knowledge of major discoveries and models relating to the atom such as Rutherford model, Bohr model and interpretation of the spectral series of the hydrogen atom, Sommerfeld model, quantum theory achievements (energy levels, Quantum numbers, electron spin and orbital angular momentum, and orbital-spin interaction). The course also covers the rules of atomic emission as well as the effect of magnetic and electric field on the atom. A series of compulsory practical exercises are undertaken to demonstrate the principles involved.

**(2) Course Objectives**

**This course is designed to provide students with:**

- The fundamental of the atomic structure.
- The essential concepts of orbital motion, spin of the electron and fine structure
- The effect of magnetic and electric field on the atom

- The spectral line emission and related rules.
- Practical exercises are undertaken.

**(3) Course Contents**

**Theoretical Part:**

- **Atom Concept:** Rutherford model, Bohr postulates and Bohr model of hydrogen atom, Spectral series of hydrogen atom (Balmer, Lyman, Paschen, Brackett and Pfund), Spectrum of hydrogen like atoms, and Sommerfeld model.
- **Orbital, Spin and Fine structure**: Quantum theory achievements (energy levels - quantum numbers ), Magnetic moment of the orbital motion, Spin and magnetic moment of the electron, Stern and Gerlach experiment, Spin-Orbit interaction (LS coupling) and total angular momentum, Fine structure , and Term diagram, Pauli's exclusion principle, Selection Rule, and The Lamb shift.
- **Atoms in a magnetic and Electric Fields**: Electron spin resonance, Normal Zeeman effect Anomalous Zeeman effect , The Paschen Back effect, Stark effect, Factors affecting spectral line broadening (Doppler's width – Stark's width), and Detection of Spectral line.
- **X-ray emission and internal shells:** X-ray radiation from outer shells**,** X-ray Bremsstrahlung spectra**,** X-ray **c**haracteristic radiation**.**

**Experimental Part:**

- Balmer series of hydrogen and Hg visible spectrum Experiment.
- Grating spectrometer (Hg, Na) Experiment.
- X–ray Emission Experiment.
- Frank–Hertz experiment.
- Zeeman effect Experiment.

**(4) Assessment Criteria**

- Periodic Exams: 20%
- Oral, Student Activity and Essay: 10%
- Laboratory Work: 20%
- Final Exam: 50%

**(5) Course Teaching Strategies**

- Lectures, Reports and Essay Assignments, Homeworks, and Web-based assignments.

**(6) Text Book**

- The Physics of Atom and Quanta; Hermann Hacken, and Hans Christoph Wolf; 7th ed Springer-Verlage 2005.

**(7) Reference Books:**

- Introduction to Atomic and Nuclear Physics; H. Semat, Holt McDougal; 5th edition 1972.
- Atomic Physics; C. Foot, Oxford University Press, USA; 1st edition, 2005.

| Course Title | Course Code | Number of Study Hours | | | | Year | Level | Pre-req |
|---|---|---|---|---|---|---|---|---|
| | | Theoretical | Lab | Credit | ECTS | | | |
| Analytical Mechanics | 351PHYS-3 | 3 | --- | 3 | 5.6 | 3rd | 5th | 251PHYS |

| Student's Workload | | | |
|---|---|---|---|
| **In-class activities** | **Contact Hours** | **Self-learning/study** | **Hours** |
| Lectures | 45 | Preparation for classes | 75 |
| Laboratory | --- | Working on lab experiment | -- |
| Exams and quizzes | 5 | HW/Assignments | 20 |
| | | Study for exam | 20 |
| Total | **50~=42** | Total | **115** |
| | | | |
| Total Learning Hours(Workload) | **157** | Equivalent **ECTS**=Total Workload/28=**5.6** | |

**(1) Brief Course Description**

This course emphasizes on the advanced physical concepts and mathematical techniques associated with dynamic systems. Special features of the course will be the introduction of Lagrangian and Hamiltonian methods to demonstrate the power of these methods in solving problems in mechanics. The course covers also the kinematics and dynamics of rigid bodies as well as the dynamics of many particles systems.

**(2) Course Objectives**

**This course is designed to provide students with:**

- Introduction to the concept of generalized coordinates and generalized forces
- Lagrangian and Hamiltonian Mechanics.
- Methods to solve complex problems of mechanics.
- Analytical methods commonly used to treat rigid bodies mechanics.
- Introduction to the many particles dynamics

**(3) Course Contents**

- Dynamics of systems of particles (center of mass and linear momentum of a system, Angular Momentum and Kinetic Energy of a system, Motion of two interacting bodies: The reduced Mass).
- Collisions (Oblique and scattering collisions).
- Rigid bodies mechanics (General theories and its applications on many types of motion, motion of rigid bodies in three dimensions.)
- Lagrangian Mechanics.
- Hamiltonian Mechanics.

**(4) Assessment Criteria**

- Mid -Term Exams: 20%
- Oral, Student Activity and Essay: 30%
- Final Exam: 50%

**(5) Course Teaching Strategies**

- Lectures, Reports and Essay Assignments, Homework, and Web-based Assignments.

**(6) Text Book**

- Analytical Mechanics; Grant R. Fowles and George L. Cassiday – 7th edition, Brooks, Cole,

publishing, 2004.

**(7) Reference Books**

- Analytical Mechanics; Louis N. Hand and Janet D. Finch, Amazon.com, 1998.

| Course Title | Course Code | Credit Hours | | | | Year | Level | Pre-req |
|---|---|---|---|---|---|---|---|---|
| | | Theoretical | Lab | Credit | ECTS | | | |
| Quantum Mechanics 1 | 352PHYS-3 | 3 | --- | 3 | 6 | 3rd | 6th | 252PHYS |

**Student's Workload**

| In-class activities | Contact Hours | Self-learning/study | Hours |
|---|---|---|---|
| Lectures | 45 | Preparation for classes | 75 |
| Laboratory | --- | Working on lab experiment | -- |
| Exams and quizzes | 5 | HW/Assignments | 25 |
| | | Study for exam | 25 |
| Total | **50~=43** | Total | **125** |

| Total Learning Hours(Workload) | **168** | Equivalent **ECTS**=Total Workload/28=**6** |
|---|---|---|

**(1) Brief Course Description**

This course covers fundamental concepts of quantum mechanics: wave properties, uncertainty principles, Schrödinger equation, and operator and matrix methods. Basic applications of the following are discussed: one-dimensional potentials (harmonic oscillator), three-dimensional central potentials (hydrogen atom), and angular momentum and spin.

**(2) Course Objectives**

**This course is designed to provide students with:**

- The failure of classical physics to explain many phenomena.
- The postulates of Quantum Mechanics.
- Mathematics of quantum mechanics.
- Time dependent and time independent Schrödinger's equation.
- Angular momentum in quantum mechanics.
- Spherically symmetric potentials

**(3) Course Contents**

- The postulates of Quantum Mechanics.
- Mathematics of quantum mechanics: Operators and expectation values, commentators and operator algebra, Bra-Ket notations.
- Time dependent and time independent Schrödinger's equation: examples of one- dimensional motion.
- Angular momentum in quantum mechanics. Spherical harmonics, addition of angular momentum, the Wigner-Eckart Theorem.
- Spherically symmetric potentials.
- Hydrogen atom

**(4) Assessment Criteria**

- Periodic Exams: 30%
- Oral, Student Activity and Essay: 20%
- Final Exam: 50%

**(5) Course Teaching Strategies**

- Lectures, Reports and Essay Assignments, Homework, and Web-based Assignments.

**(6) Text Book**

- Introduction to Quantum Mechanics; David J. Griffiths, Pearson Prentice Hall, 1995.

**(7) Reference Books**

- Introductory Quantum Mechanics; R. Liboff, 4th Edition, Addison-Wesley, 2002.
- Quantum Mechanics; Sara M. Mc Murry, Addison-Wesley, 1994.

| Course Title | Course Code | Credit Hours | | | | Year | Level | Pre-req |
|---|---|---|---|---|---|---|---|---|
| | | Theoretical | Lab | Credit | ECTS | | | |
| Statistical Physics | 353PHYS-2 | 2 | -- | 2 | 3.8 | 3rd | 6th | 222PHYS 301STAT |

**Student's Workload**

| In-class activities | Contact Hours | | Self-learning/study | Hours |
|---|---|---|---|---|
| Lectures | 30 | | Preparation for classes | 50 |
| Laboratory | --- | | Working on lab experiment | -- |
| Exams and quizzes | 5 | | HW/Assignments | 12 |
| | | | Study for exam | 15 |
| Total | **35~=30** | | Total | **80** |

| Total Learning Hours(Workload) | **110** | Equivalent **ECTS**=Total Workload/28=**3.8** |
|---|---|---|

**(1) Brief Course Description**

Statistical Physics is a probabilistic approach to equilibrium properties of systems with large number of degrees of freedom. Topics include: introduction to statisticsl methods, statistical description of systems of particles (Methodology of Statistical Mechanics), classical statistical mechanics, and quantum statistical mechanics ( Bose-Einstein and Fermi-Dirac Statistics).

**(2) Course Objectives**

**This course is designed to provide students with:**

- Introduction to statistical methods based on the probability theory.
- Statistical description of systems of particles
- Classical statistical ensembles (microcanonical, canonica, grand canonical)
- Introduction to the quantum statistical mechanics

**(3) Course Contents**

- **Introduction to statistical methods:** Random walk and binomial distribution.
- **Statistical description of systems of particles** (Methodology of Statistical Mechanics)**:**Statistical Micro and Macro states, and Motion of a particle in a box (Classical and Quantum approaches)**.**
- **Classical Statistical Mechanics:** Ideal gas theory (Boltzmann-Maxwell distribution)**,** Micro-canonical Ensemble**,** Canonical Ensemble**,** and Grand-canonical Ensemble**.**
- **Quantum Statistical Mechanics**: Bose-Einstein, Fermi-Dirac Statistics, and Black body radiation.

**(4) Assessment Criteria**

- Periodic Exams: 20%
- Oral, Student Activity and Essay: 30%
- Final Exam: 50%

**(5) Course Teaching Strategies**

- Lectures, Reports and Essay Assignments, Homework, and Web-based Assignments.

**(6) Text Book**

- Fundamentals of Statistical and Thermal Physics ; F. Reif, McGraw–Hill, 2002.

**(7) Reference Books**

- Thermodynamics, Kinetic Theory and Statistical Thermodynamics; F.W. Sears and G. L Salinger, John Wiley& Sons, Inc., 1975.
- Introduction to Statistical Physics, W. G. Rosswe, Ellis Horwood, Ltd. 1982

| Course Title | Course Code | Credit Hours | | | | Year | Level | Pre-req |
|---|---|---|---|---|---|---|---|---|
| | | Theoretical | Lab | Credit | ECTS | | | |
| Solid State Physics 1 | 371PHYS-3 | 3 | --- | 3 | 5.7 | 3rd | 6th | 311PHYS |

**Student's Workload**

| In-class activities | Contact Hours | Self-learning/study | Hours |
|---|---|---|---|
| Lectures | 45 | Preparation for classes | 75 |
| Laboratory | --- | Working on lab experiment | -- |
| Exams and quizzes | 5 | HW/Assignments | 20 |
| | | Study for exam | 22 |
| Total | **50~=43** | Total | **117** |

| | | |
|---|---|---|
| Total Learning Hours(Workload) | **160** | Equivalent **ECTS**=Total Workload/28=**5.7** |

**(1)Brief Course Description**

This course is intended to provide an introduction to the physics of solids including the properties of static (crystal structure), dynamic (lattice vibrations) arrangements of atoms and X-ray diffraction. Next we will study electron theory in metals and will identify key features distinguishing metals, insulators and semiconductors.

**(2)Course Objectives:**

**This course is designed to provide students with:**

- The fundamental of crystal structures and symmetry.
- The relationship between atomic bonding and various mechanical, thermal, and electronic properties.
- The concept of defects in solids.
- The essential elements of analysis of crystal structures using x-ray diffraction techniques.
- The theory of lattice vibrations (phonons).
- The principal of free electron theory.

- The classes of magnetic materials.

**(3)Course Contents:**

**-Crystal Structure:** Bravais lattice, primitive cell, lattice with a basis, common crystal structures (simple cubic, face centered cubic, body cantered cubic, diamond, and hexagonal), miller indices, and classification of Bravais lattice.

**-The reciprocal lattice:** definition of reciprocal lattice, construction of a reciprocal lattice, Brillouin zones, and lattice planes and reciprocal vectors.

**-Crystal binding:** crystals of inert gases, ionic crystals, covalent crystals, and metallic bonds.

**- Defects in solids:** amorphous solids; localized and extended defects.

**- X-ray diffraction:** Bragg's law, von Laue's formulation, experimental geometries suggested by the Laue condition, and structural factors.

**- Phonons:** lattice vibration, quantization of elastic waves, phonon momentum, heat capacity, thermal conductivity.

**-Magnetic Properties of Materials:** Basic Concepts in Magnetism, Diamagnetism, Paramagnetism,Ferromagnetism,Antiferromagnetism, Ferrimagnetism, Langevin Theory of Diamagnetism Quantum Mechanical Considerations: Paramagnetism, Diamagnetism, Ferromagnetism and Antiferromagnetism.

**-The Drude theory of metals:** basic assumptions of Drude model, DC electrical conductivity of a metal, Hall effect and magnetoresistance.

**(4)Assessment Criteria**

- Periodic Exams: 20%
- Student Activity(Homework, Quizzes, home activity) : 30%
- Final Exam:50%

**(5)Course Teaching Strategies**

**-** Lectures, Reports and Essay Assignments, Homework, and Web-based Assignments.

**(6) Text Book**

- C.Kittel. Introduction to Solid State Physics, 8th edn., Wiley, 2005.

**(7) References**

- Principles of the Solid State; H. V. Keer, Wiley Eastern Limited, London, 1993.
- The Solid State; H. M. Rosenberg, Oxford press, 1988.

| Course Title | Course Code | Credit Hours | | | | Year | Level | Pre-req |
|---|---|---|---|---|---|---|---|---|
| | | Theoretical | Lab | Credit | ECTS | | | |
| Electronics 2 | 411PHYS-4 | 3 | 3 | 4 | 8 | 4th | 7th | 311PHYS |

**Student's Workload**

| In-class activities | Contact Hours | Self-learning/study | Hours |
|---|---|---|---|
| Lectures | 45 | Preparation for classes | 75 |
| Laboratory | 45 | Working on lab experiment | 45 |
| Exams and quizzes | 5 | HW/Assignments | 10 |
| | | Study for exam | 15 |

| | | | | |
|---|---|---|---|---|
| Total | **95~=80** | | Total | **141** |
| | | | | |
| Total Learning Hours(Workload) | **225** | Equivalent **ECTS**=Total Workload/28=**8** | | |

**(7) Brief Course Description**

The course provides background knowledge of major discoveries and models relating to the atom such as Rutherford model, Bohr model and interpretation of the spectral series of the hydrogen atom, Sommerfeld model, quantum theory achievements (energy levels, Quantum numbers, electron spin and orbital angular momentum, and orbital-spin interaction). The course also covers the rules of atomic emission as well as the effect of magnetic and electric field on the atom. A series of compulsory practical exercises are undertaken to demonstrate the principles involved.

**(2) Course Objectives**

**This course is designed to provide students with:**

- The fundamental of the atomic structure.
- The essential concepts of orbital motion, spin of the electron and fine structure
- The effect of magnetic and electric field on the atom
- The spectral line emission and related rules.
- Practical exercises are undertaken.

**(3) Course Contents**

**Theoretical Part:**

- **Atom Concept:** Rutherford model, Bohr postulates and Bohr model of hydrogen atom, Spectral series of hydrogen atom (Balmer, Lyman, Paschen, Brackett and Pfund), Spectrum of hydrogen like atoms, and Sommerfeld model.
- **Orbital, Spin and Fine structure**: Quantum theory achievements (energy levels - quantum numbers ), Magnetic moment of the orbital motion, Spin and magnetic moment of the electron, Stern and Gerlach experiment, Spin-Orbit interaction (LS coupling) and total angular momentum, Fine structure , and Term diagram, Pauli's exclusion principle, Selection Rule, and The Lamb shift.
- **Atoms in a magnetic and Electric Fields**: Electron spin resonance, Normal Zeeman effect Anomalous Zeeman effect , The Paschen Back effect, Stark effect, Factors affecting spectral line broadening (Doppler's width – Stark's width), and Detection of Spectral line.
- **X-ray emission and internal shells:** X-ray radiation from outer shells**,** X-ray Bremsstrahlung spectra**,** X-ray **c**haracteristic radiation**.**

**Experimental Part:**

- Balmer series of hydrogen and Hg visible spectrum Experiment.
- Grating spectrometer (Hg, Na) Experiment.
- X–ray Emission Experiment.
- Frank–Hertz experiment.
- Zeeman effect Experiment.

**(4) Assessment Criteria**

- Periodic Exams: 20%
- Oral, Student Activity and Essay: 10%
- Laboratory Work: 20%
- Final Exam: 50%

**(5) Course Teaching Strategies**

- Lectures, Reports and Essay Assignments, Homeworks, and Web-based assignments.

**(6) Text Book**

- The Physics of Atom and Quanta; Hermann Hacken, and Hans Christoph Wolf; 7th ed Springer-Verlage 2005.

**(7) Reference Books:**

- Introduction to Atomic and Nuclear Physics; H. Semat, Holt McDougal; 5th edition 1972.
- Atomic Physics; C. Foot, Oxford University Press, USA; 1st edition, 2005.

| Course Title | Course Code | Credit Hours | | | | Year | Level | Pre-req |
|---|---|---|---|---|---|---|---|---|
| | | Theoretical | Lab | Credit | ECTS | | | |
| Laser and its applications | 412PHYS-3 | 3 | --- | 3 | 5.7 | 4th | 7th | 312PHYS |

**Student's Workload**

| In-class activities | Contact Hours | Self-learning/study | Hours |
|---|---|---|---|
| Lectures | 45 | Preparation for classes | 75 |
| Laboratory | --- | Working on lab experiment | -- |
| Exams and quizzes | 5 | HW/Assignments | 20 |
| | | Study for exam | 22 |
| Total | **50~=43** | Total | **117** |

| Total Learning Hours(Workload) | **160** | Equivalent **ECTS**=Total Workload/28=**5.7** |
|---|---|---|

**(8) Brief Course Description**

This course is designed to provide students with the fundamentals of laser oscillation, its properties and applications. It describes the interaction of photon with matter and covers the essential laser requirements, laser gain media, laser oscillations inside various resonators, and their stability conditions. It also discusses the laser beam characteristics, transformation, and mode structure. It enables students to explore some of the laser types and the related aspects of various technological applications that employ lasers and beam optics.

**(2) Course Objectives**

**This course is designed to provide students with:**

- The fundamental concepts and principles of light matter interactions.
- The essential concepts of laser oscillations, its operational requirements and laser beam properties.
- The formulations of laser rate equations in various systems, laser threshold conditions and some of the laser types and their characteristics.
- The adequate analysis of the continuous-wave and pulsed laser operation using appropriate formalisms.
- The criteria of assessment of optical resonator stability and mode structure.
- The basics of some laser applications.

**(3) Course Contents**

- **Laser Fundamentals:** The nature of light, Blackbody Radiation, The Einstein relations (Emission + Absorption), Rate equations (gain and population inversion), Pumping methods, Three and Four level systems, and Threshold condition of laser oscillation .
- **Laser beam propagation and transformation:** Resonators and stability condition**,** Laser Modes (transverse and longitudinal modes)**.**
- **Properties of Laser Radiation:** Coherence, Monochromaticity, Directionality, Focusing, and Brightness.
- **Some types of lasers:** Gas lasers {Atomic (He-Ne)- Ionic (Argon)- Molecular ( $CO_2$ , Excimer), Solid State Lasers (Raby, Nd:YAG, Ti:Sapphire), Semiconductor Lasers (GaA1As), Free electron laser .
- **Laser output:** Q-Switching, Methods of Q-Switch, Mode locking, and Methods of Mode Locking.
- **Laser's Applications:** Optical communication**,** Metrological and Scientific Application**,** Medical, Industrial and Military Applications**,** Commercial and Information Applications**,** Holography and its Applications.

**(4) Assessment Criteria**

- Periodic Exams: 40%
- Oral, Student Activity and Essay: 10%
- Final Exam: 50%

**(5) Course Teaching Strategies**

- Lectures, Reports and Essay Assignments, Homeworks, and Web-based assignments.

**(6) Text Book**

- Lasers and Electro-optics: Fundamentals and Engineering, Christopher C. Davis, Cambridge University Press, 2nd Ed., 2014

**(7) Reference Books**

-Principles of Laser, Orazio Sevelto- Translated by *David C. Hanna*, Springer, 5th Ed.2013
-Laser Fundamentals, William T. Silfvast, Cambridge University Press; 2nd Ed. 2008

| Course Title | Course Code | Credit Hours | | | | Year | Level | Pre-req |
|---|---|---|---|---|---|---|---|---|
| | | Theoretical | Lab | Credit | ECTS | | | |
| Modern Physics 2 | 441PHYS-4 | 3 | 3 | 4 | 8 | 4th | 8th | 342PHYS |

| Student's Workload | | | |
|---|---|---|---|
| **In-class activities** | **Contact Hours** | **Self-learning/study** | **Hours** |
| Lectures | 45 | Preparation for classes | 75 |
| Laboratory | 45 | Working on lab experiment | 45 |
| Exams and quizzes | 5 | HW/Assignments | 10 |
| | | Study for exam | 15 |
| Total | **95~=80** | Total | **141** |

| | | |
|---|---|---|
| Total Learning Hours(Workload) | **225** | Equivalent **ECTS**=Total Workload/28=**8** |

**(1)Brief Course Description**

This is an advanced and continued Modern Physics I course offered to the 8 level undergraduate senior students at the Jazan University. Molecular Spectroscopy, Modern Methods of Optical Spectroscopy, Cosmology and the Progress in Quantum Physics are the main chapters to be covered in this course. Students learn the theory of molecular bonding, their properties and spectroscopy by means of vibration, rotation and the selection rules of molecules. In the optical spectroscopy, students learn about quantum beats, Doppler-free saturation spectroscopy and two-photon absorption and finally the level-crossing spectroscopy. Students then move to learn about the Universe by means of it's origin, evolution and ultimate fate. Last but not least, students learn about the major advancement of quantum physics, e.g. quantum computers, entanglement etc. Students are also required to perform the practical classes (labs) concerning to the course contents.

**(2) Course Objectives**

**This course is designed to provide students with:**

- The fundamental of molecular spectra, optical spectroscopy, modern cosmology and advance in quantum physics.
- Analyzing the molecular spectrum, explaining the optical spectroscopy, developing their ideas about modern cosmology and the advances in quantum world (e.g. quantum computing).
- Demonstrate concepts concerning the course by means of practical classes.
- Familiar with the advanced research fields in Physics.

**(3) Course Contents**

**Theoretical Part:**

- **Molecular Physics:** The Hydrogen molecule ion, Hydrogen molecule and covalent bond, Other covalent bonding molecule (pp covalent bonds, sp covalent bonds, sp hybrid states), Ionic bonding e.g Nacl and calculation of bonding energy, Molecular vibrations, Molecular rotations, Selection rules, Molecular spectra
- **Cosmology:** The origin of the universe, Expansion of the universe, Cosmic microwave background radiation, General Theory of Relativity, Test of General Theory of Relativity, Dark Matter and Black Holes, Big Bang cosmology, Formation of Nuclei and atoms, and Future of the universe
- **Modern Methods of Optical Spectroscopy:** Classical method, Quantum beats, Doppler effect, Doppler -free saturation spectroscopy, Doppler-free two –photon absorption, Level-crossing spectroscopy, and Laser cooling of atoms
- **Progress in Quantum Physics:** Quantum entanglement, Introduction to quantum computers (History, Review of digital computers, Basic concept of the quantum computers), and Bose-Einstein Condensation

**Experimental Part:**

- Millikan experiment and measurements of the electric charges of oil droplet.
- Determination of specific charge of electron using Thomson tube.
- Determination of specific charge of electron using calibrated Helmholtz coils.
- Determination of Planck's constant using Photo- electric effect
- Investigating the energy spectrum of an X-Ray tube as a function of the high Voltage
- Investigating the energy spectrum of an X-Ray tube as a function of the emission Current
- Determination of Planck's constant using Duane-Hunt relation using X-ray emission
- Rutherford scattering: Measuring the scattering rate as a function of the scattering angle and the Atomic Number.
- Fine structure of the characteristic x-radiation of a molybdenum anode.
- Compton effect: verifying the energy loss of the scattered x-ray quantum.

**(4) Assessment Criteria**

- Periodic Exams: 15%
- Oral, Student Activity and Essay: 10%
- Laboratory Work: 25%
- Final Exam: 50%

**(5) Course Teaching Strategies**

- Lectures, Reports and Essay Assignments, Homework, and Web-based Assignments.

**(6) Text Book**

- Modern Physics; K. S. Krane, Wiley, John &Sons, Inc., 1995.
- The Physics of Atoms and Quanta; H. Haken and H.C. Wolf, Springer, 6th edition 2000.

**(7) Reference Books**

- Concepts of Modern Physics; Arthur Beiser, McGraw-Hill Book Co., 1987.
- Modern Physics, P. A. Tipler, and R. A. Llewellyn, Freeman, 4th edition 2002.

| Course Title | Course Code | Credit Hours | | | | Year | Level | Pre-req |
|---|---|---|---|---|---|---|---|---|
| | | Theoretical | Lab | Credit | ECTS | | | |
| Quantum Mechanics 2 | 451PHYS-3 | 3 | --- | 3 | 6 | 4th | 7th | 352PHYS |

**Student's Workload**

| In-class activities | Contact Hours | Self-learning/study | Hours |
|---|---|---|---|
| Lectures | 45 | Preparation for classes | 75 |
| Laboratory | --- | Working on lab experiment | -- |
| Exams and quizzes | 5 | HW/Assignments | 25 |
| | | Study for exam | 25 |
| Total | **50~=43** | Total | **125** |

| | | |
|---|---|---|
| Total Learning Hours(Workload) | **168** | Equivalent **ECTS**=Total Workload/28=**6** |

**(11) Brief Course Description**

This course is the continuation of Quantum Mechanics1. It mainly encompasses approximation techniques such as perturbation theory, variational principle, WKB method and Born approximation. These approximation techniques will be applied to calculate the energy and wave corrections to perturbed simple harmonic oscillator, relativistic correction to hydrogen atom and to study interaction of radiation with matter and scattering.

**(12) Course Objectives**

**This course is designed to provide students with:**

- Quantum mechanics that can be used in obtaining the first and second order energy and wave function corrections for nondegenerate and degenerate cases.
- Determination the transition probabilities for two-level system using time-dependent perturbation theory approximately obtain the lowest ground state energy by optimizing variational parameters of the trial function.
- Generatation of scattering amplitudes and cross sections using Born approximation.

**(13) Course Contents**

- Short review of quantum formulation.
- Time-dependent perturbation.
- Time-independent perturbation.
- Vartional principle.
- WKB approximation.
- Born's approximation (Scattering theory).

**(14) Assessment Criteria**

- Periodic Exams: 40%
- Oral, Student Activity and Essay: 10%
- Final Exam: 50%

**(5) Course Teaching Strategies**

- Lectures, Reports and Essay Assignments, Homeworks, and Web-based assignments.

**(6) Text Book**

- Introduction to quantum mechanics, David J. Griffiths, Prentice Hall Inc., 1995

**(7) Reference Books**

- Introductory Quantum Mechanics; R. Liboff, 4th Edition, Addison Wessely, 2002.
- Quantum Mechanics; Sara M. Mc Murry, Addison Wessely, 1994.

| Course Title | Course Code | Credit Hours | | | | Year | Level | Pre-req |
|---|---|---|---|---|---|---|---|---|
| | | Theoretical | Lab | Credit | ECTS | | | |
| Plasma Physics | 452PHYS-3 | 3 | --- | 3 | 5.7 | 4th | 8 th | 353PHYS |

| Student's Workload | | | | |
|---|---|---|---|---|
| In-class activities | Contact Hours | | Self-learning/study | Hours |
| Lectures | 45 | | Preparation for classes | 75 |
| Laboratory | --- | | Working on lab experiment | -- |
| Exams and quizzes | 5 | | HW/Assignments | 20 |

| | | | | |
|---|---|---|---|---|
| | | | Study for exam | 22 |
| Total | **50~=43** | | Total | **117** |
| | | | | |
| Total Learning Hours(Workload) | **160** | Equivalent **ECTS**=Total Workload/28=**5.7** | | |

**(5) Brief Course Description**

Plasma is the fourth state of matter that incredibly important in basics sciences and technology. This course is an introductory course to plasma physics in which the plasma state and the basics plasma parameters and conditions are defined. Also in this course, the plasma models, the plasma oscillation, and waves phenomena in plasma are explained, in addition. The theory of gas discharge and the breakdown mechanism in plasma are illustrated, as well as the thermonuclear fusion reactions and criteria are given.

**(6) Course Objectives**

**This course is designed to provide students with:**

- The definition of plasma state and its main behavior and characteristics.
- The basic plasma parameters and some examples of plasma state in nature.
- The plasma conditions and the relation between these conditions and the plasma behavior.
- The single particle model and the motion of the charged particle in uniform electric and magnetic field.
- The fluid plasma model, the plasma frequency, and waves in plasma.
- The theory gas discharge and the breakdown mechanism in plasma experiments.
- The thermonuclear fusion criteria and its roles in the fusion experiments.

**(7) Course Contents**

- **Plasma State:** Plasma in Nature**,** Definition of Plasma **,** Concept of Temperature**,** Debye Shielding, Plasma parameters and conditions.
- **Plasma models:** The single particle mode, and Motion of single particle in uniform *E* and *B*.
- **Waves in plasma:** The wave definition and representation**,** The phase and group velocity **,** The plasma oscillation, Electron plasma wave**,** Ion plasma (sound) waves**.**
- **Gas discharge and breakdown:** Background (The gas discharge and its classifications)**,** The Direct current (DC) discharge, Breakdown condition, The Townsend, Glow and Arc discharges.
- **Plasma experiments and diagnostics:** Introduction to controlled fusion (Fusion reaction and Lawson criterion)**,** The Magnetic Confinement, The Inertial Confinement
- **Plasma Diagnostics and plasma application** (elective)
- .

**(8) Assessment Criteria**

- Periodic Exams: 30%
- Oral, Student Activity and Essay: 20%
- Final Exam: 50%

**(5) Course Teaching Strategies**

- Lectures, Reports and Essay Assignments, Homeworks, and Web-based assignments.

**(6) Text Book**

- Introduction to Plasma Physics and Controlled Fusion; F. F. Chen, 3rd edition, Springer International Publishing Switzerland 2016.

**(7) Reference Books**

- Fundamentals of Plasma physics; Paul M. Bellan, Cambridge University Press, 2006.
- Fusion Research Principles, Experiments, and Technology, T. Dolan, Pergamum Press 2000.
- Introduction to Plasma Physics; R.J. Goldston, P.H. Rutherford, Institute of Physics Publishing, London, 1997.

| Course Title | Course Code | Credit Hours | | | | Year | Level | Pre-req |
|---|---|---|---|---|---|---|---|---|
| | | Theoretical | Lab | Credit | ECTS | | | |
| Nuclear physics 1 | 461PHYS-3 | 3 | --- | 3 | 5.7 | 4th | 7 th | 352PHYS |

**Student's Workload**

| In-class activities | Contact Hours | Self-learning/study | Hours |
|---|---|---|---|
| Lectures | 45 | Preparation for classes | 75 |
| Laboratory | --- | Working on lab experiment | -- |
| Exams and quizzes | 5 | HW/Assignments | 20 |
| | | Study for exam | 22 |
| Total | **50~=43** | Total | **117** |

| Total Learning Hours(Workload) | **160** | Equivalent **ECTS**=Total Workload/28=**5.7** |
|---|---|---|

**(1) Brief Course Description**

This course is to provide knowledge and understanding of the basics of nuclear physics like nuclear properties, force, structure, radioactivity, reactions and power production to enable progression to a postgraduate course or to provide a platform for entering industry.

**(2) Course Objectives**

**This course is designed to provide students with:**

- The fundamental of the nuclear physics and its scale.
- The basic properties of the nuclear force.
- The structure of the nucleus under different nuclear models.
- The stability of nuclei and their decay.
- The fission process and the basics of nuclear reactor.
- The fusion process and how intermediate and heavy elements are created in the stars.

**(3) Course Contents**

- **Nuclear Properties:** Nuclear scale, units, constants, size and density, components, Notation, isotopes, The nuclear chart (Nuclear landscape), how to write a nuclear reaction, Binding Energy BE, Average Binding Energy BE/A, Q-value.
- **Nuclear forces**: Nuclear properties, charge distribution, potential proton and neutron potential wells, force.
- **Nuclear models**: Fermi gas model, Liquid drop model, Shell model, deformation.
- **Radioactivity**: Types of radiation,- Alpha , - Beta+ , Beta-, - Gamma, Electron capture, decay chains, Uses of Radioactivity, Radioactivity decay law, Half-life, life time, nuclear dating, Carbon, Rock dating
- **Nuclear reactions:** The conservation laws, types of reaction, Elastic, Inelastic, Transfer, Compound, Fission, why fission happens, spontaneous, induced (controlled), nuclear reactor., Fusion, p-p cycle, CNO cycle, nucleosynthesis.

**(4) Assessment Criteria**

**(4)** Periodic Exams: 20%

**(5)** Oral, Student Activity and Essays: 30%
**(6)** Final Exam: 50%

**(5) Course Teaching Strategies**

Lectures, Reports and Essay Assignments, Homeworks, and Web-based Assignments.

**(6) Text Book**

- Introductory Nuclear Physics, Krane K.S. Wiley, New York, (1987).

**(7) Reference Books**

- Nuclear and Particle Physics, Williams W.S.C Clarendon Press, Oxford, (1991).

| Course Title | Course Code | Credit Hours | | | | Year | Level | Pre-req |
|---|---|---|---|---|---|---|---|---|
| | | Theoretical | Lab | Credit | ECTS | | | |
| **Modern Physics 2** | **462PHYS-4** | **3** | **3** | **4** | **8** | **4th** | **8th** | **461PHYS** |

**Student's Workload**

| In-class activities | Contact Hours | Self-learning/study | Hours |
|---|---|---|---|
| Lectures | 45 | Preparation for classes | 75 |
| Laboratory | 45 | Working on lab experiment | 45 |
| Exams and quizzes | 5 | HW/Assignments | 10 |
| | | Study for exam | 15 |
| Total | **95~=80** | Total | **141** |

| Total Learning Hours(Workload) | **225** | Equivalent **ECTS**=Total Workload/28=**8** |
|---|---|---|

**(9)Brief Course Description**

This is an advanced course offered to the 8th level undergraduate senior students at the Jazan University. Particle and radiation interactions with matter, particle detectors, particle accelerators, particles zoo and the standard model are the main chapters to be covered in this course. The learning outcome of this course is to let trainee understand the particles interaction (based on their identifications, e.g., electron, proton, alpha, photon etc.) with matter. These interactions measured by an electronic device named detector. Students learn the theoretical aspects on detector development and how it works. In order to produce the particles in the laboratory we need particle accelerators and students learn how to design these accelerators and their working mechanism. Students also learn the elementary particles based on their spin, charge, mass and lifetime. Finally they will learn the Standard Model briefly that describes the elementary particles and their interactions that shape our known universe. Students are also required to perform the practical classes (labs) concerning to the course contents.

**(2) Course Objectives**

**This course is designed to provide students with:**

- The fundamental of particle and radiation interaction with matter, particle detection, acceleration, particle zoo and the standard model of elementary particles.

- Know how the particle detectors and accelerators are designed and familiar with the modern cutting edge technologies.
- Explain particle classifications and the corresponding theoretical model.
- Demonstrate concepts concerning the course by means of practical classes.
- Familiar with the advanced research in nuclear and particle physics fields.

**(3) Course Contents**

**Theoretical Part:**

- **Energy Deposition in Media:**Charged particles interaction with matter, Bethe Bloch formula, Energy loss through bremsstrahlung, Photon interaction with matter, Photoelectric, Compton and pair production mechanism, Interaction of neutrons with matter, Interaction of hadrons with matter (briefly).
- **Particle Detection:** Ionization detectors**,** Ionization counters, proportional counters and Geiger Muller counters, Scintillation detectors**,** Time of Flight**,** Cherenkov detectors**,** Semiconductor detectors**,** Calorimeters**,** and Layer detectors (e.g. ATLAS, CMS at CERN).
- **Accelerators:** Electrostatic accelerators**,** Resonance accelerators**,** Synchronous accelerators**,** Phase stability, strong focusing and colliding beam**,** and Large Hadron Collider at CERN (basic information from web).
- **Properties and Interactions of Elementary Particles:** Four basic forces**,** Elementary particles (their history)**,** Quantum number (Baryon, lepton, strangeness, isospin etc.), Gell-Mann_Nisjijima relation, Production and decay of resonances, Violation of quantum numbers, Weak interaction (Hadrinic weak decays, semileptonic processes etc.), Electromagnetic interaction, Symmetries, Parity, Time Reversal, CPT theorem.
- **Formulation of the Standard Mode:** Quarks and leptons, Quark content of mesons, Quark content of baryons, Color quantum number, Quark model for mesons and baryons, Valance and sea quarks in hadrons, Chromodynamics and confinement.

**Experimental Part:**

- Plotting a GM Plateau
- Geiger Tube Efficiency
- Inverse Square Law
- Absorption of Gamma Rays
- Backscattering of Gamma Rays
- Determining the half-life of Ba-137
- Recording and calibrating a g spectrum
- Detection Efficiency of a NaI(Ti) Detector
- Calculation of β/ϒ ratio

**(4) Assessment Criteria**

- Periodic Exams: 15%
- Oral, Student Activity and Essay: 10%
- Laboratory Work: 25%
- Final Exam: 50%

**(5) Course Teaching Strategies**

- Lectures, Reports and Essay Assignments, Homeworks, and Web-based assignments.

**(6) Text Book**

- Introduction to nuclear and particle Physics; A. Das and T. Ferbel, World Scientific Publishing, 2005.

**(7) Reference Books**

- Radiation Detection and Measurement; G. Knoll, John Wiley & Sons, 2000.
- Nuclear Physics; Irving Kaplan, Addison-WesleyPublishing Company, Cambridge, Mass, 1962.

| Course Title | Course Code | Credit Hours | | | | Year | Level | Pre-req |
|---|---|---|---|---|---|---|---|---|
| | | Theoretical | Lab | Credit | ECTS | | | |
| Solid State Physics 2 | 471PHYS-4 | 3 | 3 | 4 | 8 | 4th | 8th | 461PHYS |

**Student's Workload**

| In-class activities | Contact Hours | Self-learning/study | Hours |
|---|---|---|---|
| Lectures | 45 | Preparation for classes | 75 |
| Laboratory | 45 | Working on lab experiment | 45 |
| Exams and quizzes | 5 | HW/Assignments | 10 |
| | | Study for exam | 15 |
| Total | **95~=80** | Total | **141** |

| | | |
|---|---|---|
| Total Learning Hours(Workload) | **225** | Equivalent **ECTS**=Total Workload/28=**8** |

**Brief Course Description**

This course is a continuation of solid state physics 1 course. In its first part, it covers quantum approach of free electron theory of solids, band theory of solids, electrical, dielectric and magnetic properties of solids. The second part deals with semiconductor physics theory and applications which cover energy bands and carrier concentrations in semiconductor at equilibrium, carrier transport phenomena and some devices applications.

**(2) Course Objectives**

**This course is designed to provide student with:**

- The free electron gas theory, the basic concepts of quantum mechanics, statistical mechanics and atomic spectroscopy.
- The free electron theory of metals, the band theory of solids and Bloch wave function to understand the origin of energy bands in metals and semiconductors.
- Kronig-Penny model of solids according to band theory.
- Solids to metal insulator and semiconductors according to their band diagram and with respect to their different properties.
- The solid metals and semiconductors according to their, electric, dielectric and magnetic properties.
- Experiments included in the lab. section to acquire the experience with laboratory's apparatus, interpret different experimental results, and justify different phenomena experimentally.

**(3) Course Contents**

**The theoretical part :**

- **Free electron theory of metals according to quantum theory** ( the properties of the essential state of Fermi-gas, Fermi-distribution of electrons, Fermi-Dirac distribution, electronic specific heat of metals, them-ionic emission).
- **The band theory of solids** (schrodinger equation for solids-the origin of energy bands in solids-Bloch function- wave function properties of the electron in the crystal and Briolloun zones-Kronig-Penny model- classification of solids according to band theory, the effective mass of electron.
- **Insulators and ferro-electric substances** (the electric fields in insulators- dielectric constant and

electric polarization- ferro-electric crystals).

- **Semiconductors**: pure semiconductors - doped semiconductors, concentration of the electric charge carriers, energy bands and charge carrier in equilibrium, generation rate and recombination of the electric charge carriers, transport phenomena and applications**.**

**The experimental part :**

- Analysis of dielectrics using x-rays.
- Hall effect.
- The photo-conductivity.
- The luminesces .
- The ferro-magnetism.
- Absorption coefficients of insulators.
- The thermo-electric effect.
- Band gap of semiconductors.
- Planck's constants using Light emitting diodes.
- Solar cell experiments.

**(4) Assessment Criteria**

- Periodic Exams: 15%
- Oral, student activity and Essay: 10%
- Laboratory Work :25%
- Final Exam:50%

**(5) Course Teaching Strategies**

- Lectures, Paper Assignments, Homework, Web-based Assignments

**(6) Text Book:**

- Introduction to solid states, C. Kittle, 7th Edition, John-Wiley and sons Inc. 2007.

**(7) Reference Books**

- Principles of the solid state, H. V. Keer, Wiley Eastern limited, London, 1993.
- The solid state, H. M. Rosenberg, Oxford Press, 1988.

| Course Title | Course Code | Credit Hours | | | | Year | Level | Pre-req |
|---|---|---|---|---|---|---|---|---|
| | | Theoretical | Lab | Credit | ECTS | | | |
| Graduation Project | 491PHYS-4 | 2 | 2 | 4 | 8.4 | 4th | 7th | Department approval |

**Student's Workload**

| In-class activities | Contact Hours | Self-learning/study | Hours |
|---|---|---|---|
| Orientation classes and interaction with the supervisor | **25** | Preparation for project work | 50 |
| Lab or theoretical work | **40** | Working on data and analysis | 80 |
| Demonstration and discussion | **15** | Tasks accomplishments and report writing | 15 |
| Presentations and Viva | **10** | Preparation for viva | 15 |
| Total | **75** | Total | **160** |
| | | | |
| Total Learning | **235** | Equivalent **ECTS**=Total Workload/**28**=**8.4** | |

| | | |
|---|---|---|
| Hours(Workload) | | |

**(1) Brief Course Description**

The undergraduate research project may take a number of different forms. It might involve carrying out a small experimental investigation, involving the use of laboratory facilities and underpinned by a review of previous work in the same theme. The project could be a computational programming work, consisting of a small numerical simulation of special physics phenomena. In this case the attention should focus on the computational technique and its effectiveness of describing the phenomena. The project could even consist on a detailed literature review in a particular subject, but it would need to be critical and theoretical in its approach, and involve much more research than a long essay.

**(2) Course Objectives**

**This course is designed to provide students with:**

-A research work experience supervised by a faculty member
-The possibility to expand his knowledge in a specific area
-A strengthening of his scientific skills
-A strengthening of his writing skills
-The possibility to present and defend his project in front of an audience.

**(3) Course Contents**

- Literature review
- Analysis and discussion of the problem
- New approaches to the problem (Theoretical or Experimental)
- Application of the approaches
- Results analysis and discussion
- Writing the dissertation
- Preparation of the defending presentation

**(4) Assessment Criteria**

Supervisor: 50%
Referees: 50%

**(5) Course Teaching Strategies**

- Lectures, Paper Assignments, Homeworks, and Web-based Assignments

**(6) Text Book and references:** as per the research topic