College of Science
King Faisal University
Kingdom of Saudi Arabia

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Document Title:	**Physics program manual**
Brief description of the document:	**physics program manual containing all college of science and physics department information, Track, description, outcomes, textbook, courses facilities ….**

Physics Program

Committee of Quality Assurance of the Physics Department 2020/2021 G

(1441/1442 H)

King Faisal University

College of science

Physics Department

Bachelor of Science in Physics Program Manual

2020-2021 G

1441-1442 H

Contents

1. College of Science

1.1. History

The College of Science was established by Supreme Decree No. 7/10522 / B on 12th of June 2002 to include four academic Departments: Biology, Chemistry, Physics and Mathematics and statistics. These Departments were included earlierin the College of Education, providing four educational Bachelor's degree in the above four majors as well as two Master's degree, Mathematics and Physics. During the academic year 2013-2014, a new master's program was introduced in Chemistry, followed by three master's programs in the academic year 2016/2017 from the Department of Biological Sciences in the fields of Zoology, Botany and Microbiology. Accordingly, the College awards four Bachelor's degrees, Chemistry, Physics, Biology and Mathematics and statistics beside six master's degrees in Physics, Mathematics, Chemistry, Zoology, Botany and Microbiology. The College is currently working on offering new PhD programs for all scientific specialties in addition to some higher diploma programs according to the needs of the labor market. Furthermore, the College provides an extensive out-of-College support to other colleges of the University, including the colleges of Medicine, Veterinary Medicine, Agricultural and Nutritional Sciences, Computer Sciences, Pharmaceutical Sciences, Engineering and Education. In addition to the College Deanship, the College administration consists of several Vice-Deans and administrators to organize the academic work efficiently. Three Vice-Deans are.found in the male Section, the Academic Affairs, Graduate Studies and Research and Development and Community Service. One Vice-Dean exists in the female section for the Academic and Administrative Affairs and includes two administration units, for administrative and technical affairs.

The College has more than 400 of faculty members, lecturers and demonstrators as well as more than 80 technicians and administrative staff contributing in the service of the educational process. The College also has more than 4,000 male and female students in all scientific disciplines for Bachelor's and master's degrees.

The College contains developed academic halls such as smart classrooms, TV broadcasting classrooms beside teaching and research laboratories. These teaching rooms and laboratories became more appropriate after moving to the new building, where they contain sophisticated scientific devices to help the student in learning process and professors in scientific research. As a part of its plan of development, the new students of the College of Science joined the preparatory year starting from the first semester of the academic year 2018/2019.

The College periodically reviews its education plans. The four Departments at the College have recently revised their curricula in order to keep abreast of recent developments in the fields of science. The objective of this development is to provide the society with graduates who are able to cope labor market needs as well as, for getting local and international academic accreditation to its programs for better quality and effectiveness. The College is reviewing its research orientations and strategies for the coming years to keep them aligned with the vision of the Kingdom 2030 to serve national issues in different scientific fields and to join advanced research fields such as energy, health, nanotechnology and food security. In this regard, the College is interested in community partnership, where the College offers many activities related to Community service by providing specialized training workshops for beneficiaries from some government sectors, allowing Pre-university education students to visit research laboratories and encouraging research that serves issues of environment and society. In addition, the college offers an important annual number of qualified graduates who participate in various scientific disciplines in the service of the community.

1.2. Vision

"Excellence in education and scientific research in basic sciences and their applications and enhancing community engagement ".

1.3. Mission

Providing advanced academic programs in agreement with international standards to meet the labor market requirements, conducting outstanding scientific research to contribute in the community engagement, and preparing human competencies that capable of carrying out their duties in an attractive and stimulating environment.

1.4. Objectives

1. Excellence in basic sciences education and their applications.
2. Contribute to the development of outstanding scientific research.
3. Lifelong development of human resources.
4. Transferring and indigenization of technology and its optimum use.
5. Enhancing community engagement that will lead to mutual enrichment.

1.5. Values

1 .Loyalty

2 .Quality

3 .Institutional work

4 .Justice

5 .Innovation

6. Lifelong learning

1.6. College Curriculum and Study Plan Committee

A Curriculum and Study Plan Committee was reformed by the Dean of the College of Science on 25/12/1439, decision No. 24195. This committee was assigned the task of preparing the curricula of the four Departments at the College of Science and submit them to the University Curriculum and Study Plan Permanent Committee.

1.7. College Departments

The College of Science includes in its organizational structure four academic Departments as follows:

1. Department of Biology
2. Department of Chemistry
3. Department of Mathematics and Statistics
4. Department of Physics

1.8. Degree Title Awarded by the College

The College of Science awards the **Bachelor of Science Degree** in one of the four following majors: Biology, Chemistry, Mathematics and Physics.

1.9. College Study System

The College of Science offers undergraduate programs of study following the semester system for at least four years including a summer training. The summer training is a mandatory and compulsory course for all the students at the College.

1.10. Admission Requirements

The admission requirements will be in accordance with the criteria set by the College Council and the admission requirements of King Faisal University (KFU). To be eligible for admission, the applicant must:

- A Recent Secondary School Certificate in scientific track with a minimum average of 75%.
- Passed the General Aptitude Test (GAT) offered by the Saudi National Center for Assessment of Higher Education.
- Passed the Standard Achievement Admission Test (SAAT) offered by the Saudi National Center of Assessment of Higher Education.
- Achieved a minimum combined percentage (Secondary, GAT and SAAT) of 70%.

1.11. Notes:

1. The language of instruction in all the Departments will be English except for the university and some college requirement and elective courses which will be taught in Arabic.
2. Progression from the Preparatory Year Program to the first year of the programs at the College of Science depends on the student getting a Cumulative Grade Point Average (GPA) of not less than 2.75 out of 5.

2. The Department of Physics

2.1 Rationale

The purpose of the proposed undergraduate program in physics is to achieve distinction in intellectual, academic and research achievements in physics concepts and applications. Contributing to the development of outstanding physics research, transferring and indigenizing up-to-date technologies and their optimum use, and promoting community engagement that will lead to mutual enrichment.

2.2 Relevance of the program to the mission and goals of the institution

The College of Science at King Faisal University undergoes a major reviving of their study plan for their major departments. This is due to the major switch in the language of instruction from Arabic to English language. The introduction of a preparatory year for all students who have been accepted to study at the College of Science is proposed to cope with this language change requirement, and to improve the mathematical and the English skills of the students.

The courses' contents and Learning Outcomes (LO) for the new Physics program courses are required to comply with the National Center for Assessment in Higher Education (NCAAA), therefore,

a major review / reconstruction of the physics study plan is required to fulfill this requirement in alignment with the program objectives. Furthermore, a specialized team from Ohio University conducted a visit to KFU to evaluate and study the restructuring of the study plans of all the academic departments. The team gave a concluding final report with recommendations about restructuring the academic study plans, these remarks have been taken into account when applicable. The student is awarded the Bachelor of Science in Physics upon the completion of a 129 credits in the new Physics study plan.

2.3 Program Mission

Providing advanced academic program in Physics in agreement with international standards to meet the labor market requirements, conducting outstanding scientific research to contribute in the community engagement, and preparing qualified and competent people that are capable of carrying out their duties in an attractive and stimulating environment.

2.4 Program Goals, Objectives and Indicators:

Goals	Performance Indicators
1. Excellence in teaching physics and its applications.	KPI-P-2: Students' Evaluation of quality of learning experience in the program
	KPI- P-3: Students' evaluation of the quality of the courses.
	KPI-P-7: Graduates' employability & enrolment in postgraduate. programs
	KPI-P-9: Employers' evaluation of the program graduates proficiency.
2. Contribution in distinguished research in physics.	KPI-P-14: Percentage of publications of faculty members.
	KPI-P-15: Rate of published research per faculty member.
	KPI-P-16: Citations rate in refereed journals per faculty member
3. Continuous development of human resources.	KPI-P-9: Employers' evaluation of the program graduate's proficiency.
	KPI-P-10: Students' satisfaction with the offered services.
	KPI-P-6: Students' performance in the professional and/or national examinations
	KPI-P-7:Graduates' employability & enrolment in postgraduate programs.
4. Ongoing development of recent technology in the field of physics.	Project (4-1-1): Encouraging the registration of patents from research results and converting them into marketable products. (operational plan)
	Project (4-1-2): Maximizing the benefit of and training on research devices. (operational plan)
5. Enhancing community engagement that leads to mutual enrichment.	KPI-P-1: Percentage of achieved indicators of the program operational plan objectives.

2.5 Program learning outcomes

In defining and selecting the program learning outcomes, the classifications of the learning outcomes, the Saudi Arabian Qualification Framework is applied.

Knowledge and Understanding	
K1	Describe fundamental concepts, principles, theories and laws relevant to the physics course subjects.
K2	Recall experimental techniques, tools and basic concepts for physics laboratory.
Skills	
S1	Interpret physics concepts and principles and apply them to analyze a given situation/phenomenon.
S2	Demonstrate skills in problem solving and critical thinking.
S3	Demonstrate the ability of using software packages to analyze physics-relevant theoretical and experimental problems.
S4	Employ different information resources to perform an independent study of a topic or a subject.
S5	Communicate comprehensively in writing and orally using proper scientific language.
Values	
V1	Implement ethical standards of practice as the basis of all interactions with organizations, communities and individuals.
V2	Demonstrate self-dependence, responsibility, active and effective contribution within work groups, and the tendency to responsible and effective leadership.

2.6 Professional Occupations

1. Instructor in Higher Education (Higher Education Sector).
2. Research Assistant (Higher Education sector and Research Institutes).
3. Scientific Informatics Consultant.
4. Laboratory technician (Higher Education sector and Research Institutes).
5. Instrumental technician (Industry and Private Sectors).
6. Technician in radiology clinics (Health sector).
7. Measurement and Calibration officer (The National Measurement and Calibration Center).
8. Inspector in government agencies such as Ministry of Trade and SASO.
9. Scientific equipment salesperson (Private Sector).

2.7 Benchmark Institutions and References

The Table below shows the benchmark institutions and references used in the development of the program:

Institution	Country	Website
The University of Ohio at Athens	USA	https://www.ohio.edu/

University of California at Davis	USA	https://www.ucdavis.edu/
American University of Beirut	Lebanon	https://www.aub.edu.lb/
King Saud University	KSA	https://ksu.edu.sa/
Qassim University	KSA	https://www.qu.edu.sa

2.8 Prospective Accrediting Agencies

1. NCAAA for local accreditation
2. ABET for international accreditation.

2.9 Program Structure and Organization

General Framework for the Distribution of Program Units

Program Structure	Required/ Elective	No. of courses	Credit Hours	Percentage
Institution Requirements	Required	2	4	3.1%
	Elective	2	4	3.1%
College Requirements	Required	12	28	21.7%
	Elective	1	3	2.3%
Program Requirements	Required	23	76	58.9%
	Elective	3	9	7.0%
Capstone Course/Project	Required	1	2	1.6%
Field Experience/ Intern-ship	Required	1	3	2.3%
Others	NA	NA	NA	NA
Total		**45**	**129**	**100%**

2.10 Bachelor of Science in Physics Study Plan

Level	Course Code	Course Title	Required or Elective	Pre-Requisite Courses	Credit Hours	Type of requirements (Institution, College or Department)
Level 1	0824101	General Physics1	Required	-	3	College
	0824111	General Physics1 Lab	Required	-	1	College
	1900101	Islamic Creed and doctrines	Required	-	2	University
	7402103	Literary Appreciation	Required	-	2	College
	0827101	Calculus 1	Required	-	4	College
	0827102	Introduction to Computer Sciences	Required	-	3	College
	0827112	Introduction to Computer Sciences Lab	Required	-	1	College
Total					16	
	19xxxxx	University Elective	Elective	-	2	University

Level 2	7402102	Arabic editing	Required	-	2	College
	0825101	General Chemistry1	Required	-	3	College
	0825111	General Chemistry Lab1	Required	-	1	College
	0827103	Introduction to statistics	Required	-	4	College
	0826101	General Biology	Required	-	3	College
	0826111	General Biology Lab	Required	-	1	College
Total					16	
Level 3	0824212	General Physics 2 Lab	Required	-	1	Physics Department
	0827202	Calculus 2	Required	0827101	4	Math Department
	0824201	Mathematical Physics 1	Required	0827101	3	Physics Department
	0824203	General Physics 3	Required	-	3	Physics Department
	0824213	General Physics 3 Lab	Required	-	1	Physics Department
	19xxxxx	University Elective	Elective	-	2	University
Total					17	
Level 4	0824204	Waves	Required	0824201	3	Physics Department
	0827205	Calculus 3	Required	0827202	4	Math Department
	0824205	Modern Physics	Required	0824203	3	Physics Department
	0824206	Optics	Required	0824203	3	Physics Department
	0827204	Linear Algebra 1	Required	-	3	Math Department
	1900102	Islamic Culture	Required	-	2	University
Total					18	
Level 5	0824302	Classical Mechanics	Required	0824201	3	Physics Department
	0824303	Electromagnetism 1	Required	0824201	3	Physics Department
	0824305	Electronics 1	Required	0824201	3	Physics Department
	0827304	Elementary Differential Equations	Required	0827202	3	Math Department
	0824301	Mathematical Physics2	Required	0824201	3	Physics Department
Total					15	
Level 6	0824304	Electromagnetism 2	Required	0824303	3	Physics Department
	0824306	Electronics 2	Required	0824305	3	Physics Department
	0824316	Electronics 2 Lab	Required	0824305	2	Physics Department
	0824307	Quantum Mechanics 1	Required	0824301	3	Physics Department
	082Xxxxx	College Elective 1	Elective	-	3	College of Science
	Total				14	
	0824399	Summer Training	Required	Gained 79 Credits	3	Physics Department
Level 7	0824401	Thermal and Statistical Physics	Required	0824203 0824307	3	Physics Department
	0824402	Solid State 1	Required	0824307	3	Physics Department
	0824407	Quantum Mechanics 2	Required	0824307	3	Physics Department
	0824404	Nuclear Physics	Required	0824307 0824205	3	Physics Department
	0824405	Research Project	Required	Gained 96 Credits	2	Physics Department
	0824411	Modern Physics Lab	Required	0824307 0824205	2	Physics Department
Total					16	
Level 8	0824403	Solid State 2	Required	0824402	3	Physics Department
	0824412	Solid State Physics Lab	Required	0824402	2	Physics Department
	0824xxxx	Department Elective 1	Elective	-	3	Physics Department
	0824xxxx	Department Elective 2	Elective	-	3	Physics Department
	0824xxxx	Department Elective 3	Elective	-	3	Physics Department
					14	

2.11 KFU-University Requirements

Table 1 : University Elective courses Students must select Two course from University elective courses		
Course number	**Course title**	Credits
1900103	Islamic Morals and Occupational Ethics	2
1900104	Studies in the Prophet's Biography	2
1900105	Medical Jurisprudence	2
1900106	Economy and Politics in Islam	2
1900107	Social System and Family Behavior	2
1900108	Management and Entrepreneurship	2
1900109	Health and Fitness	2
1900110	Research Skills	2
1900111	Voluntary Work	2
1900112	Medicine: Type and Usage	2
1900113	Human Rights in Islam	2
1900114	Food and Nutrition	2

2.12 College of Sciences Requirements

Table 2 : College of Science Elective Courses student must select one course from college elective courses				
Course name	**Lec-ture**	**tutorial**	**Lab**	Prerequisites
Environmental Chemistry	**3**	**0**	**0**	-
Inorganic Chemistry 1	**3**	**0**	**0**	0825101
Bioinformatics	**3**	**0**	**0**	0826101
Linear Algebra 2	**3**	**0**	**0**	0827204
Probability Theory	**3**	**0**	**0**	0827103

Table 3 : Department of Physics Elective Courses student must select 3 courses from department elective courses					
Course number	**Course name**	**lecture**	**tutorial**	**Lab**	Prerequisites
0824420	Materials Characterization and nanotechnology	3	**0**	**0**	0824307 0824402
0824421	Biophysics	3	**0**	**0**	0824205
0824422	Photonics and Fiber Optics	3	**0**	**0**	0824301 0824303

0824423	Introduction to spectroscopy Analysis	3	**0**	**0**	0824301 0824307
0824424	Medical Physics	3	**0**	**0**	0824205
0824425	Laser	3	**0**	**0**	0824304 0824203
0824426	Astronomy	3	**0**	**0**	0824101
0824427	Plasma Physics	3	**0**	**0**	0824302 0284303 0824301
0824428	Atomic Physics	3	**0**	**0**	0824205 0824307
0824429	Polymer Physics	2	**0**	**0**	0824401
0824430	Polymer Physics Lab	**0**	**0**	**1**	0824401
0824431	Computational Physics	2	**0**	**0**	0824201 0827102 0827112
0824432	Computational Physics Lab	**0**	**0**	**1**	0824201 0827102 0827112

3. Course Descriptions (Specialization Requirements)

1. General Physics 1- 0824101 (3 credits)

General physics 1 is an introductory physics course that covers kinematics, vector analysis, force dynamics, kinematics and dynamics of circular motion, work, energy, linear momentum collisions, rotational kinematics, angular momentum, static equilibrium, elastic properties of solids, fluid dynamics

Prerequisite:

Corequisite:

Textbook: Physics for Scientists and Engineers with Modern Physics. Raymond A. Serway and John W. Jewett - ISBN 9781337553292-Edition 10 (2018) by Cengage Learning US.

2. General Physics 1 Lab- 0824111 (1 credit)

This course covers the following topics: The concepts of basic measurements, Hooke's Law, balance of forces, equilibrium at incline surface, energy conservation during free fall, circular motion and angular acceleration, torque, pressure, viscosity of fluids, surface tension and Archimedes' principle.

Prerequisite:

Corequisite: General Physics 1: Phys 101

Textbook: Physics Laboratory Experiments, 7/E, by Jerry D. Wilson, Lander College, Cecilia A. Hernádez, Houghton Mifflin-Cengage, 2009.

3. General Physics 2- 0824202 (3 credits)

The course covers Electric force and Coulomb's law Force, Electric fields, Electrical potential, Current and resistance, Capacitors, Direct current circuits, Alternating current circuits, Current density, Resistivity and conductivity, Ohm's law, Gauss's law and its applications, Magnetic field, Ampere's law, Biot-Savart Law, Faraday's law.

Prerequisite:

Corequisite:

Textbook: Physics for Scientists and Engineers with Modern Physics. Raymond A. Serway and John W. Jewett - ISBN 9781337553292-Edition 10 (2018) by Cengage Learning US.

4. General Physics 2 Lab - 0824212 (1 credit)

The course covers Ohm's law, Kirchhoff's law, Resistivity, Meter bridge, NTC-PTC, Biot-Savaart Law, Capacitors, RC-circuits, Joule-Heat, Magnetic Moment, Tangent galvanometer.

Prerequisite:

Corequisite: General Physics 2: Phys 202

Textbook: Physics Laboratory Experiments, 7/E, by Jerry D. Wilson, Lander College, Cecilia A. Hernádez, Houghton Mifflin-Cengage, 2009, ISBN-10: 0547227485 ISBN-13: 9780547227481.

5. General Physics 3 – 0824203 (3 credits)

The course covers the following subjects: Simple harmonic motion, the Pendulum, Wave motion, Superposition and Interference, sound waves, standing waves, Doppler Effect, Temperature and the Zero Law of Thermodynamics, the First Law of Thermodynamics, Some Applications of the First Law of Thermodynamics, Macroscopic Description of an Ideal Gas.

Prerequisite:

Corequisite:

Textbook: Physics for Scientists and Engineers with Modern Physics. Raymond A. Serway and John W. Jewett - ISBN 9781337553292-Edition 10 (2018) by Cengage Learning US.

6. General Physics 3 Lab - 0824213 (1 credit)

The course covers the following subjects: Simple Pendulum, Glass prism refraction, Speed of light, Sonometer, Resonant tube (one open end), Standing waves (Meld's experiment), Seebeck's effect, Young double-slit experiment, Diffraction grating, Coefficient of Linear, Thermal expansion, specific heat, and Latent heat of ice.

Prerequisite:

Corequisite: General Physics 3: Phys 203

Textbook: Physics Laboratory Experiments, 7/E, by Jerry D. Wilson, Lander College, Cecilia A. Hernádez, Houghton Mifflin-Cengage, 2009, ISBN-10: 0547227485 ISBN-13: 9780547227481.

7. Waves – 0824204 (3 credits)

Periodic Phenomena, simple harmonic motion, Longitudinal (sound) and Transverse (string under tension) mechanical Waves, Transverse Electromagnetic Waves, Complex Numbers and Phasor Technique, energy, superposition, Free, Damped, and Forced Mechanical Oscillations, quality factor Q, power at resonance, transient phenomena, coupled oscillators, travelling waves, standing waves, Applications of Fourier analysis , Doppler effect to sound waves.

Prerequisite: Mathematical Physics 1, Phys 201

Corequisite:

Textbook: The Physics of Vibrations and Waves H. J. Pain Pain, John Wiley.

8. Modern Physics - 0824205 (3 credits)

The course covers 1- Special Theory of Relativity. 2- Black body radiation. 3- The interaction of matter with light: photoelectric effect and Kempton scattering - pair production 4- De Broglie theory: wave-particle duality. 5- The Davison and Germer experiment. 6- Heisenberg Uncertainty Principle 7. A particle trapped in a box. 8- Atomic models (Thomson - Rutherford - Bauer). 9- X-ray diffraction. 10- Schrödinger's wave equation.

Prerequisite: General Physics 3: Phys 203

Corequisite:

Textbook: Arthur Beiser, Concepts of Modern Physics: 6th Edition, McGraw-Hill, Inc. (2003)

9. Modern Physics Lab - 08241345 (2 Credits)

Modern Physics Lab course is a laboratory-based course, which allows students to experimentally reproduce and deepen their understanding of many important subjects in the areas of modern physics

such as wave-particle duality, interaction of light with matter, radiation detection, atomic spectra and quantum phenomena.

Prerequisite: Quantum Mechanics 1: Phys 307, Modern Physics: Phys 205

Corequisite:

Textbook: Modern Physics and Quantum Mechanics, Elmer E. Anderson, W.B. Saunders Co., 1971. Introduction to Modern Physics, Floyd K. Richtmyer, McGraw-Hill, Inc. Concepts of Modern Physics 6th Ed., Arthur Beiser, by McGraw-Hill, Inc (2003). Modern Physics, Raymond A. Serway, Clement J. Moses, Curt A. Moyer, Brooks Cole (2004)

10. Optics - 0824206 (3 credits)

This course covered the following topics Geometrical Optics and Image formation by optical systems, Wave's theory of light, Interference, Wavefront splitting interferometer, Amplitude splitting interferometer, Fabry-Perot interferometer, Matrix algebra in optics

Prerequisite: General Physics 3: Phys 203

Corequisite

Textbook: Introduction to Optics, by Frank J. Pedrotti, Leno M, Leno S. Pedrotti, 3rd ed. 2006, Publisher: Benjamin Cummings

11. Classical Mechanics 1 - 0824302 (3 credits)

This course covers the following topics: Newtonian's, Lagrangian's and Hamilton's Formulation, Variational principle The Central Force and gravitational Problem. Canonical Transformation, dynamics of rigid body (Center of mass and moment of inertia of rigid bodies). Rutherford Scattering.

Prerequisite: Mathematical Physics 1: Phys 201

Corequisite:

Textbook: Classical dynamics of Particles and Systems by: Jerry B. Marion 5th edition.

12. Electromagnetism 1- 0824303 (3 credits)

In this course, the student will be introduced to the basic concepts in electromagnetism including ; Dirac Delta function, Coulomb's law, electric field, continuous charge distribution, applications of Gauss's law, Poisson and Laplace equations, method of images, separation of variables: Cartesian, Spherical coordinates, potential of a dipole, polarization: dielectrics, induced dipoles, electric field inside a dielectric, bound charges and their physical meaning, steady currents, Biot -Savart law, Ampere's law and it's application.

Prerequisite: Mathematical Physics 1: Phys 201

Corequisite:

Textbook: D. J. Griffiths, Introduction to Electrodynamics, 4th ed., Prentice Hall, (2017).

13. Electromagnetism 2- 0824304 (3 credits)

The course is designed to provide fundamental principles and laws of magnetic properties of matter, electromagnetic induction, magnetic energy, Maxwell's equations, applications to Maxwell's equations, plane and spherical electromagnetic waves.

Prerequisite: Electromagnetism 1: Phys 303

Corequisite:

Textbook: Foundations of Electromagnetic Theory: by J. R. Reitz, F. J. Milford, 4th edition

14. Mathematical Physics 1- 0824201 (3 credits)

The course covers Sequence and series, Complex numbers &variables , Determinants and matrices ,Vector algebra and operations in Cartesian and curvilinear coordinates, Fourier series, First and second order ordinary differential equations (ODE)

Prerequisite: Calculus 1: Math 101

Corequisite:

Textbook: Mathematical methods for Physicists: George B. Arfken, 6th Ed.

15. Mathematical Physics 2 – 0824301 (3 credits)

The course covers the following topics: Complex analysis, Partial differential equations, Dirac delta function Gamma function and Beta function , Fourier Transforms and Laplace transforms, Legendre polynomials, Legendre functions and spherical harmonics, Ordinary and modified Cylindrical and Spherical Bessel's functions. Sturm-Liouville eigenvalue problem.

Prerequisite: Mathematical Physics 1: Phys 201

Corequisite:

Textbook: Mathematical methods for Physicists: George B. Arfken, 6th Ed.

16. Electronics 1 – 0824305 (3 credits)

The course covers the following topics: voltage sources, current sources and their equivalent circuits. Basic laws: Ohm's law and Kirchhoff`s law (AC, DC) DC voltage (current), AC voltage (current). Impedance and admittance in parallels and series connections, equivalents. (complex notations) AC Voltage, effective or RMS values Power concept, apparent power and power factor. Mesh analysis,

Nodal analysis method mesh analysis method Circuit analysis using PSPICE Voltage divider rule, Current divider rule Thevenin`s theorem, Norton`s theorem, Millman`s theorem, transfer functions, Decibel scale, bode plots, resonance circuits, filters.

Prerequisite: Mathematical Physics 1: Phys 201

Corequisite:

Textbook: Fundamentals of Electric Circuits 6th Edition By Charles Alexander and Matthew Sadiku, 2017

17. Electronics 2 – 0824306 (3 credits)

The course covers Introduction to Semiconductors Diode Theory, Diode Circuits, Diodes Bipolar Transistors, Transistor Biasing AC Models, Field-Effect Transistors FET Circuits, OP-AMP Theory, Oscillators, Comparators Regulated Power Supplies, Digital Electronics, Binary Arithmetic, Digital Logic and Gates, Flip-Flops and Memories Digital Counters, Shift Registers.

Prerequisite: Electronics 1: Phys 305

Corequisite:

Textbook: Electronic Principles / Edition 7 by Albert Paul Malvino, David J. Bates 2006.

18. Electronics 2 Lab- 0824316 (2 credits)

diode characteristics, Half wave rectification, Full bridge rectification, Common base The course covers Bipolar transistor IV characteristics, CMOS transistor IV characteristics, Common source circuit circuit Common emitter circuit, Op-Amps Inverting and non inverting, Discreet Logic Gates, Electronic simulators

Prerequisite: Electronics 1: Phys 305

Corequisite: Electronics 2: Phys 306

Textbook: Principles of Electronics: Analog and Digital, 1st Edition, Lloyd Fortney, (2006)

19. Quantum Mechanics 1- 0824307 (3 credits)

This course covers the following topics: Mathematical Tools for Quantum Mechanics. Linear Operators. The Eigen value Problem. Postulates of quantum mechanics. Measurement in Quantum Mechanics. Schrödinger equation. Connecting Quantum to Classical Mechanics. Wave function. Simple Problems in One Dimension. Harmonic Oscillator. Angular momentum. Hydrogen atom.

Prerequisite: Mathematical Physics 2: Phys 301

Corequisite:

Textbook: David J. Griffiths, " Introduction to Quantum Mechanics", 2nd Ed.(2017).

20. Thermal and Statistical Physics- 0824401 (3 credits)

This course covers the following topics: Thermodynamic concepts. The zero and first law of thermodynamics, heat capacities, classification of thermodynamic processes. The second law of thermodynamics, thermodynamic temperature scales, heat engines, third law of thermodynamics, Equilibrium conditions and thermodynamic potentials (thermodynamic potentials/derivatives basics of probability, binomial distribution, continuous probability distribution, central limit theorem, random walk)", thermodynamics of magnetism, paramagnetism, many particle systems, equipartition theorem, Partition function and its relation to entropy and to various thermodynamic potentials. Equilibrium classical and quantum distributions: Maxwell-Boltzmann, Bose-Einstein, and Fermi-Dirac, Bose and Fermi gases, density of states, blackbody radiation, bose condensation, Debye theory of elastic vibrations in solids, phase equilibria, clausius-clapeyron equation.

Prerequisite: General Physics 3: Phys 203, Quantum Mechanics 1: Phys 307

Corequisite:

Textbook: An Introduction to Thermal Physics, by Daniel V. Schroeder (Addison Wesley, 2000)

21. Solid State 1 – 0824402 (3 credits)

The course covers Crystallography and Crystal Structure, Wave Diffraction, Reciprocal Lattice, Binding forces and classification of solids, Lattice dynamics, Thermal Properties of Solids, Free Electrons in Metals

Prerequisite: Quantum Mechanics 1: Phys 307

Corequisite:

Textbook: C. Kittel: Introduction to Solid State Physics, 8th Edition, Wiley, 2005

22. Solid State Physics Lab – 0824412 (2 Credits)

This course covers the following topics: Principles of practical physics, Electrical conduction in solid bodies, Determining the band gap of Germanium, Hall effect in metals, Investigating the attenuation of x-rays as a function of the absorber material and thickness, Bragg reflection, Duane-Hunt relation and the determination of Planck's constant, Moseley's law and the determination of Rydberg constant, Application of x-ray fluorescence, Magnetic Hysteresis Loop, Investigating the attenuation of x-rays as a function of the absorber material and thickness, and Photoresistor.

Pre-requisite: Solid State 2: Phys 403

Corequisite:

Textbook: General Catalogue of Physics experiments of LEYBOLD Company (Solid State Physics section)

23. Quantum Mechanics 2 - 0824407 (3 credits)

The course covers Special Angular Momentum, General Theory of Spin, Properties of the Spherical Harmonics 2- 3D Problems in Spherical Coordinates: Central Potential, General Treatment, The Hydrogen Atom, Probabilities, 3- Addition of two angular momenta: General formalism.

Prerequisite: Quantum Mechanics 1: Phys 307

Corequisite:

Textbook: Nouredine Zettili, "Quantum Mechanics Concepts and Applications", 2nd Ed. (2009).

24. Materials Characterization and Nanotechnology - 0824420 (3 credits)

This course covers the following topics: Atomic Structure and Interatomic Bonding, Crystal structures and miller planes, defects, diffusion, stress and strain, understanding of physics related to nanomaterials, zero-, one-, two-dimensional nanostructures, energy bands in solids (metal, semiconductor and insulators), energy levels in nanostructures, surface-energy and –reconfiguration, nanoparticles nucleation, use of electron microscopy, X-ray diffraction, optical spectroscopy for nanomaterials characterization, top-down and bottom up synthesis methods of nanostructures; Chemical vapor deposition, electrodeposition, Sol-gel, Sputtering, devices fabrication by using Nanomaterials; Single electron transistor, carbon nanotube field effect transistor (FET), Spin-FET

Prerequisite: Quantum Mechanics 1: Phys 307, Solid State1: 402

Corequisite:

Textbook: Fundamentals of materials science and engineering, 5th edition, by William D Callister

25. Nuclear Physics – 0824404. (3 credits)

The course is designed to provide fundamental principles and laws of Nuclear Physics, including properties of atomic nuclei; Radioactivity, Radioactive series, Transient and secular equilibrium, classifications of Nuclear reactions; mechanisms of Nuclear reactions; nuclear models, Nuclear Fission and Nuclear fusion, Nuclear accelerators and nuclear reactors, Radiation detectors, Radiation units– Radiation applications – Radiation hazards and Elementary particles

Prerequisite: Modern Physics: Phys 205, Quantum Mechanics 1: Phys 307

Corequisite:

Textbook: H.S. Krane, Introductory nuclear physics, Wiley (2008).

26. Research Project: Phys 0824405 (2 credits)

The course covers selected research project experimental / theoretical work assigned to the student by the faculty member, requiring a report containing an appropriate description of the research work, acquiring data, data analysis, and conclusion.

Prerequisite: Gained 96 credit hours

Corequisite:

Textbook:

27. Solid State 2- 0824403 (3 credits)

This course covers the following topics: Free electron Fermi gas, Energy bands, Semiconductor crystals, Fermi surfaces and metals, Superconductivity, Magnetism in solids.

Prerequisite: Solid State 1: Phys 402

Corequisite:

Textbook: C. Kittel: Introduction to Solid State Physics, 8th Edition, Wiley, 2005

28. Biophysics – 0824421 (3 credits)

In this biophysics course, students will study Nature and Subject of Biophysics, Molecular Structure of Biological Systems, Energetics and Dynamics of Biological Systems. Physical Factors of the Environment, Nervous System and electricity within the body (Impulses in Nerve and Muscle Cells), and Electricity and Magnetism at the Cellular Level, Model Approaches to Some Complex Biological Processes.

Prerequisite: Modern Physics: Phys 205

Corequisite:

Textbook: Roland Glaser, Biophysics: An Introduction, Second Edition, Springer (2012).

29. Photonics and Fiber Optics – 0824422 (3 credits)

This course covers ray, wave, beam and Fourier optics, fundamentals of fiber-optic components, basics of communications, structure and manufacturing of their materials, light sources, fiber-optic measurements, trouble shouting and test equipment, global telecommunications, internet, video, mobile, sensing, imaging and illuminating applications of fiber-optics.

Prerequisite: Mathematical physics 2: Phys 301, Electromagnetism 1: Phys 303

Corequisite:

Textbook: Saleh, B. E. A. & Teich, M. C: Fundamentals of Photonics, 2nd Edition, (2007).

30. Introduction to Spectroscopy Analysis - 0824423 (3 credits)

The course covers Raman spectroscopy, infrared spectroscopy, ultraviolet and x-ray spectroscopy, Laser Spectroscopy and nuclear magnetic resonance spectroscopy.

Prerequisite: Mathematical physics 2: Phys 301, Quantum Mechanics 1: Phys 307

Corequisite:

Textbook: Kuzmany, H: Solid State Spectroscopy: An Introduction

31. Medical Physics - 0824424 (3 credits)

This course covers the following Topics: applications of physics principles and phenomena in medicine as laws of mechanics, temperature, pressure, ionizing radiation and radiation safety, radioactivity, radiation therapy, computed tomography, nuclear medicine, ultrasound, and magnetic resonance imaging.

Prerequisite: Modern Physics: Phys 205

Corequisite:

Textbook: Medical physics, by: John R. Cameron & James G. Skofronick; John Willy.

32. Laser – 0824425 (3 credits)

This course covers the following topics: Theory of lasers and basic concepts, transition probabilities, Einstein relations , population inversion, multi-level system, rate equations, laser resonators , Gaussian beam, laser modes , Q-switching , mode locking, solid state laser, fiber laser. Application of lasers

Prerequisite: General Physics 3: Phys 203, Electromagnetism 2: Phys 304

Corequisite:

Textbook: Laser Physics : From Principles to Practical Work in the Lab, Marc Eichhorn, springer 2014.

33. Plasma Physics - 0824427 (3 credits)

In this course students will learn: definition of plasma. Applications in physics and technology. Debye screening. Single-particle motions in electromagnetic fields and adiabatic invariants. Fluid models of plasmas. Waves in plasmas. Wave propagation, group velocity, cut-off and resonance. Collisions, resistivity and diffusion. Equilibrium and plasma instabilities.

Prerequisite: Mathematical Physics 2: Phys 301, Electromagnetism 1: Phys 303, Classical Mechanics: Phys 302

Corequisite:

Textbook: Introduction to Plasma physics and controlled fusion: by F. F. Chen, 3rd ed

34. Atomic Physics - 0824428 (3 credits)

The course covers the following topics: atomic phenomena (light emission and x-rays absorption), Atomic models and correspondence principle, Spectra of one valence atoms like hydrogen and sodium - Spectra of hydrogen- like atoms, Quantum numbers and quantum defects, Orbital and spin moments, Effect of external magnetic field on the atomic spectra (Zeeman Effect), Spectra of double electron atoms, Vector model of the atomic structure.

Prerequisite: Modern Physics: Phys 205, Quantum Mechanics 1: Phys 307

Corequisite:

Textbook: H. Haken, H. C. Wolf, The Physics of Atoms and Quanta, 7th edition, Springer (2005)

35. Computational Physics - 0824431 (3 credits)

This course covers the following topics: programming with suitable Package (Mathematica and FORTRAN) and suitable software for plotting scientific data (Origin, etc). learning the most traditional applied built-in functions for transformation of algebraic formulas, numerical calculation (differentiation- integration), solving algebraic equation, Solving differential equations, numerical data manipulation, writing User defined functions and subroutines, data plotting and processing, basic principles and concepts of Monte Carlo simulation, Performing Monte Carlo simulation of some physics Experiments and phenomena: Nuclear decay, Simulation of Thermodynamic Systems, Random Walk and Brownian Motion, Electrostatics, Waves, Diffusion and heat conduction, Nonlinear Systems, Simple Quantum Systems.

Prerequisite: Introduction to computer Sciences: Math 102, Introduction to computer Sciences Lab. : Math112, Mathematical Physics 1: Phys 201

Corequisite:

Textbook: Ian D. Chivers and Jane Sleightholme, Introduction to programming with FORTRAN with coverage of Fortran 90, 95, 2003, 2008 and 77, 2nd Ed., springer (2012).

36. Computational Physics Lab – 0824432 (1 credit)

This course covers the following topics: computer programming with suitable Package (Mathematica and FORTRAN), plotting scientific data with suitable software (Origin …etc.). Test the most traditional applied built-in functions especially for Mathematica Package. Practicing some simple examples

for simulation programs based on Monte Carlo technique. Writing and testing self-written simulation programs for many physics phenomena.

Prerequisite: Introduction to computer Sciences: Math 102, Introduction to computer Sciences lab: Math 112, Mathematical Physics 1: Phys 201

Corequisite: Computational Physics: Phys 431

Textbook: Timothy Sauer, Numerical Analysis, Pearson Education Inc. (2012).

37. Polymer Physics - 0824429 (3 credits)

The course covers general introduction to polymer, classification and structure of polymers, properties of polymers, application of polymers, processing and synthesis of polymers, physical techniques for studying polymers, polymer thin films: characterizations: XPS, Raman, SEM, Electrical and optical measurement.

Prerequisite: Thermal and Statistical Physics : Phys 401

Corequisite:

Textbook: An Introduction to Polymer Physics, David I. Bower Frontmatter Cambridge University Press, (2002).

38. Polymer Physics Lab - 0824430 (3 credits)

To learn polymer physics, the synthesis methods and the different structural, optical and electrical characterization techniques.

Prerequisite: Thermal and Statistical Physics: Phys 401

Corequisite: Polymer Physics: Phys 429

Textbook: An Introduction to Polymer Physics, David I. Bower Frontmatter Cambridge University Press, (2002).

4. Required Physical Resources and Facilities

Below are figures that show the facilities, resources, human resources, students, faculty and staff statistics for academic year 2020-2021.

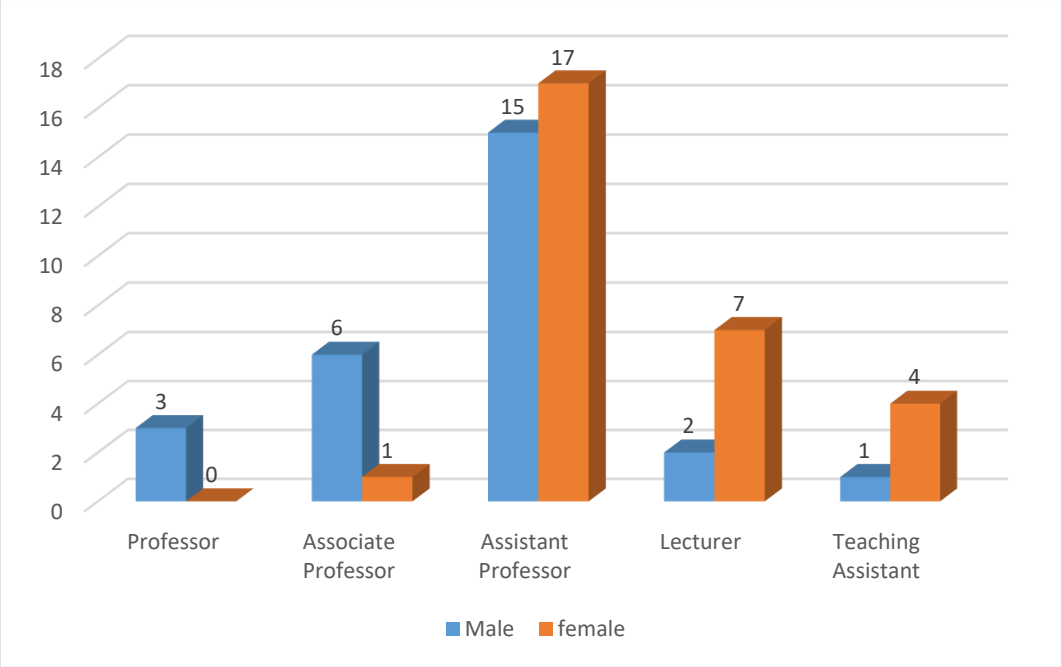

Figure 1: Teaching staff distribution in physics program for 2020-2021

	Male		Female		Total	
	Number	Size	Number	Size	Number	Size
Lab	11	204	10	184	21	388
Class rooms	8	374	5	329	13	703
Amphitheatre	1	300	1	285	2	585
Computer lab	1	18	1	18	2	36

Table 1: Details of class rooms, amphitheatres and computer laboratories for the Physics Program

Laboratory	**Codes**	**Target Average**	**Number of labs**	
			Male	Female
General physics 1 Lab – updated plan	0824-111	20	4	4
General physics 1 Lab	0814-101L	20		
General physics 2 Lab	0824-102L	20	2	2
General physics 3 Lab	0814-201L	20	2	1
Advanced Physics Lab 1	0814-306	12	1	1
Electronics 2 Lab	0814-308L	12	1	1
Advanced Physics Lab 2	0824-407	12	1	1
Average		16	Total 11	Total 10

Table 2: Physics program undergraduate Laboratories

For the provision of facilities, equipment and services suitable for the students, teaching faculty and employee with special needs, college of science provides an appropriate equipment and services for both males and females sections, as shown in table 3..

Item	Males Campus	Females Campus
Special parking's	6	6
Ramps	2	2
wheelchairs	2	1
Special Bathrooms	8	9
Elevators	5	5

Table 3: Equipment and services for students, teaching staff and employee with special needs

Physics department has 13 research labs that serve different research areas in material sciences, electronics, engineering, physical chemistry, etc. We have 59 instruments that are aimed to do synthesis, characterization, testing and devices development.

Physics department has 14 research labs that serve different research areas in material sciences, electronics, engineering, physical chemistry, etc. We have 59 instruments that are aimed to do synthesis, characterization, testing and devices development.

Research Lab	Lab number
Male Section	
Solar cell and optical characterization	1024
XPS and sputtering Lab	1067
CVD and SPS Lab	1057
SEM Lab	1092
Wet electrochemical synthesis lab	2153
Raman spectroscopy	2159
Electrical and PPMS lab	2082
Thermal and Mechanical Lab	2149
solid state reaction lab	2161
Sensor Lab	2165
Energy storage Lab	2167
Female Section	
Electrical Characterization Lab	2101
Soft Condensed Matter Physics Lab	2015
Research Lab	2092

Table 4: Research laboratory in the Physics department

Link of guideline of research equipment:

https://www.kfu.edu.sa/ar/Colleges/Science/Documents/ScientificDay/Directory%20of%20Research%20Instruments1.pdf

Link of safety manual in college of science laboratories:

https://www.kfu.edu.sa/ar/Colleges/Science/Documents/%D9%83%D8%AA%D9%8A%D8%A8%20%D8%AF%D9%84%D9%8A%D9%84%20%D8%A7%D9%84%D8%B3%D9%84%D8%A7%D9%85%D8%A9%20%D8%A8%D9%85%D8%B9%D8%A7%D9%85%D9%84%20%D9%83%D9%84%D9%8A%D8%A9%20%D8%A7%D9%84%D8%B9%D9%84%D9%88%D9%85.pdf

Administrative staff and lab technicians are also available at female and male sections, with defined tasks and responsibilities. The program has 16 official and qualified technicians (11 females and 5 males) for the operation and preparation in laboratories

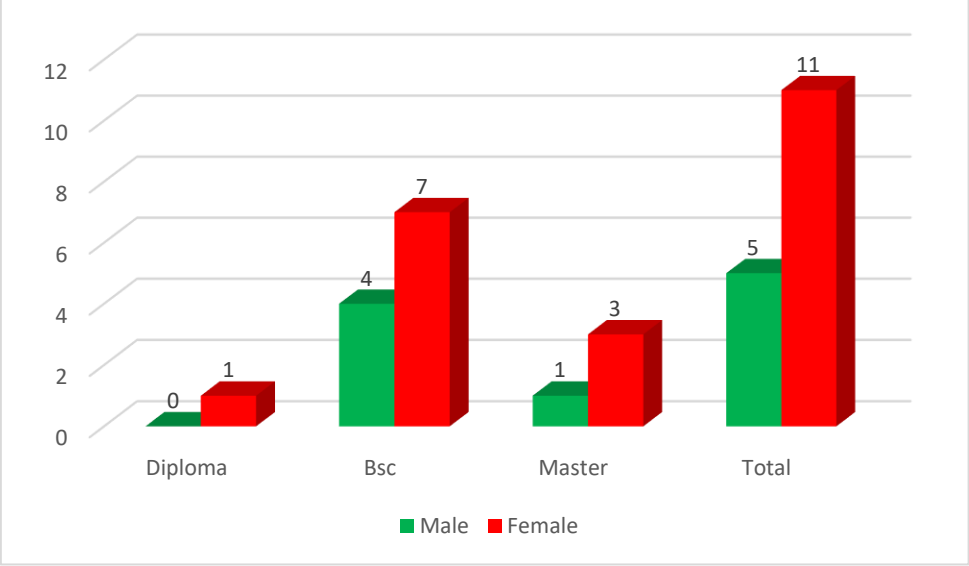

Figure 2: Physics program lab technicians and their qualifications