Kingdom of Saudi Arabia
National Commission for
Academic Accreditation & Assessment

المملكـة العربيـة السعوديـة
الهيئـــة الوطنيـــة للتقويـم
والاعـتـمـاد الأكـاديـمـي

كلية العلوم التطبيقية
Faculty of Applied Sciences

**Kingdom of Saudi Arabia**
**The National Commission for Academic Accreditation & Assessment**

# T6. Course Specifications (CS)

## Course title: Electricity and Magnetism

## Course code: 23062222-4

# Course Specifications

| | |
|---|---|
| Institution: **Umm AL – Qura University** | Date : **18/1/1438** |
| College/Department : **Jamoum University College – Physics Department** | |

## A. Course Identification and General Information

1. Course title and code: **Electricity and Magnetism (code: 23062222-4)**
2. Credit hours: **4 Hrs.**
3. Program(s) in which the course is offered. **BSc Physics**
(If general elective available in many programs indicate this rather than list programs)
4. Name of faculty member responsible for the course
**One of the staff members**
5. Level/year at which this course is offered : **2st Year / Level 3**
6. Pre-requisites for this course (if any) : - **General physics 2 4031101-4**
7. Co-requisites for this course (if any) : ---
8. Location if not on main campus: **Al-Jamoum**
9. Mode of Instruction (mark all that apply)

| | | | |
|---|---|---|---|
| a. traditional classroom | ✓ | What percentage? | 70% |
| b. blended (traditional and online) | | What percentage? | |
| c. e-learning | | What percentage? | |
| d. correspondence | | What percentage? | |
| f. other | ✓ | What percentage? | 30% |

Comments: Lab 30%

## B Objectives

1. What is the main purpose for this course?

This course is designed to provide and define the fundamental properties of the electric charge, solve technical problems associated with the electrostatic force (Coulomb force), identify that at every point in the space surrounding a charged particle, the particle sets up an electric field , which is a vector quantity and thus has both magnitude and direction, identify how an electric field can be used to explain how a charged particle can exert an electrostatic force on a second charged particle even though there is no contact between the particles, explain how a small positive test charge is used (in principle) to measure the electric field at any given point, define electric capacitance and solve technical problems associated with capacitors of various symmetries, capacitors in series and parallel combination, the microscopic effect of dielectric materials on capacitance and stored energy, define electric current, current density, and solve technical problems involving DC networks of resistors, batteries, and capacitors, Ohm's Law, Kirchhoff's laws, and RC charging and decay circuits, calculate the potential difference between any two points in a circuit, distinguish a real battery from an ideal battery and, in a circuit diagram, replace a real battery with an ideal battery and an explicitly shown resistance.

9. Calculate the net rate of energy transfer in a real battery for current in the direction of the emf and in the opposite direction, define the magnetic field and magnetic flux, solve technical problems associated with the effect of static, non-uniform and uniform magnetic fields on moving charges and current-carrying wires, loops and the magnetic dipole, calculate the magnitude and direction of the magnetic field for symmetric current distributions using the Law of Biot-Savart and Ampere's Law, and state the limitations of Ampere's Law, state Faraday's Law of Induction with Lenz's Law and use these equations to solve technical problems associated with induction, calculate inductance according to the fundamental definition, solve technical problems associated with LR circuits and coils, and calculate the stored energy in magnetic fields. In addition to these items, the students should gain practical skills through performance some experimental class, to demonstrate and consolidate the basic physics concepts in the branches of physics such as mechanics, properties of matter, heat and optics and also aims to link the mathematical equations to the applied physics.

2. Briefly describe any plans for developing and improving the course that are being implemented. (e.g. increased use of IT or web based reference material, changes in content as a result of new research in the field)

1- Outlines of the physical laws, principles and the associated proofs.
2. Highlighting the day life applications whenever exist.
3. Encourage the students to see more details in the international web sites and reference books in the library.
4- Encourage the student to build an example of different experiments related to course
5- Frequently check for the latest discovery in science

## C. Course Description (Note: General description in the form used in Bulletin or handbook)

Course Description:

The course will cover the principle of physics, electric charge and Coulomb's law, the electric field, Gauss law, Electric potential, capacitors and dielectric, current and resistance, DC circuits. The magnetic field and Ampere's law. This course will provide a conceptual and experimental background in physics sufficient to enable students to take courses that are more advanced in related fields.

**1 Topics to be Covered**

| Topics | No of Weeks | Contact hours |
|---|---|---|
| **Electric charge and Coulomb's law**<br>1- Introduction.<br>2- Electric Charge<br>3- Conductors and Insulators<br>4- Coulomb's law<br>5- Charge is Quantized<br>6- Charge is Conserved | **1** | **3** |
| **The Electric Field**<br>1- Fields.<br>2- The Electric Field E<br>3- The Electric Field of a Point Charges and Lines of Force<br>4- The Electric Field of Continuous Charge Distributions<br>5- A Point Charge in an Electric Field<br>6- A Dipole in an Electric Field | **1** | **3** |
| ❖ **Gauss Law**<br>1- Introduction The flux of a Vector Field<br>2- The Flux of the Electric Field<br>3- Gauss law<br>4- A Charged Insolated Conductor<br>5- Applications of Gauss law<br>6- Experimental Tests of Gauss law and Coulomb law | **1** | **3** |
| ❖ **Electric Potential**<br>1- Electrostatic and Gravitational Forces<br>2- Electrical Potential Energy<br>3- Electric Potential<br>4- Calculating the Potential from the Field<br>5- Potential due to Point Charge<br>6- Potential due to a Collection of Point Charges<br>7- The Electric Potential of Continuous Charge distribution<br>8- Equipotential Surfaces<br>9- Calculating the Field from the Potential<br>10- An Insulated Conductor | **2** | **6** |

| | | |
|---|---|---|
| **Capacitors and dielectrics**<br>1- Capacitance<br>2- Calculating the Capacitance<br>3- Capacitors in Series and Parallel<br>4- Energy Storage in an Electric Field<br>5- Capacitor with Dielectric<br>6- Dielectrics: an Atomic View<br>7- Dielectrics and Gauss law | **1.5** | **5** |
| **Current and Resistance**<br>1. Electric Current<br>2. Current Denstiy<br>3. Resistance, Resistivity, and Conductivity<br>4. Ohm's law<br>5. Ohm's law: A Microscopic View<br>6. Energy Transfers in an Electric Circuit | **1.5** | **5** |
| **DC Circuits**<br>1. Electromotive Force<br>2. Calculating the Current in a Single Loop<br>3. Potential Differences<br>4. Resistors in Series and Parallel<br>5. Multiloop Circuits<br>6. RC Circuits | **1.5** | **5** |
| **The Magnetic Field**<br>1. The Magnetic Field B<br>2. The Magnetic Force on a Moving Charge<br>3. Circulating Charges<br>4. The Hall Effect.<br>5. The Magnetic Force on a Current<br>6. Torque on a Current LoopThe Magnetic Force on a Current<br>7. The Magnetic Dipole | **2** | **6** |
| **Ampere's Law**<br>1. The Biot-Savart Law.<br>2. Applications of the Biot-Savart Law<br>3. Lines of Magnetic Field<br>4. Two Parallel Conductors<br>5. Ampere's Law<br>6. Solenoids and Toroids. | **2** | **6** |
| | **14 weeks** | **42hrs** |

## Practical part:

1. Safety and Security at the lab.
2. Introduction.
3. Determining the capacitance of a capacitor / connecting capacitors in series and in parallel
4. Studying Ohm's Law / connecting two resistors in series and in parallel
5. Determining the time constant of an RC circuit
6. Kirchhoff's Rules (The Junction Rule and The Loop Rule)

| 2. Course components (total contact hours and credits per semester): | | | | | | |
|---|---|---|---|---|---|---|
| | Lecture | Tutorial | Laboratory or Studio | Practical | Other: | Total |
| Contact Hours | **42** | | **42** | | | **84** |
| Credit | **3** | | **1** | | | |

| 3. Additional private study/learning hours expected for students per week. | 4 |
|---|---|

## 4. Course Learning Outcomes in NQF Domains of Learning and Alignment with Assessment Methods and Teaching Strategy

On the table below are the five NQF Learning Domains, numbered in the left column.
**First**, insert the suitable and measurable course learning outcomes required in the appropriate learning domains (see suggestions below the table).
**Second**, insert supporting teaching strategies that fit and align with the assessment methods and intended learning outcomes.
**Third**, insert appropriate assessment methods that accurately measure and evaluate the learning outcome. Each course learning outcomes, assessment method, and teaching strategy ought to reasonably fit and flow together as an integrated learning and teaching process. (Courses are not required to include learning outcomes from each domain.)

| Code # | NQF Learning Domains And Course Learning Outcomes | Course Teaching Strategies | Course Assessment Methods |
|---|---|---|---|
| **1.0** | **Knowledge** | | |
| 1.1 | Define the physical quantities, physical phenomena, and basic principles. | 1- Demonstrating the basic principles through lectures.<br>2. Discussing phenomena with illustrating pictures and diagrams.<br>3. Lecturing method: Board, Power point.<br>4. Discussions<br>5. Brain storming<br>6. Start each chapter by general idea and the benefit of it. | Solve some example during the lecture.<br>Discussions during the lectures<br>Exams:<br>a) Quizzes (E-learning)<br>b) Short exams (mid- term exams)<br>c) Long exams (final)<br>d) Oral exams<br>. |
| 1.2 | Describe the physical laws and quantities using mathematics | | |
| 1.3 | Determine the physical quantities at the Lab. | 1. Doing team research or team project.<br>2.Doing team work to perform some experiments<br>3. Perform the experiments correctly.<br>4. Demonstrate the results correctly.<br>5. Write the reports about the experiment.<br>6. Discussion with the student about the results | Writing scientific Reports.<br>Lab assignments<br>Exam. |

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|---|---|---|---|
| **2.0** | **Cognitive Skills** | | |
| 2.1 | Apply the laws of physics to calculate some quantities. | 1. Preparing main outlines for teaching.<br>2. Following some proofs.<br>3. Define duties for each chapter<br>4. Encourage the student to look for the information in different references.<br>5. Ask the student to attend lectures for practice solving problem. | 1. Exams (Midterm, final, quizzes)<br>2. Asking about physical laws previously taught<br>3. Writing reports on selected parts of the course.<br>4. Discussions of how to simplify or analyze some phenomena. |
| 2.2 | Solve problems in physics by using suitable mathematics. | | |
| 2.3 | Analyse and interpret quantitative results. | | |
| 2.4 | Apply physical principle on day life phenomena. | | |
| 2.5 | Derive the physical laws and formulas. | | |
| **3.0** | **Interpersonal Skills & Responsibility** | | |
| 3.1 | Show responsibility for self-learning to be aware with recent developments in physics | • Search through the internet and the library.<br>• Small group discussion.<br>• Enhance self-learning skills.<br>• Develop their interest in Science through : (lab work, visits to scientific and research institutes). | • Evaluate the efforts of each student in preparing the report.<br>• Evaluate the scientific reports.<br>• Evaluate the team work in lab and small groups.<br>• Evaluation of students presentations. |
| 3.2 | Work effectively in groups and exercise leadership when appropriate. | | |
| **4.0** | **Communication, Information Technology, Numerical** | | |
| 4.1 | Communicate effectively in oral and written form. | • Incorporating the use and utilization of computer, software, network and multimedia through courses<br>• preparing a report on some topics related to the course depending on web sites | • Evaluating the scientific reports.<br>• Evaluating activities and homework |
| 4.2 | Collect and classify the material for the course. | | |
| 4.3 | Use basic physics terminology in English. | | |
| 4.4 | Acquire the skills to use the internet communicates tools. | | |
| **5.0** | **Psychomotor** | | |
| 5.1 | Use experimental tools safely and correctly. | Follow up the students in lab and during carryout all experimental work. | • Practical exam.<br>• Giving additional marks for the results with high and good accuracy |
| 5.2 | Determine the physical quantity correctly at the Lab. | | |

| 5. Map course LOs with the program LOs. (Place course LO #s in the left column and program LO #s across the top.) | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Course LOs #** | **Program Learning Outcomes (Use Program LO Code #s provided in the Program Specifications)** | | | | | | | | | | | | | | | |
| | **1.1** | **1.2** | **1.3** | **2.1** | **2.2** | **2.3** | **2.4** | **2.5** | **3.1** | **3.2** | **4.1** | **4.2** | **4.3** | **4.4** | **5.1** | **5.2** |
| **1.1** | ✓ | | | | | | | | | | | | | | | |
| **1.2** | | ✓ | | | | | | | | | | | | | | |
| **1.3** | | | ✓ | | | | | | | | | | | | | |
| **2.1** | | | | ✓ | | | | | | | | | | | | |
| **2.2** | | | | | ✓ | | | | | | | | | | | |
| **2.3** | | | | | | ✓ | | | | | | | | | | |
| **2.4** | | | | | | | ✓ | | | | | | | | | |
| **2.5** | | | | | | | | ✓ | | | | | | | | |
| **3.1** | | | | | | | | | ✓ | | | | | | | |
| **3.2** | | | | | | | | | | ✓ | | | | | | |
| **4.1** | | | | | | | | | | | ✓ | | | | | |
| **4.2** | | | | | | | | | | | | ✓ | | | | |
| **4.3** | | | | | | | | | | | | | ✓ | | | |
| **4.4** | | | | | | | | | | | | | | ✓ | | |
| **5.1** | | | | | | | | | | | | | | | ✓ | |
| **5.2** | | | | | | | | | | | | | | | | ✓ |

| 6. Schedule of Assessment Tasks for Students During the Semester | | | |
|---|---|---|---|
| | Assessment task (e.g. essay, test, group project, examination, speech, oral presentation, etc.) | Week Due | Proportion of Total Assessment |
| 1 | Exercises & Home works (lectures) | All weeks | 5% |
| 2 | Exercises & Home works (lab) | All weeks | 5% |
| 3 | Participation in lectures activities | All weeks | 5% |
| 4 | Participation in lab activities | All weeks | 5% |
| 5 | Midterm Exam (theoretical) | 8th week | 20% |
| 6 | Lab. Reports (Practical) | 11th week | 5% |
| 7 | Final Exam (Practical) | 14th week | 15% |
| 8 | Final Exam (theoretical) | 16th week | 40% |

## D. Student Academic Counseling and Support

1. Arrangements for availability of faculty and teaching staff for individual student consultations and academic advice. (include amount of time teaching staff are expected to be available each week)
Each student will supervise by academic adviser in physics Department and the time table for academic advice were given to the student each semester. (4hrs per week)

## E Learning Resources

1. List Required Textbooks
Physics, 4th edition , By: Halliday, Resnick, and Krane, Wiley (1992)

2. List Essential References Materials (Journals, Reports, etc.)

3. List Recommended Textbooks and Reference Material (Journals, Reports, etc)
University Physics with modern Physics, 13th edition, by: Hugh D. Young and Roger A. Freedman, Addison-Wesley, (2012).

4. List Electronic Materials, Web Sites, Facebook, Twitter, etc.

5. Other learning material such as computer-based programs/CD, professional standards or regulations and software.

## F. Facilities Required

Indicate requirements for the course including size of classrooms and laboratories (i.e. number of seats in classrooms and laboratories, extent of computer access etc.)

1. Accommodation (Classrooms, laboratories, demonstration rooms/labs, etc.)
   - Class room is already provided with data show

| |
|---|
| • The area of class room is suitable concerning the number of enrolled students (68) and air conditioned.<br>• Library<br>• Laboratory for fundamental of physics |
| 2. Computing resources (AV, data show, Smart Board, software, etc.)<br>• . Computer room<br>• Scientific calculator. |
| 3. Other resources (specify, e.g. if specific laboratory equipment is required, list requirements or attach list)<br>Each Class room and laboratories require a TV screen at least 65 inch-and smart, and double layer white board. |

## G Course Evaluation and Improvement Processes

| |
|---|
| 1 Strategies for Obtaining Student Feedback on Effectiveness of Teaching<br>• Questionaries<br>• Open discussion in the class room at the end of the lectures |
| 2 Other Strategies for Evaluation of Teaching by the Instructor or by the Department<br>• Revision of student answer paper by another staff member.<br>• Analysis the grades of students. |
| 3 Processes for Improvement of Teaching<br>• Preparing the course as PPT.<br>• Using scientific flash and movies.<br>• Coupling the theoretical part with laboratory part<br>• Periodical revision of course content. |
| 4. Processes for Verifying Standards of Student Achievement (e.g. check marking by an independent member teaching staff of a sample of student work, periodic exchange and remarking of tests or a sample of assignments with staff at another institution)<br>• The instructors of the course are checking together and put a unique process of evaluation.<br>• Check marking of a sample of papers by others in the department.<br>• Feedback evaluation of teaching from independent organization.<br>• Independent evaluation by another instructor that give the same course in another faculty.<br>• Evaluation by the accreditation committee in the university. |
| 5 Describe the planning arrangements for periodically reviewing course effectiveness and planning for improvement.<br>1- The following points may help to get the course effectiveness<br>• Student evaluation<br>• Course report<br>• Program report<br>• Program Self study<br>2- According to point 1 the plan of improvement should be given. |