# Kingdom of Saudi Arabia

# The National Commission for Academic Accreditation & Assessment

# COURSE SPECIFICATION

**Course title** Electromagnetism 2

**Course code:** 4034133-3

**Revised 13 December 2015**

# Course Specification

*For Guidance on the completion of this template, please refer to of Handbook 2 Internal Quality Assurance Arrangements*

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| **Institution: UMM AL – QURA UNIVERSITY** |
| **College/Department : Faculty of Applied Science – Department of Physics** |

## A Course Identification and General Information

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| 1. **Course title Electromagnetism 2**<br>2. **Course code: 4034133-3** |
| **2. Credit hours: 3hrs** |
| **3. Program(s) in which the course is offered. : B.Sc. Pure Physics** |
| **4. Name of faculty member responsible for the course:**<br>**One of the academic staff member** |
| **5. Level/year at which this course is offered: 4st Year / Level 7** |
| **6. Pre-requisites for this course (if any): Electromagnetism 1 (4033132-3)** |
| **7. Co-requisites for this course (if any):** |
| **8. Location if not on main campus: Main campus & El-Zaher Campus** |
| **9. Mode of Instruction (mark all that apply)**<br>**a. traditional classroom** **What percentage?**<br>**b. blended (traditional and online)** **What percentage?**<br>**c. e-learning** **What percentage?** |

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|---|---|
| **d. correspondence** | **What percentage?** |
| **f. other** | **What percentage?** |
| **Comments:** | |

## B Objectives

**After completing this course student should be able to:**

1. Define the fundamentals of electromagnetic field and radiations.
2. Define the magnetic field, magnetic flux, magnetic scalar potential, magnetic vector potential.
3. Apply Biot-Savart law to calculate the magnetic field due to electric current.
4. Apply Lorentz law to calculate the force acting on a wire carrying electric current placed in a magnetic field.
5. Calculate the magnetic field using Ampere's law.
6. Define the Faraday law of electromagnetic induction.
7. Calculate the self-inductance and mutual inductance.
8. Calculate the magnetic field due to a magnetized object.
9. Define the magnetization, magnetic intensity, the magnetic permeability, magnetic susceptibility.
10. Define the hysteresis loop.
11. Define the diamagnetism, Paramagnetism, and ferromagnetism.
12. Calculate the magnetic energy stored within the electric circuits.
13. Calculate the density of the magnetic energy.
14. List the Maxwell's equations in vacuum and in the materials.
15. Define the displacement current.
16. Explain the electromagnetism in bulk materials (permittivity and permeability, D and H fields) and investigating the concepts of field potential and energy was spent.
17. Discuss the Maxwell's equations and resulted in the triumphal prediction of electromagnetic radiation, but it's surprisingly hard to derive the specific equations for the radiation from an antenna.
18. Describe, in words, the ways in which various concepts in electromagnetism come into play in particular situations; to represent these electromagnetic phenomena and fields mathematically in those situations; and to predict outcomes in other similar situations.

## C. Course Description (Note: General description in the form to be used for the Bulletin or Handbook should be attached):

The course will cover the principle of electromagnetism, such as calculating the magnetic field due to steady current, calculating the magnetic induction, Calculating the magnetic

energy, the magnetic materials and their fields, Maxwell's equations and their applications, Electromagnetic waves, propagation of electromagnetic wave in different media. This course will provide a conceptual background in electromagnetism 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 |
|---|---|---|
| ❖ **The Magnetic Field of Steady Current**<br>1. Induction to magnetic field,<br>2. Lorentz force law and its applications.<br>3. Biot-Savart Law and its applications.<br>4. Ampere's Law (differential and integral shape)<br>5. Application of Ampere's law.<br>6. Divergence and curl of magnetic field.<br>7. The Magnetic Vector Potential,<br>8. The Magnetic Scalar Potential<br>9. The Magnetic Flux | **4** | **12** |
| ❖ **The Electromagnetic Induction**<br>1- Self Induction<br>2- Mutual Induction<br>3- The Neumann Formula | **1.33** | **4** |

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|---|---|---|
| ❖ **Magnetic Properties of Matter**<br>1. The origin of magnetism in the matter.<br>2. Magnetic moment of the atom.<br>3. Magnetization.<br>4. Magnetic current density.<br>5. Surface current density.<br>6. Magnetic Intensity.<br>7. Calculation of magnetic Field of a Magnetized Object.<br>8. Magnetic susceptibility,<br>9. Magnetic Permeability,<br>10. Hysteresis loop.<br>11. Classification of magnetic materials.<br>12. Diamagnetic materials<br>13. Paramagnetic materials.<br>14. Ferromagnetic materials.<br>15. Boundary condition of magnetic field.<br>16. Electric circuits containing magnetic media.<br>17. Magnetic circuits.<br>18. Examples. | **4** | **12** |
| ❖ **Magnetic Energy**<br>1- Magnetic energy of a solid circuit.<br>2- Magnetic Energy of Coupled Circuits,<br>3- Energy Density in Magnetic Field,<br>**4**- Force and Torques on Rigid Circuits | **1.33** | **4** |

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|---|---|---|
| ❖ **Maxwell's Equation's and Electromagnetic Waves**<br>1- Displacement Current,<br>2- Maxwell's Equation's<br>3- Wave Equation for Electric and Magnetic Field<br>4- Plane Wave<br>5- Plane Waves in Isotropic Insulating Media<br>6- Transfer of Plane Waves in Conductor<br>7- Resistance of conductors at ultra high frequencies.<br>8- Applications of Maxwell's Equations<br>a. Boundary Conditions.<br>b. Refraction and Reflection at the boundary of two non-conducting media.<br>9- Electromagnetic waves Energy<br>10- The Wave Equation with Sources | **3.33** | **10** |
| | **14 weeks** | **42hrs** |

| **2 Course components (total contact hours per semester):** | | | |
|---|---|---|---|
| **Lecture : 42** | **Tutorial: 28** | **Practical: 42** | **Other:42** |

**3. Additional private study/learning hours expected for students per week. (This should be an average : for the semester not a specific requirement in each week):**
28 Office hours for the semester to help students for solving assigned problems

**4. Development of Learning Outcomes in Domains of Learning**

For each of the domains of learning shown below indicate:

- A brief summary of the knowledge or skill the course is intended to develop;
- A description of the teaching strategies to be used in the course to develop that knowledge or skill;
- The methods of student assessment to be used in the course to evaluate learning outcomes in the domain concerned.

**a. Knowledge :** Description of the knowledge to be acquired

Upon successful completion of this course the student will be able to:

1. Describe current density and equation of continuity, Ohm's law, steady currents in continuous media
2. Calculate the induction to magnetic field, Lorentz force law and its applications, Biot-Savart Law and its applications, Ampere's law (differential and integral shape), divergence and curl of magnetic field, magnetic vector and scalar potential and magnetic flux
3. Solve the self-induction, mutual induction problems and the Neumann formula
4. Understand the origin of magnetism in the matter, magnetic moment of the atom, magnetization, magnetic and surface current density, magnetic intensity.
5. Calculation of magnetic field of a magnetized object, magnetic susceptibility and permeability, hysteresis loop, diamagnetic, paramagnetic, ferromagnetic materials, boundary condition of magnetic field, electric circuits containing magnetic media.
6. Determine the magnetic energy of a solid and coupled circuit, energy density in magnetic field and force and torques on rigid circuits
7. Explain the Maxwell's equation's and electromagnetic waves: displacement current, wave equation for electric and magnetic field, plane wave in isotropic insulating media, transfer of plane waves in conductor, resistance of conductors at ultra-high frequencies , applications of Maxwell's equations , electromagnetic waves energy and the wave equation with sources

**(ii) Teaching strategies to be used to develop that knowledge**

1. The methodology of teaching that includes a curriculum design, planning and

delivering teaching and assessment, combination of lectures and web-interactions by the lecturer. These will be given the opportunity of students to understand the basic science of the electromagnetic and its different applications in life.

2. Feedback and evaluation that include:
   - Flipping the lecture by using quizzes, blackboard, power point and e-learning
   - Effective by solve some examples during the lecture
   - Reflective learning, multi-cultural of electromagnetic and emotional intelligence.
   - Creating productive online electromagnetic for learning and teaching, transition and participation into education.
   - Observing teaching and learning and creating productive classroom.
   - Small group teaching and assessment learning.
   - Designing and implementing an 'outcomes-based' curriculum.
   - Teaching for reflective learning and research methods.
   - Seminar presentation and on-line learning process with (images and movies)
   - Collect the new information about what the new in electromagnetic
   - Enable the reference books and scientific sites concerning electromagnetic and its application in internet.
   - Teaching for employability,
   - Monitoring the student experience

**(iii) Methods of assessment of knowledge acquired:**

1. Periodical quizzes, assignments and homework
2. First and second mid- term exam and final exam
3. Emphasis of the students in the presence of the lecture continuously

4. Making the students are working small projects and report for electromagnetically and its applications around us.
5. Ask the student to clear the miss understanding of the course

**b. Cognitive Skills**

**(i) Cognitive skills to be developed**

At the end of the course students should be able to have

1. Define the physical principles of electromagnetism, and their application to physical phenomena.
2. Use physical laws and principles to understand the subject
3. Simplify problems and analyze phenomena
4. Analyse and explain natural phenomena.
5. Ability to explain the idea with the student own words.
6. Ability to identify, formulate and solve the electromagnetic represent the problems mathematically

**(ii) Teaching strategies to be used to develop these cognitive skills:**

1. Preparing main outlines for teaching in the starting of the lecture
2. Define tasks for each chapter
3. Open discussions during the lectures
4. Brain storming, group work, homework assignments and small project
5. Encourage the student to look for the information in different sources

**(iii)Methods of assessment of students cognitive skills**

1. All exams and short quizzes must contain questions that can measure these skills.
2. Asking the students about physical meaning and laws previously taught
3. Emphasize the student writing reports on selected parts of the course

4. Discussions of how to simplify or analyse after the lecture

**c. Interpersonal Skills and Responsibility**

**At the end of the course, the student will be able to:**

1. Learn independently and take up responsibility
2. Fluent in dealing with others and collaborative work.
3. Respects the opinions of others .
4. Accepts criticism.
5. Evaluate electromagnetic information.
6. Analyse electromagnetic data.
7. Choose representative examples for each group of electromagnetic .

**(i) Teaching strategies to be used to develop these skills and abilities**

1. Learn how to search the internet and use the library
2. Teamwork and small group discussion
3. Interactive learning
4. Case Study

**(ii) Methods for assessment of the students interpersonal skills and capacity to carry responsibility**

1. Making quizzes on the previous lecture.
2. Checking report and evaluate the efforts and scientific values of each student in preparing report.
3. Mini project and evaluate the work in team
4. Evaluation of the role of each student in teamwork assignment
5. Assignments and evaluation of students presentations

**d. Communication, Information Technology and Numerical Skills**

**(i) Description of the skills to be developed in this domain. At the end of the course, the student will be able to:**

1. Enhancing the ability of students to use computers and internet.

2. Interpret Physical phenomena.
3. Present Physical phenomena orally.
4. Know how to write a report.
5. Computation
6. Problem solving
7. Data analysis and interpretation.
8. Feeling physical reality of results

**(ii) Teaching strategies to be used to develop these skills**

1. Know the basic physical principles of electromagnetic.
2. Discuss with the student
3. Homework (preparing a report on some topics related to the course depending on web sites).
4. Seminars presentation
5. Field visits to laboratory and factories

**(iii)Methods of assessment of students numerical and communication skills**

1. Their interaction with the lectures and discussions
2. Evaluation of presentations
3. Evaluation of reports
4. Oral discussion

**e. Psychomotor Skills (if applicable)**

**(i) Description of the psychomotor skills to be developed and the level of performance required**

- NA

**(ii) Teaching strategies to be used to develop these skills**

- NA

**(iii)Methods of assessment of students psychomotor skills**

- NA

**5. Schedule of Assessment Tasks for Students During the Semester**

| | Assessment task (eg. essay, test, group project, examination etc.) | Week due | Proportion of Final Assessment |
|---|---|---|---|
| 1 | Midterm 1 | 5th week | 15% |
| 2 | Midterm 2 | 10th week | 15% |
| 3 | Quizzes and In-Class Problem Solving | Each 2 weeks w | 5% |
| 4 | Presence of students | All lectures | 5% |
| 5 | Small project | 12th week | 5% |
| 6 | Homework | Every week | 5% |
| 7 | Final exam | End of semester | 50% |

## D. Student Support

1. Arrangements for availability of faculty for individual student consultations and academic advice. (include amount of time faculty are available each week)
   - Department and Faculty web-page with communication tolls in black board. •
   - 4 Office hours/ week.

## E. Learning Resources

**Required Text(s):**

- Foundations of Electromagnetic Theory by Reitz, John R., Milford, Frederick J.,

Christy, Robert W. [Addison-Wesley, 2008] 4th Edition
- Electromagnetic Fields and Waves by Paul Lorrain, Dale R. Corson, Francois Lorrain [W. H. Freeman and Company, 1988] 3rd Edition
- Introduction to Electrodynamics by David J. Griffiths, [Prentice-Hall, Inc., 1999], 3rd Edition.

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**Recommended Reading List**

- I.S. Grant and W.R. Phillips, Electromagnetism, Second Edition, John Wiley & Sons, New York, 2008.
- Elements of Electromagnetics : M. N. O. sadiku [ Oxford University Press, 2001] 3rd Edition.

**Electronic Materials, Web Sites**

- Web Sites, Social Media, Blackboard, Facebook, Twitter, etc.)
- Consult courses in website of the certified universities,.
- www.youtube.com.)
- http://en.wikipedia.org/wiki/Electromagnetism

**Other learning material such as computer-based programs/CD, professional standards/regulations**

**F. Facilities Required**

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

1. **Accommodation (Lecture rooms, laboratories, 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.
- Library
- Laboratory for electricity and magnetism and laboratory of optics and modern

physics.

2. **Computing resources**

Providing class rooms with computers , AV, data show, Smart Board, software, etc.)

**3.Other resources (specify --eg. If specific laboratory equipment is required, list requirements or attach list)**

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## G Course Evaluation and Improvement Processes

**1. Strategies for Obtaining Student Feedback on Effectiveness of Teaching**

- Questionaries
- Open discussion in the class room at the end of the lectures
- Meeting with students
- Open door policy

**2. Other Strategies for Evaluation of Teaching by the Instructor or by the Department**

- Revision of student answer paper by another staff member.
- Analysis the grades of students.
- E-Learning Suggestions - e-Learning Documentation

**3. Processes for Improvement of Teaching**

- Preparing the course as PPT.
- Using scientific movies.
- Coupling the theoretical part with laboratory part
- Periodical revision of course content.
- Report writing of the course and determine goals.
- Fortification of the student learning.
- Handling the weakness point

**4. Processes for Verifying Standards of Student Achievement (eg. check marking by an independent faculty member of a sample of student work, periodic exchange and remarking of a sample of assignments with a faculty member in another institution)**

After the agreement of Department and Faculty administrations

- The instructors of the course are checking together and put a unique process of evaluation.

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| • Feedback evaluation of teaching from independent organization. |
| **5 Describe the planning arrangements for periodically reviewing course effectiveness and planning for improvement.**<br><br>• Periodical revision by Quality Assurance Units in the Department and institution for (Student evaluation, Course report, Program report, Program Self-study, Plan of improvement should be given.<br>• Collect all reports and evaluations at the end of the year for a reviewing purpose.<br>• Conduct a workshop to presents finding of reports and evaluation to share knowledge. |

**Date: 13 December 2015**

**Head of the Physics Department**

***Dr. Hatem Alamri***