** University of Management and Technology**

**School of Science and Technology**

**Department of Basic Sciences**

**Course Code** **NS-125/PH-104**

**Course Title: APPLIED PHYSICS/ELECTRICITY AND MAGNETISM**

**Program: BS (H/EE/CS/SE/PH/CH/MA/IE/EPE/TN)**

**Course Outline (Spring Semester 2013)**

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| --- | --- | --- | --- | --- |
| **Schedule** | Monday----Saturday | **Pre-requisite** | ME-105 Applied Mechanics | |
| **Course Coordinator** | Zaheer Hussain Shah | **Contact** | [zaheer.hussain@umt.edu.pk](mailto:zaheer.hussain@umt.edu.pk)  [bsc.cod@umt.edu.pk](mailto:bsc.cod@umt.edu.pk) | |
| **Course**  **Description** | Coulomb’s law, electric field due to a single charge and distribution of charges, electric flux and Gauss’s law, electric potential due to a single charge and distribution of charges, capacitance and dielectrics, current and resistances, direct current circuits, Kirchhoff’s rules, RC circuits, magnetic field and forces, Biot-Savart law, Ampere’s law, Faraday’s law of induction, inductance, alternating current circuits, RL circuits, LC circuits and RLC circuits, Maxwell’s equations, and electromagnetic waves.  The learning in this course is strengthened by related lab work. | | | |
| **Expected**  **Outcomes** | Participants will learn calculus based general physics approach. They will also be ready for Electronics, Electromagnetic and Instrumentation and Measurements courses. | | | |
| **Text**  **Book** | Physics for Scientist and Engineers, Raymond A. Serway, John W. Jewett, Jr., 6thEdition, Thomson Brooks/Cole, US, 2004. | | | |
| **Assignment & Projects** | i). Problems will be assigned at regular intervals as an assignment.  ii). Projects on different topics may also be assigned to the students.  Marks will be deducted for late submission. | **Quizzes** | | All quizzes will be announced well before time.  No make-ups will be offered for missed quizzes. |
| **Mid Term**  **Examination** | A 60-minutes exam will cover all the material covered during the first  14-16 lectures.  Combined Mid Term exam for all multiple sections. | **Final**  **Examination** | | A 120-minutes exam will cover all the material covered during the semester.  Combined Final exam for all multiple sections. |
| **Attendance**  **Policy** | Students missing more than 20% of the lectures will receive an “SA” grade in the course and will not be allowed to take final exam. | | | |
| **Grading**  **Policy** | Assignment +Projects+ Quizzes: 20%  Mid Term Examination: 20%  Final Examination: 40%  Lab Work : 20% | | | |

Applied Physics/Electricity and Magnetism

**Lecture Plan (Spring 2013)**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Week** | **Lecture**  **#** | **TOPICS** | **CH** | **SECTIONS** |
| 1 | 1  2 | Electric charge and Coulomb’s Law  Electric field of point charge and continuous charge | 23  23 | 1 – 3  4 – 5 |
| 2 | 1  2 | Motion of a charged particle in uniform electric field  Electric flux and Gauss’ Law | 23  24 | 6 – 7  1 – 2 |
| 3 | 1  2 | Application of Gauss’ Law  Potential difference and electric potential | 24  25 | 3 - 4  1 – 2 |
| 4 | 1  2 | Electric potential energy due to point charges  Electric potential of continuous charge distributions | 25  25 | 3 – 4  5 – 6 |
| 5 | 1  2 | Capacitance  Combination of capacitors | 26  26 | 1 – 2  3 – 4 |
| 6 | 1  2 | Capacitors with dielectrics  Electric current and resistance | 26  27 | 5 – 7  1 – 3 |
| 7 | 1  2 | Ohm’s Law and electrical power  DC circuits and combination of resistors | 27  28 | 4 – 6  1 – 2 |
| 8 | 1  2 | Calculating the current in a multi-loop circuit  RC circuits | 28  28 | 3  4 – 5 |
| 9 | 1  2 | The magnetic force on a current carrying conductor  Motion of charged particle in uniform magnetic field | 29  29 | 1 – 3  4 – 6 |
| 10 | 1  2 | The Biot-Savart Law and Ampere’s Law  The magnetic field of a solenoid | 30  30 | 1 - 3  4 - 9 |
| 11 | 1  2 | Faraday’s Law of induction  Motion EMF and Lenz’s Law | 31  31 | 1 – 2  3 – 4 |
| 12 | 1  2 | Generators, motors and Maxwell’s equations  Self Inductance | 31  32 | 5 – 7  1 – 2 |
| 13 | 1  2 | Energy stored in an inductor  Alternating current sources | 32  33 | 3 - 6  1 – 4 |
| 14 | 1  2 | RLC series circuit  The transformers | 33  33 | 5 – 7  8 – 9 |
| 15 | 1  2 | Maxwell’s equations and electromagnetic wave  Momentum and radiation pressure | 34  34 | 1 – 3  4 – 6 |

NS 125 Applied Physics Lab

**Lab Work**

|  |  |
| --- | --- |
| **Lab Policy** | Students are expected to perform experiments (as per attached list) related to the course work, analyze the data, draw conclusions, and write a report. Grades will be awarded based on student’s lab reports and a final exam in the lab. |
| **Grading**  **Policy for Lab work** | Laboratory Reports 12 Marks  Final Examination 08 Marks |
| **Make-up Labs** | If due to an unavoidable circumstance a student has to miss a Lab, then he/she should obtain an excuse for this from the instructor. The instructor will accept an excuse only if he feels that the student had a genuine reason. In an accepted case the instructor may allow the student to take a make-up session. |
| **Attendance**  **Policy** **for Lab** | Students missing more than 20% of the Labs. (Excused or unexcused) will receive an “SA” grade in the Lab work. |

**OVERALL POLICY:**

* **Student has to pass both Course work and Lab work separately.**
* **Student failing in the Course work but passing in the Lab work, has to repeat both Course work and Lab work.**
* **Student failing in the Lab work but passing in the Course work, has to repeat Lab work alone.**

List of Experiments

|  |  |  |
| --- | --- | --- |
| **Week** | **Ex No.** | **Title of Experiment** |
| 1st | Lab Orientation Week | |
| **Data Analysis and Presentation** | | |
| 2nd | 1 | To learn how to analyze experimental data and to practice error analysis. |
| **Measurement of thickness of a very thin sample** | | |
| 3rd | 2 | To estimate the number of atoms in the thickness of a pencil line. |
| **Capacitors in series and parallel** | | |
| 4th | 3 | To measure the capacitance of a capacitor & to investigate the capacitance of capacitors in series and in parallel. |
| **Determination of capacitance of a capacitor by a graphical method** | | |
| 5th | 4 | To determine the capacitance of a capacitor by a graphical method. |
| **Dependence of Current on different combinations of Resistors in a Circuit.** | | |
| 6th | 5 | To measure the current in a circuit depending upon the arrangement of resistors within the circuit and find the value of unknown resistance. |
| **Ohm’s Law** | | |
| 7th | 6 | To study Ohm’s law as applied to a “linear” DC circuit. To show the behavior of some “non-linear” circuit elements which do not obey Ohm’s law. |
| **Wheatstone Bridge** | | |
| 8th | 7 | To introduce bridge circuits and null detection method to measure the resistance of a conductor. To determine the variation of the resistance of a conductor with its length. |
| **Conversion of a Galvanometer to Voltmeter reading up to 6 volts** | | |
| 9th | 8 | To study how a moving coil galvanometer circuit can be modified to construct a voltmeter (reading up to 6 volt). |
| **Conversion of a Galvanometer to Ammeter reading up to 0.2 Ampere** | | |
| 10th | 9 | To study how a moving coil galvanometer circuit can be modified to construct an ammeter (reading up to 0.2 ampere). |
| **Earth’s Magnetic Field** | | |
| 11th | 10 | To measure the horizontal component of the earth’s magnetic field. |
| **Kirchhoff’s Laws** | | |
| 12th | 11 | To study Kirchoff’s laws in the case of a two-loop circuit. |
| 13th | **Revision Week** | |
| 14th | **Lab Final Examination** | |
| 15th | Week for Preparation of Theory Final Examination | |

\* The listed sequence of the experiments may vary from student-to-student. However, each student must perform all the listed experiments.