**University of Management and Technology**

**School of Science**

**Department of Physics**

**Course Code** **PH-106**

**Course Title: MEDICAL PHYSICS**

**Program: BS (BT/ BC)**

**Schedule**

**Course Outline (Spring Semester 2021)**

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| --- | --- | --- | --- | --- |
| **Course Coordinator** | Hafiz Arslan Hashim | **Contact** | arslan.hashim@umt.edu.pk | |
| **Course**  **Description** | Electricity and DC Circuits, Conductors and Insulators, Electric Force (Coulomb’s law) and Electric Field, Superposition of Electric Fields, Electric Potential, Potential Energy and Work, The Heat and ECG, The Capacitor, Energy Stored in a Capacitor, Capacitors in Series and Parallel, Ohm’s Law, Electric circuits, Power Sources, Kirchoff’s Laws, Electric Shock Hazards, Electricity in Cells, Charging and Discharging of RC Circuits, The Nature of Light, Reflection, Refration, Dispersion, Geometric Optics, The Eye and Vision: Emmetropia, Myopia, Hypermetropia, Wave Optics: Interference, Diffraction, Visual Acuity, Atom and Atomic Physics, The Nuucleus and Nuclear Physics, Production of Ionising Radiation, Interactions of Ionising Radiation (X-rays, Gamma-rays), Biological Effects of Ionising Radiation , Medical Imaging, Magnetism and MRI. . | | | |
| **Expected**  **Outcomes** | Much of the biological research during the past hundred years has been directed toward understanding living systems in terms of basic physical laws. This effort has yielded some significant successes. The purpose of this course is to relate some of the concepts in physics to living systems. Students will be prepared to undertake advance courses in Life Science and Medical Physics. | | | |
| **Text Book**  **Ref. Book** | Introduction to Biological Physics for the Health and Life Sciences, Kirsten Franklin, Paul Muir, Terry Scott, Lara Wilcocks, and Paul Yates, John Wiley and Sons, UK, 2010.  Physics in Biology and Medicine, Paul Davidovits, 3rd edition, Elsevier (Academic Press) 2008. | | | |
| **Assignment & Projects** | Problems will be assigned at regular intervals as an assignment. | **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 15 lectures | **Final**  **Examination** | | A 120-minutes exam will cover all the material covered during the semester. |
| **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. | | | |

**MEDICAL PHYSICS**

**Lecture Plan (Spring 2019)**

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| --- | --- | --- | --- | --- |
| **Week** | **Lecture**  **#** | **TOPICS** | **CH** | **SECTIONS** |
| 1 | 1  2 | Static Electricity: Conductors and Insulators  Electric Force and Electric Field | 23  24 | 1 – 5  1 – 7 |
| 2 | 1  2 | Electric Potential Energy  The Heart and ECG | 25  25 | 1 – 4  3 – 7 |
| 3 | 1  2 | Capacitors: Series and Parallel Connections  Electric Current: Drift Velocity | 26  27 | 1 – 5  1 – 6 |
| 4 | 1  2 | Power Sources and Ohm’s Law  Time Behaviour of RC – Circuits | 27  28 | 7 – 15  1 – 4 |
| 5 | 1  2 | The Nature of Light  Plane and Spherical Mirrors | 29  30 | 1 – 5  1 – 3 |
| 6 | 1  2 | Lenses and Magnificaion  The Parts of the Eyes | 30  31 | 4 – 6  1 – 5 |
| 7 | 1  2 | Emmetropia, Myopia, Hypermetropia, Color Vision  Superposition and Interference of waves | 31  32 | 6 – 10  1 – 5 |
| 8 | 1  2 | Diffraction and Thin-Film Interference  The Bohr Model of the Atom | 32  33 | 6 – 10  1 – 4 |
| 9 | 1  2 | Quantum Mechanics  Nuclei and Isotopes | 33  34 | 5 – 6  1 – 3 |
| 10 | 1  2 | Nuclear Decay and Stability  Production of Ionising Radiation | 34  35 | 4 – 5  1 – 3 |
| 11 | 1  2 | Other Sources of Radiation  Attenuation and Cross Section | 35  36 | 4 – 5  1 – 3 |
| 12 | 1  2 | X-rays and Gamma Radiation  Dose and Dose Equivalent | 36  37 | 4 – 5  1 – 3 |
| 13 | 1  2 | Medical Effects and Risk  Medical Imaging | 37  38 | 4 – 6  1 – 4 |
| 14 | 1  2 | CT Scan, PET Scan, Ultrasound Sonography  A brief Outline of MRI | 38  39 | 5 – 7  1 – 3 |
| 15 | 1  2 | Nuclear Magnetic Resonance  Revision | 39  - | 4 – 5  – |



Department of Physics

Medical Physics Lab

(PH-106)

**Lab Work (Spring 2019)**

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| **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 14 Marks  Final Examination 06 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 “F” 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.**

Department of Physics

Medical Physics Lab

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List of Experiments

|  |  |
| --- | --- |
| **Week** | **Experiment Title\*** |
| 1 | Lab. Orientation Week |
| 2 | DATA ANALYSIS AND PRESENTATION |
| 3 | MEASUREMENT OF THICKNESS OF A VERY THIN SAMPLE |
| 4 | HORIZONTAL COMPONENT OF EARTH’s MAGNETIC FIELD |
| 5 | APPLICATIONS OF PHOTOELECTRIC EFFECT |
| 6 | CAPACITORS IN SERIES AND PARALLEL |
| 7 | DETERMINATION OF CAPACITANCE OF A CAPACITOR BY A GRAPHICAL METHOD |
| 8 | OHM'S LAW |
| 9 | WHEATSTONE BRIDGE |
| 10 | CONVERSION OF A GALVANOMETER TO VOLTMETER READING UPTO 6 VOLTS |
| 11 | CONVERSION OF A GALVANOMETER TO AMMETER READING UPTO 0.2 AMPERE |
| 12 | KIRCHHOFF'S LAWS |
| 13 | Make-up |
| 14 | Final Exam. |
| 15 | No Lab |

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