REPUBLIC OF YEMEN
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Quality Assurance and Accreditation

الجمهورية اليمنية
جامعة العلوم والتكنولوجيا
إدارة ضمان الجودة والاعتماد

# Course Syllabus

**Faculty: Faculty of Medicine and Health Sciences**
**Department: Health Sciences**
**Program: Radiologic Technology & Medical Imaging**

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معتمد
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| I. General information about the course instructor : | | | | | | | |
|---|---|---|---|---|---|---|---|
| Name | Dr. Abdullah Taher | Office Hours(3 Hours Weekly ) | | | | | |
| Location & phone number | UST- 715989708 | Sat | Sun | Mon | Tue | Wed | Thu |
| Email | Ataher8383@yahoo.com | | | | | | |

| II. General information about the course: | | | | | | |
|---|---|---|---|---|---|---|
| 1. | Course Title : | Nuclear Medicine Physics | | | | |
| 2. | Course Code and Number : | BMI321 | | | | |
| 3. | Credit Hours : | Credit Hours | | | | Total |
| | | Theoretical | Seminar/Tutorial | Practical | Training | |
| | | 2 | 1 | | | 3 |
| 4. | Study Level and Semester: | 3rd level, 2nd semester | | | | |
| 5. | Pre-requisites (if any): | Radiation physics (2) course. | | | | |
| 6. | Co-requisites (if any): | - | | | | |
| 7. | Program in which the course is offered: | Radiologic Technology & Medical Imaging | | | | |
| 8. | Teaching Language: | English | | | | |
| 9. | Instruction location: | UST- Sana'a | | | | |

## III. Course Description

This course provides student with the principles of nuclear medicine physics as applied to medical imaging and radiation therapy applications.
The course topics cover and focus on nucleus structure, nomenclature and nuclear radiation types, radio nuclides, radiation (particulate and non-particulate), natural and artificial radiation sources, radionuclide production, radioactivity, radiopharmaceutical dose determinations, calculations of radioactive decay, exponential equations, calculation of radiation dosimetry, nuclear radiation

| عميد الكلية: | رئيس القسم: | المراجع : | الموصف : |
|---|---|---|---|
| د. عبدالله المخلافي | د. عبدالحبيب ردمان | أ.د. إسماعيل الشرعبي | د. عبدالله طاهر |

interactions with matter, radiation shielding formulation and counting statistics. In addition this course demonstrate the physical aspects of nuclear medicine applications including: scintillation detectors, multichannel analyzers, Gamma camera, SPECT (single photon emission computerized tomography), PET (positron emission tomography), as well as the quality control procedures for Nuclear Medicine instrumentations.

The course carried out using: lectures, self-learning, seminar, applied research, discussion, Brainstorming session, Miniature education, Solve problems, and other activities to teach this course. Evaluation via periodic oral presentation, written assignments, reports, and final written exam.

## IV. Course Aims:

1. Demonstrate the basic knowledge of physics related to nuclear medicine concepts.
2. Analyze the effect of nuclear physics parameters on diagnostic and therapeutic procedures .
3. Learn to apply various physics concepts related to nuclear imaging and theraputic problems.
4. Extend students' knowledge with nuclear medicine physics applications such as gamma camera, SPECT scan, PET scan, and nuclear medicine therapy systems.

## V. Course Intended Learning Outcomes (CILOs) :

1. Demonstrate the procedures of radiopharmaceuticals preparation and nuclear medicine imaging.
2. Develop understanding of physical aspects in nuclear medicine applications.
3. Interpret the relations between the physical affecting factors on the work of nuclear medicine applications using physical laws and mathematical equations..
4. Learn to apply scientific roles into nuclear medicine imaging..
5. Gain experience from applying theories solutions in radionuclides dosimetry, and radiation protection.
6. Implement physical principle to improve the quality of nuclear images.
7. Prepare the literature review for reports using library and internet.
8. Manage the tasks regarding doing assignments about the course materials in a team.

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## VI. Course Contents

**Theoretical Aspect:**

| No. | Course Topics/Units | Sub-topics | No. of Weeks | Contact Hours |
|---|---|---|---|---|
| 1 | **Ch. 1 Atomic & Nuclear Structure** | Atomic structure, Nuclear components, Classification of Nuclei, Binding Energy, radio nuclides, Nuclear radiation (particulate and non-particulate), and Nuclear Stability | 2 | 4 |
| 2 | **Ch. 2 Production of radioisotopes** | Nuclear Fission, Radioisotope Generator, cyclotron, technetium-99m generator, isotope calibrator | 2 | 4 |
| 3 | **Ch. 3 Radioactivity** | Radioactive decay, Methods of radioactive decay, Decay Schemes, The radioactive decay law, Half-life. | 2 | 4 |
| 4 | **Ch. 4 Interaction of radiation with matter** | Alpha particles, Beta particles, Gamma rays, Photoelectric effect, Compton effect, attenuation, Half value layer, | 2 | 4 |
| 5 | **Ch. 5 Radiation Detectors** | Gas-Filled Detectors, DC Voltage Dependence, Ionisation Chamber, Scintillation detectors, Photomultiplier Tube, Pulse Height Analysis, Scintillation Spectrometer, | 3 | 6 |
| 6 | **Ch. 6 Nuclear medicine Systems physics** | Gamma Camera, Collimation, Emission Tomography, Single Photon Emission Computed Tomography (SPECT), Positron Emission Tomography (PET), Nuclear medicine therapy systems | 3 | 6 |
| **Total number of weeks and hours** | | | **14** | **28** |

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| VII. Second: Practical/Tutorial/Clinical Aspects | | | |
|---|---|---|---|
| **Write up practical/tutorial/clinical topics** | | | |
| **No.** | **Practical/Tutorial/Clinical topics** | **No. of Weeks** | **Contact Hours** |
| 1 | Binding energy measurements (**Tutorial**). | 2 | 2 |
| 2 | Report about Artificial radionuclides used in medicine. | 4 | 2 |
| 3 | Measurement of radioactivity and half- life for some radionuclides. | 6 | 2 |
| 4 | Nuclear radiation types and sources. | 7 | 2 |
| 5 | Mass Attenuation Coefficient measurement. | 9 | 2 |
| 6 | Attenuation of Gamma-rays parameters | 11 | 2 |
| 7 | Nuclear radiation dose calibration. | 13 | 2 |
| **Total number of weeks and hours** | | **7** | **14** |

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