1. **Course Number and Course Title:**

   COE 49408 – Introduction to Biomedical Imaging

2. **Credit Hours:**

   3 – 0 – 3

3. **Prerequisites and/or Co-Requisites:**

   Prerequisites: PHY 101 General Physics I and MTH 221 Linear Algebra

4. **Name and Contact Information of Instructor:**

   Name: Dr. Salam Dhou

5. **Course Description (Catalog Description):**

   Introduces biomedical image processing fundamentals, including image characteristics, image formation, enhancement, visualization, and analysis. Covers the principles and the clinical applications of the main biomedical imaging modalities including x-ray imaging, computed tomography, magnetic resonance imaging, ultrasound imaging, and positron emission tomography.

6. **Textbook and other Supplemental Material:**

   Textbook:

   - N.B. Smith and A. Webb, *Introduction to Medical imaging: Physics, Engineering and Clinical applications*, 1st ed., Cambridge, 2010.

   Other supplemental material:

   - T.M. Deserno (Editor), *Biomedical Image Processing*, Springer-Verlag Berlin Heidelberg, 2011.

7. **Course Learning Outcomes:**

   Upon completion of the course, students will be able to:

   1. Demonstrate knowledge and understanding of the use of biomedical imaging.
   2. Evaluate biomedical images based on fundamental image characteristics such as spatial resolution, signal-to-noise ratio, contrast, and imaging artifacts.
   3. Analyze using science principles the interactions between the applied energy format and the biological tissues in different biomedical imaging modalities including x-ray imaging, computed tomography (CT), magnetic resonance imaging (MRI), ultrasound imaging, and positron emission tomography.
   4. Discuss the clinical applications of each of the biomedical imaging modalities.
   5. Apply biomedical image processing and analysis techniques on phantom and real biomedical images to solve real clinical problems.

8. **Teaching and Learning Methodologies:**

   Methods include lectures, problem-based learning, class discussions, and group work. Students learning is assessed via quizzes, exams, homework, and team projects.

9. Course Topics and Schedule:

Topic/Activity	Weeks
Introduction to biomedical imaging	Week 1
Image processing fundamentals: general image characteristics, image formation concepts, evaluation of biomedical images	Week 2
X-Ray Imaging: principles, instrumentation, clinical applications	Week 3
Computed Tomography (CT): imaging principles, instrumentation	Week 4
Computed Tomography (CT): reconstruction algorithms	Week 5
Computed Tomography (CT): image quality, clinical applications	Week 6
Magnetic Resonance Imaging (MRI): imaging principles, instrumentation	Week 7
Magnetic Resonance Imaging (MRI): image quality, clinical applications	Week 8
Image processing: image enhancement, visualization, application on phantom and real clinical images	Week 9
Image processing: image analysis, application on phantom and real clinical images to solve real clinical problems	Week 10
Ultrasound Imaging: imaging principles, instrumentation	Week 11
Ultrasound Imaging: image quality, clinical applications	Week 12
Positron Emission Tomography (PET): imaging principles, instrumentation	Week 13
Positron Emission Tomography (PET): image quality, clinical applications	Week 14
Revision and team project presentations	Week 15
Final Exam	Week 16