**DAIHC-2-01T: Introduction to Medical Imaging & Biomedical Signals**

Total Marks: 100
External Marks: 70
Internal Marks: 30
Credits: 4

**Detailed Contents**

| Module | Module Name | Module Contents | Lectures /Tutorials Hours |
|---|---|---|---|
| **Module-1** | Fundamentals of Medical Imaging Technologies | • Introduction to medical imaging and its clinical importance<br>• Physics and instrumentation of imaging modalities: X-ray: Radiographic principles, image formation, applications; Computed Tomography (CT): Tomographic reconstruction, contrast media; Magnetic Resonance Imaging (MRI): Principles of nuclear magnetic resonance, image contrast, safety aspects; Ultrasound: Acoustic principles, Doppler imaging, echocardiography<br>• Image formats and storage standards: DICOM overview<br>• Applications of imaging in diagnosis and treatment planning | 15 |
| **Module-II** | Introduction to Biomedical Signals | • Basics of physiological signal generation<br>• Signal types: ECG (Electrocardiogram) – cardiac activity, waveforms, abnormalities, EEG (Electroencephalogram) – brain signals, frequency bands, clinical significance, EMG (Electromyogram) – muscle activation patterns<br>• Signal acquisition: Electrodes, amplifiers, and A/D conversion<br>• Noise in biomedical signals: Sources and reduction methods<br>• Basics of sampling theorem and aliasing | 15 |
| **Module** | **Module Name** | **Module Contents** | **Lectures /Tutorials Hours** |
| **Module-III** | Signal and Image | • Preprocessing: Noise removal, filtering | 15 |

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| | Processing Techniques | (low-pass, high-pass, notch filters)<br>• Time-domain and frequency-domain analysis<br>• Image preprocessing: Contrast enhancement, histogram equalization, edge detection<br>• Image transformation: Fourier transform, wavelet transform (basics)<br>• Segmentation and feature extraction (basic methods) | |
| **Module-IV** | Computational Analysis of Medical Data | • Introduction to tools: Python (NumPy, SciPy, OpenCV), MATLAB<br>• Feature extraction from biosignals: ECG intervals, EEG rhythms, EMG patterns<br>• Basic image analysis workflows: ROI selection, intensity profiling<br>• Diagnostic indicators and decision-support based on extracted features | 15 |

**Books**


• Prince, J. L., & Links, J. M. (2014). Medical imaging signals and systems (2nd ed.). Pearson.
• Rangayyan, R. M. (2015). Biomedical signal analysis: A case-study approach (2nd ed.). Wiley-IEEE Press.
• Webb, A. (2017). Principles of biomedical imaging (2nd ed.). Cambridge University Press.
• Acharya, U. R., Sree, S. V., Faust, O., & Suri, J. S. (2012). Advanced biomedical signal analysis (Vol. 1). IOS Press.