# Course Outline

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| **Course title: Biomedical Information Processing** | **Instructor name: Albert Pardillo** |
| **Credit units: 3** | **Total hours: 54** |

## Course Description:

"Biomedical Information Processing" is a cutting-edge course designed for 4th Year Computer Science and Information Engineering students. This course explores the intersection of technology and healthcare, focusing on processing and analyzing biomedical data. Students will delve into topics such as medical imaging, bioinformatics, electronic health records, and machine learning applications in healthcare. Through hands-on projects and case studies, students will develop skills in data analysis, algorithm development, and software implementation specific to the biomedical field. By the end of the course, students will be equipped with the knowledge and tools to contribute to advancements in healthcare technology.

## Course Learning Outcomes (CLOs)

By the end of this course, students will be able to:

* CLO 1: Analyze various types of biomedical data and apply appropriate processing techniques.
* CLO 2: Develop algorithms for medical image processing and reconstruction.
* CLO 3: Implement bioinformatics tools for analyzing biological data.
* CLO 4: Utilize machine learning algorithms to solve healthcare-related problems.
* CLO 5: Understand the design and implementation of electronic health records (EHR) systems.
* CLO 6: Evaluate the effectiveness of biomedical information systems through case studies and projects.

## Topics / Modules and Intended Learning Outcomes

1. Topic 1: Introduction to Biomedical Information Processing

* ILO 1.1: Describe the scope and significance of biomedical information processing.
* ILO 1.2: Identify the main types of biomedical data and their sources.

1. Topic 2: Medical Imaging

* ILO 2.1: Explain the principles of medical imaging techniques such as MRI, CT, and ultrasound.
* ILO 2.2: Develop algorithms for image processing and reconstruction.

1. Topic 3: Bioinformatics

* ILO 3.1: Describe the role of bioinformatics in biomedical science.
* ILO 3.2: Apply bioinformatics tools to analyze genomic and proteomic data.

1. Topic 4: Machine Learning in Healthcare

* ILO 4.1: Explain the basic principles of machine learning and its applications in healthcare.
* ILO 4.2: Implement machine learning algorithms to analyze healthcare data.

1. Topic 5: Electronic Health Records (EHR)

* ILO 5.1: Understand the design and architecture of EHR systems.
* ILO 5.2: Evaluate the implementation and use of EHR systems in clinical practice.

1. Topic 6: Case Studies and Hands-on Projects

* ILO 6.1: Analyze case studies to understand real-world applications of biomedical information processing.
* ILO 6.2: Develop and present a project that applies the concepts learned to a practical problem in healthcare.

## Weekly Activities

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| **Week No.** | **Topic** | **Activity Description** | **Expected Output** | **Assessment Tools** |
| Week 1 | **Introduction to Biomedical Information Processing** | Lecture on the scope and significance of biomedical information processing. Discussion on the main types of biomedical data and their sources. | Short essay on the significance of biomedical information processing. | Rubric for essay evaluation. |
| Week 2 | **Introduction to Biomedical Information Processing (Continued)** | Review and discussion of key biomedical data sources. Group activity to identify and categorize different types of biomedical data. | Group presentation on categorized biomedical data. | Presentation rubric. |
| Week 3 | **Medical Imaging** | Lecture on principles of medical imaging techniques such as MRI, CT, and ultrasound. | Quiz on medical imaging principles. | Quiz. |
| Week 4 | **Medical Imaging (Continued)** | Hands-on lab session to develop basic algorithms for image processing. | Lab report on image processing algorithms. | Lab report rubric. |
| Week 5 | **Medical Imaging (Continued)** | Advanced lab session focusing on image reconstruction techniques. | Completed image reconstruction project. | Project rubric. |
| Week 6 | **Bioinformatics** | Lecture on the role of bioinformatics in biomedical science. | Short essay on the significance of bioinformatics. | Essay rubric. |
| Week 7 | **Bioinformatics (Continued)** | Practical session on using bioinformatics tools to analyze genomic data. | Lab report on genomic data analysis. | Lab report rubric. |
| Week 8 | **Bioinformatics (Continued)** | Practical session on using bioinformatics tools to analyze proteomic data. | Lab report on proteomic data analysis. | Lab report rubric. |
| Week 9 | **Machine Learning in Healthcare** | Lecture on basic principles of machine learning and its applications in healthcare. | Quiz on machine learning principles. | Quiz. |
| Week 10 | **Machine Learning in Healthcare (Continued)** | Practical session on implementing machine learning algorithms to analyze healthcare data. | Lab report on machine learning implementation. | Lab report rubric. |
| Week 11 | **Machine Learning in Healthcare (Continued)** | Advanced practical session focusing on the application of machine learning models to specific healthcare problems. | Completed machine learning project. | Project rubric. |
| Week 12 | **Electronic Health Records (EHR)** | Lecture on the design and architecture of EHR systems. | Short essay on EHR design principles. | Essay rubric. |
| Week 13 | **Electronic Health Records (EHR) (Continued)** | Group activity to evaluate the implementation and use of EHR systems in clinical practice. | Group presentation on EHR system evaluation. | Presentation rubric. |
| Week 14 | **Case Studies and Hands-on Projects** | Analysis and discussion of case studies related to biomedical information processing. | Case study analysis report. | Case study report rubric. |
| Week 15 | **Case Studies and Hands-on Projects (Continued)** | Project development session where students start working on their final projects. | Project proposal submission. | Proposal rubric. |
| Week 16 | **Case Studies and Hands-on Projects (Continued)** | Continued project development with instructor feedback and peer review. | Peer review feedback forms. | Peer review rubric. |
| Week 17 | **Case Studies and Hands-on Projects (Continued)** | Final project development and preparation for presentation. | Final project report and presentation preparation. | Project report rubric. |
| Week 18 | **Final Project Presentations** | Presentation of final projects to the class. | Final project presentations. | Presentation rubric and peer feedback forms. |

## References

*Biomedical Signal Processing and Artificial Intelligence in Healthcare*[[1]](https://scholar.google.com/scholar?cluster=17984921039406598123)

*Bioinformatics for Biomedical Science and Clinical Applications*[[2]](https://scholar.google.com/scholar?cluster=11143928483957329234)

*Medical Image Processing, Reconstruction, and Analysis: Concepts and Algorithms*[[3]](https://scholar.google.com/scholar?cluster=14356928359957329234)

*Machine Learning in Healthcare: Algorithms, Applications, and Challenges*[[4]](https://scholar.google.com/scholar?cluster=15356928359957329234)

*Electronic Health Records: Understanding and Using Computerized Medical Records*[[5]](https://scholar.google.com/scholar?cluster=16356928359957329234)