## DEPARTMENT OF MEDICAL ELECTRONICS AND ENGINEERING

### Vision

To be a leading force in the field of medical electronics in understanding medical equipment for health care.

### Mission

- To impart knowledge base and skill sets in the field of medical electronics.
- Inculcate managerial and entrepreneurial skills to work in multidisciplinary environment.
- To provide a best learning ambience for academics & research leading to global competence.
- To analyze and design latest life saving technologies to solve societal problems.

### Program Educational Objectives

**PEO 1:** To impart fundamental knowledge in science and technology to perform challenging roles in new trends of medical electronics.

**PEO2:** To develop professional attitude, good communication skill and to work in multidisciplinary teams with strong ethical, spiritual background.

**PEO3:** To excel in the field of research and innovation there by contributing to the evolving technology.

### Program Specific Outcomes (PSOs)

**PSO 1:** Investigate, Implement and demonstrate various applications of analog and digital electronic subsystems in designing and building biomedical instrumentation systems.

**PSO 2:** Specify, architect and prototype health-care solutions by applying signal and medical image processing techniques on modern hardware and software platforms

**PSO 3:** Design, develop and verify processes, algorithms and computer programs for medical purposes

**Program Outcomes:**

**Engineering Graduates will be able to:**

- **Engineering knowledge:** Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
- **Problem analysis:** Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.
- **Design/development of solutions:** Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.
- **Conduct investigations of complex problems:** Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.
- **Modern tool usage:** Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations.
- **The engineer and society:** Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice.
- **Environment and sustainability:** Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.
- **Ethics:** Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.
- **Individual and team work:** Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.
- **Communication:** Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.
- **Project management and finance:** Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.
- **Life-long learning:** Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.

# SRI SIDDHARTHA INSTITUTE OF TECHNOLOGY- TUMAKURU

**(A constituent College of Siddhartha Academy of Higher Education, Tumakuru)**

## *Scheme of Teaching and Examination*-2018

**Choice based Credit System (CBCS)(Effective from the academic year 2018-19)**

| **VII Semester B.E. Medical Electronics** (Subjects and Syllabus as per AICTE-Model Curriculum for UG Course in Engg. & Tech.- Jan. 2018) | | | | | | **Teaching Hours/week** | | | | **Examination** | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| *SI No.* | *Course and Course Code* | | *Course Title* | *Teaching dept.* | *Board of Exam.* | *L* | *T* | *P* | *C* | *Duration in Hrs.* | *CIE* | *SEE* | *Total Marks* |
| 01 | PC | 18ML701 | Principles of Medical Imaging | ML | ML | 3 | - | - | 3 | 3 | 50 | 50 | 100 |
| 02 | PC | 18ML702 | Biomedical DSP | ML | ML | 3 | - | - | 3 | 3 | 50 | 50 | 100 |
| 03 | PC | 18ML7PE3x | Professional Elective-III | ML | ML | 3 | - | - | 3 | 3 | 50 | 50 | 100 |
| 04 | PC | 18ML7PE4x | Professional Elective-IV | ML | ML | 3 | - | - | 3 | 3 | 50 | 50 | 100 |
| 05 | PC | 18ML705 | Biomedical DSP Lab | ML | ML | - | - | 3 | 1 | 3 | 50 | 50 | 100 |
| 06 | PC | 18ML706 | Python Lab | ML | ML | - | - | 3 | 1 | 3 | 50 | 50 | 100 |
| 07 | PC | 18ML7TS01 | Technical Seminar | ML | ML | - | - | - | 1 | - | 50 | - | 50 |
| 08 | PC | 18ML7PW01 | Project Phase-1 | ML | ML | - | - | 4 | 2 | - | 50 | - | 50 |
| Total | | | | | | 12 | - | 10 | 17 | 18 | 400 | 350 | 700 |

BS-Basic Science=26 Credits, ES-Engineering Science=19 Credits, HS-Humanities and Social sciences= 10 Credits,
PC-Professional core=73+12=85 Credits, PE-Professional Elective =6+6=12 Credits, OE-Open Elective = 6 Credits.

L-Lecture, T-Tutorial, P-Practical, CIE-Continuous Internal Evaluation, SEE-Semester End Examination

**Professional Elective III**:

18ML7PE31: Artificial Organs and Biomaterials
18ML7PE32: Biometrics
18ML7PE33: Artificial Intelligence

**Professional Elective IV**:

18ML7PE41: Pattern Recognition and its applications in Medicine
18ML7PE42: Machine Learning
18ML7PE43: Medical Device Development

# SRI SIDDHARTHA INSTITUTE OF TECHNOLOGY- TUMAKURU

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## *Scheme of Teaching and Examination*-2018

**Choice based Credit System (CBCS)(Effective from the academic year 2018-19)**

| **VIII Semester B.E. Medical Electronics** (Subjects and Syllabus as per AICTE-Model Curriculum for UG Course in Engg. & Tech.- Jan. 2018) | | | | | | **Teaching Hours/week** | | | | **Examination** | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| *SI No.* | *Course and Course Code* | | *Course Title* | *Teaching dept.* | *Board of Exam.* | *L* | *T* | *P* | *C* | *Duration in Hrs.* | *CIE* | *SEE* | *Total Marks* |
| 01 | PC | 18ML8PE1x | Professional Elective -V | ML | ML | 3 | - | - | 3 | 3 | 50 | 50 | 100 |
| 02 | PC | 18ML8PE2x | Professional Elective-VI | ML | ML | 3 | - | - | 3 | 3 | 50 | 50 | 100 |
| 03 | PC | 18ML8PE3x | Professional Elective-VII | ML | ML | 3 | - | - | 3 | 3 | 50 | 50 | 100 |
| 04 | PC | 18ML8PW02 | Project Phase-2 | ML | ML | - | - | 14 | 7 | 3 | 50 | 50 | 100 |
| Total | | | | | | 9 | - | 14 | 16 | 12 | 200 | 200 | 400 |
| BS-Basic Science=26 Credits, ES-Engineering Science=19 Credits, HS-Humanities and Social sciences=10 Credits<br>PC-Professional core=85+6=91 Credits,, PE-Professional Elective =12+6=18 Credits, OE-Open Elective = 6 Credits | | | | | | | | | | | | | |
| **Total Credits=BS+ES+HS+PC+PE+OE+PW=26+19+10+91+18+6=170 credits** | | | | | | | | | | | | | |
| L-Lecture, T-Tutorial, P-Practical, CIE-Continuous Internal Evaluation, SEE-Semester End Examination | | | | | | | | | | | | | |

| | |
|---|---|
| **Professional Elective V:** 18ML8PE11: Neural Network<br>18ML8PE12: Clinical Data Analytics<br>18ML8PE13: Brain Computer Interface | **Professional Elective VI**: 18ML8PE21: Hospital Management and Professional Ethics<br>18ML8PE22: Rehabilitation Engineering<br>18ML8PE23: Smart Wearable Sensor |
| **Professional Elective VII:** 18ML8PE31: IOT in Healthcare<br>18ML8PE32: Biostatistics and Biomechanics<br>18ML8PE33: Biomedical Therapeutic Equipments | |

# Sri Siddhartha Institute of Technology, Tumkur

(A constituent College of Siddhartha Academy of Higher Education, Tumakuru)

## Department of Medical Electronics

Syllabus for the Academic Year 2021-22

**Subject Name: Principles Of Medical Imaging** **Semester: VII**

**Subject Code: 18ML701** **L-T-P-C: 3-0-0-3**

**Course Objectives:**

| Sl. No. | Course Objectives |
|---|---|
| **1.** | Build the physics background of interaction of radiation with matter, enabling participants to understand projection radiography, mammography, and fluoroscopy and train them to assess image distortions, image attenuation for x-ray radiography systems. |
| **2.** | Expose students to the developments in X-ray Computed Tomography leading to modern day multi-slice, helical CT scanners and introduce the concept of computed tomography reconstruction. |
| **3.** | Divulge the image formation, image quality, and imaging hardware for ultrasound scanning. Explain the imaging principles and derive the fundamental equation of MRI. |
| **4.** | Expose the participants to advanced MR techniques including fast spin echoes, MRI angiography, echo planar imaging, magnetization prepared sequences, diffusion and perfusion theory and sequences. |

| Unit | Course content | Teaching hrs |
|---|---|---|
| **UNIT I** | **X-rays:** Introduction to Electromagnetic Spectrum, Fundamentals of Rays, Generation and Detection of X-Rays, X-ray Diagnostic Method | **08** |
| **UNIT II** | **X-Rays:** Recent Developments, X-ray Imaging Characteristics, Biological effects of Ionizing radiation. | **08** |
| **UNIT III** | **Ultrasound:** Fundamentals of Acoustic Propagation, Generation and Detection of Ultrasound, Ultrasonic Diagnostics Methods, New Developments, Image Characteristics, Biological effects of Ultrasounds. | **08** |
| **UNIT IV** | **Radionuclide Imaging:** Fundamentals of Radioactivity, Generation and Detection of nuclear emission, Diagnostic methods using radiation detector probes, Radionuclide Imaging Systems**, New** Radionuclide Imaging methods, Characteristics of Radionuclide Images, Internal radiation dosimeter and biological effects**.** | **08** |
| **UNIT V** | **Magnetic Resonance Imaging**<br>Fundamentals of nuclear magnetic resonance, Generation and Detection of NMR signal, Imaging Methods, In vivo NMR Spectroscopy, Characteristics of MRI, Biological Effects of Magnetic Fields. | **07** |

**Course Outcomes:**

| Sl. No. | Course Outcomes |
|---|---|
| **CO1** | To gain knowledge on X-rays and its generation. |
| **CO2** | To understand and distinguish different diagnostic method. |
| **CO3** | To explain concepts of CT, Projection functions of CT. |
| **CO4** | Understand the principles of Radionuclide imaging and Magnetic resonance imaging. |

**Question Paper Pattern:**

Total 5 units of syllabus, 2 full questions from each unit (20marks each) and total 20 marks from each unit. Total 10 Questions for 100 marks, covers 100% syllabus, and student has to answer any 5 full questions (1 to1 choice). Each question carries maximum 4 subdivisions.

**Text Books:**

| SI No | Text Book title | Author | Volume and Year of Edition |
|---|---|---|---|
| 1 | Principles of Medical Imaging | Shung K. Kirk, Tsui Benjamin, Smith.B.Michael, | Academic press, 2012 |
| 2 | Fundamentals of Medical Imaging | Suetens Paul | Cambridge University Press, 2002 |

**Reference Books:**

| SI No | Text Book title | Author | Volume and Year of Edition |
|---|---|---|---|
| 1 | Handbook of Biomedical Instrumentation | Khandpur R.S | 3nd Ed., Tata-McGRaw Hill, 2014 |
| 2 | Medical Imaging Principles and Practices | Mostafa Analoui Joseph D. Bronzino Donald R. Peterson | CRC Press 2013 |
| 3 | Scientific Basis of Medical Imaging | Wells P.N.T | Newyork presss, 1982 |
| 4 | Handbook of Biological Effects of Electromagnetic Fields | Polks c and Postow E | CRC Press, 2014 |

# Sri Siddhartha Institute of Technology, Tumkur

(A constituent College of Siddhartha Academy of Higher Education, Tumakuru)

## Department of Medical Electronics

Syllabus for the Academic Year 2021-22

**Subject Name: Biomedical Digital Signal Processing** **Semester: VII**

**Subject Code: 18ML702** **L-T-P-C: 3-0-0-3**

**Course Objectives:**

| Sl. No. | Course Objectives |
|---|---|
| **1.** | This course helps to understand the nature and difficulties to acquire bio-signals and its processing concepts for analysis. |
| **2.** | It also helps to bring out the concepts related Neurological signal processing and sleep disorder. |
| **3.** | Explains the concept of data compression techniques. |
| **4.** | Emphasizes on signal averaging, adaptive filers and its applications. |

| Unit | Course content | Teaching hrs |
|---|---|---|
| **UNIT I** | **Introduction to Biomedical Signals:** The nature of biomedical signals, the action potential, objectives of biomedical signal analysis, difficulties in biomedical signal analysis, computer aided diagnosis.<br><br>**Neurological signal processing:** The brain and its potentials, The electrophysiological origin of brain waves, The EEG signal and its characteristics, EEG analysis. | **08** |
| **UNIT II** | **ECG Signal Processing:** ECG data acquisition, ECG lead system, ECG parameters and their estimation, ECG QRS detection techniques: Template matching, differentiation based QRS detection techniques. Estimation of R-R Interval: Finite first difference method. The use of multi-scale analysis for parameter estimation of ECG waveforms, Arrhythmia analysis monitoring, long term continuous ECG recording. | **08** |
| **UNIT III** | **Sleep EEG:** Data acquisition and classification of sleep stages, The Markov model and Markov chains, Dynamics of sleep-wake transitions, Hypnogram model parameters, event history analysis for modeling sleep. | **08** |
| **UNIT IV** | **Ecg Data Reduction Techniques***:* direct data compression techniques, direct ECG data compression techniques: Turing point algorithm, AZTEC algorithm and FAN algorithm, other data compression techniques: data compression by DPCM, data compression method comparison, huffman coding. | **08** |
| **UNIT V** | **Signal Averaging*:*** Basics of signal averaging, signal averaging as a digital filter, a typical averager.<br>**Adaptive Filters*:*** Principle of an adaptive filter, the steepest | **07** |

| | | |
|---|---|---|
| | descent algorithm, adaptive noise canceller: (a)cancellation of 60 Hz interference in electrocardiography, (b) Canceling donor-heart interference in heart-transplant electrocardiography, (c)Cancellation of ECG signal from the electrical activity of the chest muscles, (d)Canceling of maternal ECG in fetal ECG, (e)Cancellation of High frequency noise in Electro-surgery. | |

**Course Outcomes:**

| Sl. No. | Course Outcomes |
|---|---|
| **CO1** | Recall the origin of EEG signals and their characteristics. |
| **CO2** | Recall the origin of ECG signals and their characteristics, also to acquire and analyze the events, patterns and processing. |
| **CO3** | To understand the concepts of data acquisition and classifying sleep stages. |
| **CO4** | To understand ECG data reduction techniques, signal averaging, adaptive filters and its medical applications. |

**Question Paper Pattern:**

Total 5 units of syllabus, 2 full questions from each unit (20marks each) and total 20 marks from each unit. Total 10 Questions for 100 marks, covers 100% syllabus, and student has to answer any 5 full questions (1 to1 choice). Each question carries maximum 4 subdivisions.

**Text Books:**

| SI No | Text Book title | Author | Volume and Year of Edition |
|---|---|---|---|
| 1 | Biomedical Digital Signal Processing | Willis J. Tompkins | PHI, 2005 |
| 2 | Biomedical Signal Processing- principles and techniques | D. C. Reddy | Tata McGraw-Hill, 2005 |
| 3 | Biomedical Signal Analysis | Rangaraj M. Rangayyan | IEEE Press, 2005 |

**Reference Books:**

| SI No | Text Book title | Author | Volume and Year of Edition |
|---|---|---|---|
| 1 | Biomedical Signal Processing | Akay M | Academic: Press 1994 |
| 2 | Biomedical Signal Processing | Cohen.A | CRC Press, 1986. |
| 3 | Advanced Methods of Biomedical Signal Processing | Sergio Cerutti and Carlo Marchesi, | Willey, 2012 |

**Subject Name: Artificial Organs and Biomaterials** **Semester: VII**

**Subject Code: 18ML7PE31** **L-T-P-C: 3-0-0-3**

**Course Objectives:**

| Sl. No. | Course Objectives |
|---|---|
| **1.** | To create awareness to the student with modern artificial organs devices and methods used to partially support or completely replace pathological organ |
| **2.** | Understand the design and working of artificial heart, kidney, and blood |
| **3.** | To know about working of heart valve. Design of artificial heart valve |
| **4.** | Study about biomaterial which is used for design of artificial organ. Understand the characteristics of polymeric and metallic biomaterial. |

| Unit | Course content | Teaching hrs |
|---|---|---|
| **UNIT I** | **ARTIFICIAL ORGANS: INTRODUCTION:** Substitutive medicine, outlook for organ replacement, design consideration, evaluation process.<br>**ARTIFICIAL HEART AND CIRCULATORY ASSIST DEVICES:** Engineering design, Engg design of artificial heart and circulatory assist devices. | **08** |
| **UNIT II** | **ARTIFICIAL KIDNEY:** Functions of the kidneys, kidney disease, renal failure, renal transplantation, artificial kidney, dialyzers, and membranes for haemodialysis, haemodialysis machine, peritoneal dialysis equipment-therapy format, fluid and solute removal.<br>**ARTIFICIAL BLOOD:** Artificial oxygen carriers, fluorocarbons, hemoglo bin for oxygen carrying plasma expanders, hemoglobin based artificial blood. | **08** |
| **UNIT III** | **ARTIFICIAL LUNGS:** Gas exchange systems, Cardiopulmonary bypass (heart-lung machine)-principle, block diagram and working, artificial lung versus natural lung.<br>**CARDIAC VALVE PROSTHESES:** Mechanical valves, tissue valves, current types of prostheses, tissue versus mechanical, engineering concerns and hemodynamic assessment of prosthetic heart valves, implications for thrombus deposition, durability, current trends in valve design. | **08** |
| **UNIT IV** | **BIOMATERIALS:** Introduction to biomaterials, uses of biomaterials, biomaterials in organs & body systems, materials for use in the body, performance of biomaterials.<br>**METALLIC BIOMATERIALS:** Introduction, Stainless steel, Cobalt-Chromium alloy, Titanium alloys, Titanium-Nickel alloys, Dental metals, Corrosion of metallic implants, Manufacturing of implants. | **08** |

| | | |
|---|---|---|
| **UNIT V** | **CERAMIC BIOMATERIALS:** Introduction, non absorbable/relatively bioinert bioceramics, biodegradable/restorable ceramics, bioreactive ceramics, deterioration of ceramics, bioceramic-manufacturing techniques<br>**POLYMERIC BIOMATERIALS:** Introduction, polymerization and basic structure, polymers used as biomaterials, sterilization, surface modifications to for improving biocompatibility. | **07** |

**Course Outcomes:**

| Sl. No. | Course Outcomes |
|---|---|
| **CO1** | Understand the need of artificial organs. |
| **CO2** | Understand the function of various organs in your body. |
| **CO3** | Learn about the design of the various artificial organs using biomaterial. |
| **CO4** | Understand the various biomaterials. Learn composite, biodegradable polymeric and tissue derived materials. |

**Question Paper Pattern:**

Total 5 units of syllabus, 2 full questions from each unit (20marks each) and total 20 marks from each unit. Total 10 Questions for 100 marks, covers 100% syllabus, and student has to answer any 5 full questions (1 to1 choice). Each question carries maximum 4 subdivisions.

**Text Books:**

| SI No | Text Book title | Author | Volume and Year of Edition |
|---|---|---|---|
| 1 | Biomedical Engineering Handbook-Volume1 | J.D.Bronzino | CRC Press / IEEE Press, 2000. |
| 2 | Biomedical Engineering Handbook-Volume 2 | J.D.Bronzino | CRC Press / IEEE Press, 2000. |

**Reference Books:**

| SI No | Text Book title | Author | Volume and Year of Edition |
|---|---|---|---|
| 1 | Handbook of Biomedical Instrumentation | R.S.Khandpur | Tata McGraw Hill, 2003. |
| 2 | A Textbook of Biomaterials and Artificial Organs | NA Vikraman | Amazon Digital Services LLC - KDP Print US, 2009. |
| 3 | Biomaterials, Artificial Organs and Tissue Engineering | L. L. Hench, Julian R. Jones | CRC press, 2005. |
| 4 | Biomaterials: Principles and Applications | Joon B. Park, Joseph D. Bronzino | CRC Press 2015. |

# Sri Siddhartha Institute of Technology, Tumkur

(A constituent College of Siddhartha Academy of Higher Education, Tumakuru)

## Department of Medical Electronics

Syllabus for the Academic Year 2021-22

**Subject Name: Biometrics** **Semester: VII**

**Subject Code: 18ML7PE32** **L-T-P-C: 3-0-0-3**

**Course Objectives:**

| Sl. No. | Course Objectives |
|---|---|
| **1.** | To understand the state-of-the-art in biometric technologies |
| **2.** | To survey the currently available biometric systems |
| **3.** | To explore ways to improve some of the current techniques |
| **4.** | To learn and implement some of the biometrics authentication |

| Unit | Course content | Teaching hrs |
|---|---|---|
| **UNIT I** | Introduction – Benefits of biometric security – Verification and identification – Basic working of biometric matching – Accuracy – False match rate – False non-match rate – Failure to enroll rate – Derived metrics – Layered biometric solutions. | **08** |
| **UNIT II** | Finger scan – Features – Components – Operation (Steps) – Competing finger Scan technologies – Strength and weakness. Types of algorithms used for interpretation. Voice Scan - Features – Components – Operation (Steps) – Competing voice Scan (facial) technologies – Strength and weakness. | **08** |
| **UNIT III** | Iris Scan - Features – Components – Operation (Steps) – Competing iris Scan technologies – Strength and weakness. Facial Scan - Features – Components – Operation (Steps) – Competing facial Scan technologies – Strength and weakness. | **08** |
| **UNIT IV** | Other physiological biometrics – Hand scan – Retina scan – AFIS (Automatic Finger Print Identification Systems) – Behavioral Biometrics – Signature scan- keystroke scan. | **08** |
| **UNIT V** | Biometrics Application – Biometric Solution Matrix – Bio privacy – Comparison of privacy factor in different biometrics technologies – Designing privacy sympathetic biometric systems. Biometric standards – (BioAPI , BAPI) – Biometric middleware. Biometrics for Network Security: Statistical measures of Biometrics. Biometric Transactions. | **07** |

**Course Outcomes:**

| Sl. No. | Course Outcomes |
|---|---|
| **CO1** | Understand the fundamentals and the need of biometrics. |
| **CO2** | Learn the deployment, strength & weakness of the types of Biometrics. |
| **CO3** | Learn the uncommon biometrics and its usage. |
| **CO4** | Understand the applications of Biometrics and learn the risks, standards and testing / Evaluation process of Biometrics. |

**Question Paper Pattern:**

Total 5 units of syllabus, 2 full questions from each unit (20marks each) and total 20 marks from each unit. Total 10 Questions for 100 marks, covers 100% syllabus, and student has to answer any 5 full questions (1 to1 choice). Each question carries maximum 4 subdivisions.

**Text Books:**

| SI No | Text Book title | Author | Volume and Year of Edition |
|---|---|---|---|
| 1 | Biometrics–Identity Verification in a Networked. | Samir Nanavati, Michael Thieme, Raj Nanavati, | World–Wiley India Pvt Ltd, 2002. |
| 2 | Biometrics for Network Security | Paul Reid | Pearson Education, 2004. |

**Reference Books:**

| SI No | Text Book title | Author | Volume and Year of Edition |
|---|---|---|---|
| 1 | Biometrics- The Ultimate Reference-, | John D. Woodward Jr. Wiley Dreamtech. | Springer 2012. |
| 2 | Biometric Systems Technology, Design and Performance Evaluation, | James Wayman, Anil Jain, Davide Maltoni and Dario Maio, | Springer Publications, 2000. |
| 3 | Personal Identification in Networked Society | Jain, A.K.; R Bolle, Ruud M.; S Pankanti, Sharath | 1st ed. 1999. 2nd printing, Springer Publications 2006. |
| 4 | Handbook of Biometrics | Jain, Anil K.; Flynn, Patrick; Ross, Arun A | Springer, 2008. |

**Subject Name: Artificial Intelligence** **Semester: VII**

**Subject Code: 18ML7PE33** **L-T-P-C: 3-0-0-3**

**Course Objectives:**

| Sl. No. | Course Objectives |
|---|---|
| **1.** | To create appreciation and understanding of both the achievements of AI and the theory underlying those achievements. |
| **2.** | To impart basic proficiency in representing real life problems in a state space representation so as to solve them using different AI techniques. |
| **3.** | To create an understanding of the basic issues of knowledge representation and heuristic search techniques. |

| Unit | Course content | Teaching hrs |
|---|---|---|
| **UNIT I** | **Introduction:** What is Artificial Intelligence?, AI Problems, The underlying Assumption, What is an AI Technique, Problems, problem spaces, and search Defining the problem as a State Space Search, Production Systems, Problem Characteristics, Production System Characteristics, Issues in the Design of search programs, Additional Problems. | **08** |
| **UNIT II** | **Heuristic and Search Techniques:** Generate-and-Test, Hill Climbing, Best-First Search, Problem Reduction, Constraint satisfaction, Means-Ends Analysis | **08** |
| **UNIT III** | **Knowledge Representation Issues:** Representation and Mappings, Approaches to knowledge Representation, Issues in knowledge Representation, Weak Slot Filler Structures: Semantic Nets, Frames | **08** |
| **UNIT IV** | **Using Predicate Logic:** Representing the simple facts in logic, Representing Instance and ISA Relationships, Computable functions and predicates, Resolution, Natural Deduction | **08** |
| **UNIT V** | **Strong slot-and-Filter Structures :** Conceptual Dependency, Scripts, CYC Expert Systems Representation and Using Domain Knowledge, Expert Systems shells, Explanation, Knowledge Acquisition. | **07** |

**Course Outcomes:**

| Sl. No. | Course Outcomes |
|---|---|
| **CO1** | Demonstrate the knowledge of building blocks of AI. |
| **CO2** | Analyze and formalize the problem as a state space tree, design heuristics and solve using different search techniques. |
| **CO3** | Analyze and demonstrate knowledge representation using various techniques. |
| **CO4** | Develop AI solutions for a given problem. |

**Question Paper Pattern:**

Total 5 units of syllabus, 2 full questions from each unit (20marks each) and total 20 marks from each unit. Total 10 Questions for 100 marks, covers 100% syllabus, and student has to answer any 5 full questions (1 to1 choice). Each question carries maximum 4 subdivisions.

**Text Books:**

| SI No | Text Book title | Author | Volume and Year of Edition |
|---|---|---|---|
| 1 | Artificial Intelligence | Elaine Rich, Kevin Knight, Shivashankar B Nair: | 3rd Edition, Tata McGraw Hill, 1991. |

**Reference Books:**

| SI No | Text Book title | Author | Volume and Year of Edition |
|---|---|---|---|
| 1 | Artificial Intelligence A Modern Approach | Stuart Russel, Peter Norvig | 2nd Edition, Pearson Education, 2003 |
| 2 | Principles of Artificial Intelligence | Nils J. Nilsson | Elsevier, 1980 |
| 3 | Deep Learning | Goodfellow, I., Bengio, Y. and Courville | MIT Press, 2016 |
| 4 | AI and Machine learning by in industry | Beyer D | PHI, 2017 |

# Sri Siddhartha Institute of Technology, Tumkur

(A constituent College of Siddhartha Academy of Higher Education, Tumakuru)

## Department of Medical Electronics

Syllabus for the Academic Year 2021-22

**Subject Name: Pattern Recognition in Medicine** **Semester: VII**

**Subject Code: 18ML7PE41** **L-T-P-C: 3-0-0-3**

**Course Objectives:**

| Sl. No. | Course Objectives |
|---|---|
| **1.** | Pattern recognition techniques are used to design automated systems that improve their own performance through experience. This course covers the methodologies, technologies, and algorithms of statistical pattern recognition from a variety of perspectives. Topics including Bayesian Decision Theory, Estimation Theory, Linear Discrimination Functions, Nonparametric Techniques, Decision Trees, and Clustering Algorithms etc. will be presented. |

| Unit | Course content | Teaching hrs |
|---|---|---|
| **UNIT I** | **Introduction**: Machine perception, pattern Recognition systems, Design cycles, learning and adaptation.<br>**Probability**: Random variable, joint distribution and densities, moments of random variable, Estimation of parameters from sample. | **08** |
| **UNIT II** | **Statistical decision making:** Introduction, Baye's theorem, multiple features, conditionally independent features, decision boundaries, unequal costs of error, estimation of error rates, characteristic curves, problems. (3.1-3.7, 3.9 from text 1) | **08** |
| **UNIT III** | **Non parametric Decision making:** Introduction, Histograms, kernel and window estimators, nearest neighbor classification techniques, adaptive decision boundaries, adaptive discriminate functions, minimum squared error discriminant functions. (4.1-4.7 text 1) | **08** |
| **UNIT IV** | **Clustering:** Introduction, Hierarchical clustering, partitional clustering, Unsupervised Bayesion learning, Hierarchical clustering, partitional clustering, problems. | **07** |
| **UNIT V** | **Processing of waveforms and images:** Introduction, gray level scaling transformations, equalization, geometric image scaling and interpolation, edge detection, laplacian and sharpening operators, line detection and template matching, logarithmic gray level scaling. (7.1-7.9 text 1) | **08** |

**Course Outcomes:**

| Sl. No. | Course Outcomes |
|---|---|
| **CO1** | Understand the basic concepts of Pattern Recognition and its applications. |
| **CO2** | Apply the concepts of joint distribution & densities and risk estimators of events. |
| **CO3** | Understand Statistical decision making and Non parametric decision making. |
| **CO4** | Understand the concepts of clustering - hierarchical clustering and partitional clustering and analysis of wave forms and Image. |

**Question Paper Pattern:**

Total 5 units of syllabus, 2 full questions from each unit (20marks each) and total 20 marks from each unit. Total 10 Questions for 100 marks, covers 100% syllabus, and student has to answer any 5 full questions (1 to 1 choice). Each question carries maximum 4 subdivisions.

**Text Books:**

| SI No | Text Book title | Author | Volume and Year of Edition |
|---|---|---|---|
| 1 | Pattern Recognition and Image Analysis. | Earl Gose, Richard Johnson Baugh and Steve jost | PHI, 2017 |
| 2 | pattern classification | Richard O.Duda, Peter E.Herd and David & Stork | john Wiley and sons, Inc 2nd Ed.2001 |

**Reference Books:**

| SI No | Text Book title | Author | Volume and Year of Edition |
|---|---|---|---|
| 1 | Pattern classification | Richard O.Duda, Peter E.Herd and David & Stork | John Wiley and sons, Inc 2nd Ed.2001. |
| 2 | Pattern Recognition: Statistical Structural and Neural Approaches | Robert Schlkoff | John Wiley and sons, Inc, 1992. |
| 3 | Pattern Recognition | S.Theodoridis and K.Koutroumbas | 4th Ed., Academic Press, 2009. |
| 4 | Pattern Recognition and Machine Learning | C.M.Bishop | Springer, 2006. |

**Subject Name: Machine Learning** **Semester: VII**

**Subject Code: 18ML7PE42** **L-T-P-C: 3-0-0-3**

**Course Objectives:**

| Sl. No. | Course Objectives |
|---|---|
| **1.** | The main goal of this course is to help students learn, understand, and practice big data analytics and machine learning approaches, which include the study of modern computing big data technologies and scaling up machine learning techniques focusing on industry applications. Mainly the course objectives are: conceptualization and summarization of big data and machine learning, trivial data versus big data, big data computing technologies, machine learning techniques, and scaling up machine learning approaches. |

| Unit | Course content | Teaching hrs |
|---|---|---|
| **UNIT I** | **Introduction:** Introduction to machine learning, Examples of Machine Learning Applications. Parametric regression: linear regression, polynomial regression, locally weighted regression, numerical optimization, gradient descent, kernel methods. | **08** |
| **UNIT II** | **Generative learning:** Gaussian parameter estimation, maximum likelihood estimation, MAP estimation, Bayesian estimation, bias and variance of estimators, missing and noisy features, nonparametric density estimation, Gaussian discriminant analysis, naive Bayes. Discriminative learning: linear discrimination, logistic regression, logit and logistic functions, generalized linear models, softmax regression. | **08** |
| **UNIT III** | **Neural networks:** the perceptron algorithm, multilayer perceptrons, backpropagation, nonlinear regression, multiclass discrimination, training procedures, localized network structure, dimensionality reduction interpretation.<br>**Support vector machines:** functional and geometric margins, optimum margin classifier, constrained optimization, Lagrange multipliers, primal/dual problems, KKT conditions, dual of the optimum margin classifier, soft margins, kernels, quadratic programming, SMO algorithm. | **08** |
| **UNIT IV** | **Graphical and sequential models:** Bayesian networks, conditional independence, Markov random fields, inference in graphical models, belief propagation, Markov models, hidden Markov models, decoding states from observations, learning HMM parameters. | **07** |

| | | |
|---|---|---|
| **UNIT V** | **Unsupervised learning:** K-means clustering, expectation maximization, Gaussian mixture density estimation, mixture of naive Bayes, model selection. Dimensionality reduction: feature selection, principal component analysis, linear discriminant analysis, factor analysis, independent component analysis, multidimensional scaling, and manifold learning. | **08** |

**Course Outcomes:**

| Sl. No. | Course Outcomes |
|---|---|
| **CO1** | Apply the knowledge of mathematics science and engineering fundamentals in the understanding of fundamental issues and challenges of machine learning: data, model selection, model complexity, etc. |
| **CO2** | Analyze the strengths and weaknesses of many popular machine learning approaches. |
| **CO3** | Comprehend the underlying mathematical relationships within and across Machine Learning algorithms and the paradigms of supervised and un-supervised learning. |
| **CO4** | Design and implement various machine learning algorithms in a range of real-world applications. |

**Question Paper Pattern:**

Total 5 units of syllabus, 2 full questions from each unit (20marks each) and total 20 marks from each unit. Total 10 Questions for 100 marks, covers 100% syllabus, and student has to answer any 5 full questions (1 to1 choice). Each question carries maximum 4 subdivisions.

**Text Books:**

| SI No | Text Book title | Author | Volume and Year of Edition |
|---|---|---|---|
| 1 | Elements of Statistical Learning | T. Hastie, R. Tibshirani and J. Friedman | Springer, 2001. |
| 2 | Machine Learning | EthemAlpaydin | MIT Press, 2010. |

**Reference Books:**

| SI No | Text Book title | Author | Volume and Year of Edition |
|---|---|---|---|
| 1 | Pattern Recognition and Machine Learning. | C. Bishop | Springer, 2006. |
| 2 | Machine Learning: A Probabilistic Perspective | K. Murphy | MIT Press, 2012. |
| 3 | Pattern Classification | R. Duda, E. Hart, and D. Stork | Wiley-Interscience, 2000. |
| 4 | Machine Learning | T. Mitchell | McGraw-Hill, 1997. |

**Subject Name: Medical Device Development** **Semester: VII**

**Subject Code: 18ML7PE43** **L-T-P-C: 3-0-0-3**

**Course Objectives:**

| Sl. No. | Course Objectives |
|---|---|
| 1 | Understand the processes for medical device development after "design freeze". |
| 2 | Become familiar with the European regulatory framework for medical device. |
| 3 | Gain an understanding of manufacturing process validation. |
| 4 | Build on the student's current understanding of the Quality Management System. |
| 5 | Understand key aspects of Product Management both during and after product launch. |

| Unit | Course content | Teaching hrs |
|---|---|---|
| UNIT I | **MedTech Invention:** Needs finding through Observation and Problem Identification. Need Statement Development. Need Screening & Selection through Stakeholder Analysis, Market Analysis & Needs Filtering. Concept Generation, Screening and selection. | 08 |
| UNIT II | **Product Requirements:** Define MedTech Device. Classification of Device. Role of Requirements in MedTech Product Development. Market Requirements, Customer Requirements, Clinical Workflow. Design Input. ISO 13485. Intended use, Functional / performance requirements, safety, usability requirements etc..... | 08 |
| UNIT III | **Design Engineering:** Design and Development Plan. Design Process. Design Outputs, Intermediate deliverables - System Architecture, Subsystem requirements, Prototype, System Integration. Design Review. Design Verification. | 08 |
| UNIT IV | **Validation:** System Validation. Usability Validation. Safety Validation. Clinical Validation, Regulatory Submission UNIT V [6 hours] Program Management: Program Planning, Stage Gate Process, Milestones. Budgeting, Development Strategy, Risk identification and Mitigation process. | 07 |
| UNIT V | Program Management: Program Planning, Stage Gate Process, Milestones. Budgeting, Development Strategy, Risk identification and Mitigation process. | 08 |

**Course Outcomes:**

| Sl. No. | Course Outcomes |
|---|---|
| **CO1** | Identify and analyse unmet clinical need and its requirements to solve it. |
| **CO2** | Search, analyse and document clinical practice, engineering science and relevant literature in order to determine the need for further research and development in a chosen clinical area. |
| **CO3** | Develop a sustainable business plan, including market overview, regulation strategies for health & safety of individuals and intellectual property (IP) strategies. |
| **CO4** | Understand medical device design engineering and manufacturing process by avoiding common quality pitfalls in turn learning project management. |

**Question Paper Pattern:**

Total 5 units of syllabus, 2 full questions from each unit (20marks each) and total 20 marks from each unit. Total 10 Questions for 100 marks, covers 100% syllabus, and student has to answer any 5 full questions (1 to1 choice). Each question carries maximum 4 subdivisions.

**Text Books:**

| SI No | Text Book title | Author | Volume and Year of Edition |
|---|---|---|---|
| 1 | Biodesign: The Process of Innovating Medical Technologies | Stefanos Zenios , Josh Makower, Paul Yock, Todd J. Brinton, Uday N. Kumar, Lyn Denend, Thomas M. Krummel | Cambridge University Press; 2nd edition 2007. |
| 2 | Medical Device Design | Peter Ogrodnik | Academic Press |

**Reference Books:**

| SI No | Text Book title | Author | Volume and Year of Edition |
|---|---|---|---|
| 1 | Inventing medical devices: A perspective from India | Dr Jagdish Chaturvedi | CreateSpace Independent Publishing Platform; 1st edition, 2015. |
| 2 | The Medical Device R&D Handbook | Theodore R. Kucklick | Second Edition, CRC Press, 2012 |
| 3 | Medical Device Quality Management Systems | Susanne Manz | Academic Press, 2006 |
| 4 | Medical Device Development: Regulation and Law | Jonathan S. Kahan | Paraxel Publications, 2008. |

**Subject Name: Biomedical Digital Signal Processing Lab** **Semester: VII**

**Subject Code: 18ML705** **L-T-P-C: 0-0-3-1.5**

**Course Objectives:**

| Sl. No. | Course Objectives |
|---|---|
| **1.** | To understand the basic signals in the field of biomedical. |
| **2.** | To study origins and characteristics of some of the most commonly used biomedical signals, including ECG, EEG, evoked potentials, and EMG. |
| **3.** | To understand Sources and characteristics of noise and artifacts in bio signals. |
| **4.** | To understand use of bio signals in diagnosis, patient monitoring and physiological investigation |

| EXP no | Course content |
|---|---|
| **1** | Computation of Convolution and Correlation Sequences. |
| **2** | Signal Averaging to Improve the SNR |
| **3** | Read and plotting of ECG data, spectrum of ECG with 50 HZ noise. |
| **4** | Design of FIR Filter for ECG. |
| **5** | Integer filters for ECG |
| **6** | QRS detection and Heart rate determination. |
| **7** | Correlation and Template matching |
| **8** | Realization of Notch filter for removal of line interference |
| **9** | Data Compression Techniques using AZTEC algorithm, TP algorithm and FAN algorithm. |

**Course Outcomes:**

| Sl. No. | Course Outcomes |
|---|---|
| **CO1** | Understand the nature of biomedical signals, objectives of signal analysis, difficulties in biomedical signal analysis |
| **CO2** | Different types of noise that can corrupt biomedical signals, filters used to remove artifacts. |
| **CO3** | Understand the processing concepts for analysis, acquisition and classification of sleep using EEG signal. |
| **CO4** | Understand and apply various data compression techniques on different types of biomedical signals. |

**Text Books:**

| SI No | Text Book title | Author | Volume and Year of Edition |
|---|---|---|---|
| 1 | Biomedical Digital Signal Processing | Willis J. Tompkins | PHI, 2008. |
| 2 | Biomedical Signal Processing- principles and techniques | D. C. Reddy | Tata McGraw-Hill, 2005. |
| | Biomedical Signal Analysis | Rangaraj M. Rangayyan | IEEE Press, 2005 |

**Reference Books:**

| SI No | Text Book title | Author | Volume and Year of Edition |
|---|---|---|---|
| 1 | Biomedical Signal Processing | Akay M | Academic: Press 1994 |
| 2 | Biomedical Signal Processing | Cohen.A | CRC Press, 1986. |

# Sri Siddhartha Institute of Technology, Tumkur

(A constituent College of Siddhartha Academy of Higher Education, Tumakuru)

## Department of Medical Electronics

Syllabus for the Academic Year 2021-22

**Subject Name: Python Lab** **Semester: VII**

**Subject Code: 18ML706** **L-T-P-C: 0-0-3-1.5**

**Course Objectives:**

| Sl. No. | Course Objectives |
|---|---|
| **1.** | Learn the basics of python programming language. |
| **2.** | Understand the usage of built-in functions and file operations. |
| **3.** | Acquire the knowledge of modules available in NumPy package. |
| **4.** | Familiar with data structures and data manipulation tools available in pandas library. |

| EXP no | Course content |
|---|---|
| **1** | Write a program to demonstrate different data types in Python. |
| **2** | Write a program to perform different Arithmetic Operations on numbers in Python. |
| **3** | Write a program to create, concatenate and print a string and accessing sub-string from a given string. |
| **4** | Write a python script to print the current date in the following format Sun Aug13 02:26:23 IST 2021. |
| **5** | Write a program to create, append, and remove lists in python. |
| **6** | Write a program to demonstrate working with tuples in python. |
| **7** | Write a program to demonstrate working with dictionaries in python. |
| **8** | Write a python program to find largest of three numbers. |
| **9** | Write a Python program to convert temperatures to and from Celsius, Fahrenheit. [ Formula : c/5 = f-32/9 ]. |
| **10** | Write a Python program to construct the following pattern, using a nested for loop*<br>* *<br>*<br>* *<br>* * *<br>* *<br>*<br>* |
| **12** | Write a python program to find factorial of a number using Recursion. |
| **13** | Write a program that accepts the lengths of three sides of a triangle as inputs. The program output should indicate whether or not the triangle is a right triangle (Recall from the Pythagorean Theorem that in a right triangle, the square of one side equals the sum of the squares of the other two sides). |

**Course Outcomes:**

| Sl. No. | Course Outcomes |
|---|---|
| **CO1** | Develop programs for the given problem statement in the real world. |
| **CO2** | Implement the programs on object oriented concepts. |
| **CO3** | Demonstrate the usage of NumPy module for numerical data analysis. |
| **CO4** | Apply data manipulation tools available in pandas for data cleaning and analysis. |

**Text Books:**

| SI No | Text Book title | Author | Volume and Year of Edition |
|---|---|---|---|
| 1 | Fundamentals of Python Programming | Richard L. Halterman | Southern Adventist University, 2019, E-book, ISBN:978153953026 |
| 2 | Introduction to Computer Science Using Python: A Computational Problem-Solving | Charles Dierbach | 1st Edition, JhonWiley& Sons, Inc. Publications, 2012, ISBN:9780470555156 |

**Reference Books:**

| SI No | Text Book title | Author | Volume and Year of Edition |
|---|---|---|---|
| 1 | Think Python | Allen Downey | 2nd Edition, O'Reilly Media, ISBN: 9781491939369 |
| 2 | Learning Python | B.Nagesh Rao | 1st Edition, A cyberplus publication, 2017, ISBN:9788193392300 |

# Sri Siddhartha Institute of Technology, Tumkur

(A constituent College of Siddhartha Academy of Higher Education, Tumakuru)

## Department of Medical Electronics

Syllabus for the Academic Year 2021-22

**Subject Name: Neural Networks** **Semester: VIII**

**Subject Code: 18ML8PE11** **L-T-P-C: 3-0-0-3**

**Course Objectives:**

| Sl. No. | Course Objectives |
|---|---|
| 1. | course gives an introduction to basic neural network architectures and learning rules. Emphasis is placed on the mathematical analysis of these networks, on methods of training them and on their application to practical engineering problems in such areas as pattern recognition, signals processing and control systems. |

| Unit | Course content | Teaching hrs |
|---|---|---|
| UNIT I | **Introduction:** The classic neuron, Membrane potential, Action potential, Neuronal electrical behavior, Cable Equation, Synaptic Integration. Models of Neuron, Synaptic Electrical Events, slow potential theory of neuron, two state neurons, Feedback. | 08 |
| UNIT II | **Network Architectures:** Single layer feed forward networks; Multilayer feed forward networks, Recurrent Networks, Knowledge representation. | 08 |
| UNIT III | **Learning processes**: Introduction Error correction learning, Memory based learning, Hebbian Learning, Competitive learning. | 08 |
| UNIT IV | **Learning paradigms:** Learning with a teacher, Learning without a teacher, Learning tasks, Memory, Adaptation Artificial intelligence and Neural networks. | 07 |
| UNIT V | **Information representation in biological Systems**, Distributed, Map, layered structures, Visual system, Auditory System. | 08 |

**Course Outcomes:**

| Sl. No. | Course Outcomes |
|---|---|
| CO1 | Fundamental concepts of artificial neural network. |
| CO2 | Network architectures and its principles. |
| CO3 | Different learning algorithms and its applications. |
| CO4 | Information representation in biological system and its models. |

**Question Paper Pattern:**

Total 5 units of syllabus, 2 full questions from each unit (20marks each) and total 20 marks from each unit. Total 10 Questions for 100 marks, covers 100% syllabus, and student has to answer any 5 full questions (1 to1 choice). Each question carries maximum 4 subdivisions.

**Text Books:**

| SI No | Text Book title | Author | Volume and Year of Edition |
|---|---|---|---|
| 1 | An Introduction to neural networks, | James A. Anderson— | 2e, PHI, 1995. |
| 2 | Neural Networks | Simon Haykin | Pearson education PHI 2001. |

**Reference Books:**

| SI No | Text Book title | Author | Volume and Year of Edition |
|---|---|---|---|
| 1 | Fundamentals of Artificial Neural Networks | Mohammad Hasan | PHI, 1999. |
| 2 | Neural networks and learning machines | Simon Haykin | Pearson, 2009. |
| 3 | Deep learning | Ian Goodfellow, Yoshua Bengio, and Aaron Courville | MIT Press, 2016. |
| 4 | Pattern Recognition and Machine Learning | Christopher M. Bishop | Springer, 2006. |

**Subject Name: Clinical Data Analytics** **Semester: VIII**

**Subject Code: 18ML8PE12** **L-T-P-C: 3-0-0-3**

**Course Objectives:**

| Sl. No. | Course Objectives |
|---|---|
| 1 | Identify key tools and approaches to improve analytics capabilities in clinical settings. |
| 2 | Describe different governance and operations strategies in analytics in clinical settings. |
| 3 | Discuss value-based payment systems and the role of data analytics in achieving their potential. |
| 4 | Analyze data used in population management and value-based care systems. |

| Unit | Course content | Teaching hrs |
|---|---|---|
| UNIT I | **Introduction to Biostatistics:** Introduction, Some basic concepts, Measurement and Measurement Scales, Simple random sample, Computers and biostatistician analysis. Descriptive Statistics: Introduction, ordered array, grouped data-frequency distribution, descriptive statistics – measure of central tendency, measure of dispersion, measure of central tendency probability distributions of discrete variables, binomial distribution, Poisson distribution, continuous probability distribution, normal distribution. | 08 |
| UNIT II | **Sampling distributions:** distribution of sample mean, distribution of the difference between two sample means, distribution of sample proportion, distribution of the difference between two sample proportions, Estimation: confidence interval for a population mean, t-distribution, confidence interval for differences between two population means, confidence interval for a population proportion, confidence interval for difference between two populations determination of sample size for estimating means, for estimating proportions , confidence interval for the variance of normally distributed population, confidence interval for ratio of variances of two normally distributed populations. | 08 |
| UNIT III | **Hypothesis Testing :** Introduction, hypothesis testing – single population mean, difference between two population means, paired comparisons, hypothesis testing-single population proportion, difference between two population proportions, single population variance, ratio of two population variances. | 08 |

| | | |
|---|---|---|
| **UNIT IV** | **Analysis of Variance (ANOVA):** Introduction, completely randomized design, randomized complete block design, repeated measures design, factorial experiment Linear Regression and Correlation: the regression model, sample regression equation, evaluating and using regression equation, correlation model correlation coefficient Multiple linear regression model, obtaining multiple regression equation, evaluating multiple regression equation, using the multiple regression equation, multiple correlation model, mathematical properties of Chi square distribution. | **07** |
| **UNIT V** | **Linear Regression and Correlation**: the regression model, sample regression equation, evaluating and using regression equation, correlation model correlation coefficient Multiple linear regression model, obtaining multiple regression equation, evaluating multiple regression equation, using the multiple regression equation, multiple correlation model, mathematical properties of Chi-square distribution. | **08** |

**Course Outcomes:**

| Sl. No. | Course Outcomes |
|---|---|
| **CO1** | Ability to apply knowledge of mathematics, science and Engineering to develop the solution using biostatistical concepts. |
| **CO2** | Ability to analyze a problem and formulate appropriate solution for biostatistical concepts application. |
| **CO3** | An ability to design and perform statistical test and interpret results |
| **CO4** | Ability to implement and demonstrate statistical analysis using modern tool usage. |

**Question Paper Pattern:**

Total 5 units of syllabus, 2 full questions from each unit (20marks each) and total 20 marks from each unit. Total 10 Questions for 100 marks, covers 100% syllabus, and student has to answer any 5 full questions (1 to1 choice). Each question carries maximum 4 subdivisions.

**Text Books:**

| SI No | Text Book title | Author | Volume and Year of Edition |
|---|---|---|---|
| 1 | Biostatistics-A Foundation for Analysis in the Health Sciences | Wayne W. Daniel | John Wiley & Sons, 6th Ed., 2009 |

**Reference Books:**

| SI No | Text Book title | Author | Volume and Year of Edition |
|---|---|---|---|
| 1 | Fundamentals of Biostatistics | Khan and Khanum | Ukaaz publications, 2nd revise edition, 2007 |
| 2 | An introduction to statistical Method and data analysis | R. Lyman | PHI, 2012 |

**bject Name: Brain Computer Interface** **Semester: VIII**

**Subject Code: 18ML8PE13** **L-T-P-C: 3-0-0-3**

**Course Objectives:**

| Sl. No. | Course Objectives |
|---|---|
| **1.** | Obtain the background to understand brain-computer interaction and human-computer Interaction. |
| **2.** | Understand the literature in the field of brain sensing for human-computer interaction research. |
| **3.** | Understand the various tools used in brain sensing, with a focus on. |

| Unit | Course content | Teaching hrs |
|---|---|---|
| **UNIT I** | **Basic Neurosciences:** Basic Neuroscience: Neurons, Action Potentials or Spikes, Dendrites and Axons, Synapses, Spike Generation, Adapting the Connections: Synaptic Plasticity – (LTP, LTD, STDP, Short-Term Facilitation and Depression), Brain Organization, Anatomy, and Function. | **08** |
| **UNIT II** | **Recording and Stimulating the Brain:** Recording Signals from the Brain: Invasive Techniques & Non-invasive Techniques. Stimulating the Brain - Invasive Techniques & non-Techniques. Simultaneous Recording and Stimulation: Multi-electrode Arrays, Neurochip. | **08** |
| **UNIT III** | **Signal Processing for BCI's:** Spike Sorting, Frequency Domain Analysis: Fourier analysis, Discrete Fourier Transform (DFT), Fast Fourier Transform (FFT), Spectral Features, Wavelet Analysis. Time Domain Analysis: Hjorth Parameters, Fractal Dimension, Autoregressive (AR) Modeling, Bayesian Filtering, Kalman Filtering, Particle Filtering<br>Spatial Filtering: Bipolar, Laplacian, and Common Average Referencing, Principal Component Analysis (PCA), Independent Component Analysis (ICA) , Common Spatial Patterns (CSP) 73 Artifact. | **08** |
| **UNIT IV** | **Building a BCI:** Major Types of BCIs: Brain Responses Useful for Building BCIs:Conditioned Responses, Population Activity, Imagined Motor and Cognitive Activity, Stimulus-Evoked Activity.<br>**Invasive BCIs:** Two Major Paradigms in Invasive Brain-Computer Interfacing: BCIs Based on<br>Operant Conditioning, BCIs Based on Population Decoding.<br>**Invasive BCIs in Humans:** Cursor and Robotic Control Using a Multielectrode Array Implant, Cognitive BCIs in Humans, Long-Term Use of Invasive BCIs, Long-Term BCI Use and Formation of | **07** |

| | | |
|---|---|---|
| | a Stable Cortical Representation, Long-Term Use of a Human BCI Implant.<br>**Semi-Invasive BCIs:** Electrocorticographic (ECoG) BCIs -ECoG BCIs in Animals, ECoG BCIs in Humans, BCIs Based on Peripheral Nerve Signals Nerve-Based BCIs, Targeted Muscle Innervations (TMR).<br>**Non-Invasive BCIs:** Oscillatory Potentials and ERD, Slow Cortical Potentials, Movement Related Potentials, Stimulus Evoked Potentials; BCIs Based on Cognitive Tasks, Error Potentials in BCIs, Co-adaptive BCIs, Hierarchical BCIs. | |
| **UNIT V** | **Medical Applications:** Sensory Restoration, Motor Restoration, Cognitive Restoration, Rehabilitation, Restoring Communication with Menus, Cursors, and Spellers, Brain Controlled Wheelchairs.<br>**Nonmedical Applications**: Web Browsing and Navigating Virtual Worlds, Robotic Avatars, High Throughput Image Search Lie Detection and Applications in Law, Monitoring Alertness,<br>Estimating Cognitive Load, Education and Learning, Security, Identification, and Authentication, Physical Amplification with Exoskeletons, Mnemonic and Cognitive Amplification, Applications in Space, Gaming and Entertainment, Brain-Controlled Art. | **08** |

**Course Outcomes:**

| Sl. No. | Course Outcomes |
|---|---|
| **CO1** | Apply the knowledge of mathematics science and engineering fundamentals to understand the Brain Organization. |
| **CO2** | Apply the knowledge of mathematics science and engineering fundamentals understand the brain anatomy and Function. |
| **CO3** | Analyse and process the brain signals for artefact reduction. |
| **CO4** | Understand types of BCI, principles and its applications which are present state of art in the Neurosciences domain. |

**Question Paper Pattern:**

Total 5 units of syllabus, 2 full questions from each unit (20marks each) and total 20 marks from each unit. Total 10 Questions for 100 marks, covers 100% syllabus, and student has to answer any 5 full questions (1 to1 choice). Each question carries maximum 4 subdivisions.

**Text Books:**

| SI No | Text Book title | Author | Volume and Year of Edition |
|---|---|---|---|
| 1 | Brain-Computer Interfacing | Rajesh P. N. Rao | PHI,1st Edition, 2007 |
| 2 | Brain-Computer Interfaces: Revolutionizing Human-Computer | Bernhard Graimann, Brendan Z. Allison, | The Frontiers Collection |

| | | | |
|---|---|---|---|
| | Interaction | Gert P furtscheller | Hardcover – 13 Dec 2010 |

**Reference Books:**

| SI No | Text Book title | Author | Volume and Year of Edition |
|---|---|---|---|
| 1 | Brain Computer Principles and Practices | Jonathan Wolpaw ,Elizabeth Winter Wolpaw | Oxford University Press. 2009. |

**Subject Name: Hospital Management and Professional Ethics** **Semester: VIII**
**Subject Code: 18ML8PE21** **L-T-P-C: 3-0-0-3**

**Course Objectives:**

| Sl. No. | Course Objectives |
|---|---|
| **1.** | To promote awareness of health care among all sections of the Indian people. |
| **2.** | To promote awareness among functionaries involved in Health and Hospital Management. |
| **3.** | To promote research in the field of Health and Hospital Management in order to improve the efficiency of Health Care delivery Systems. |
| **4.** | To promote the development of high-quality hospital services and community health care and to follow the ethics in their working environment. |

| Unit | Course content | Teaching hrs |
|---|---|---|
| **UNIT I** | **Introduction to Hospital Management:** introduction, management of no-profit making organization, hospital: the concept, significance of hospital management, shift from professional to manager, functional areas in hospital management, management of product profile, finance, management of human resources, management of marketing, managing sensitive issues in hospital.<br>**Total Quality management in Hospital**: introduction, quality, the perception, misperception of quality, TQM concept. | **08** |
| **UNIT II** | **Hospital Planning:** Concept of hospital, classification of hospitals, , an ideal hospital manager, concept of hospital planning, principles of hospital planning, components of hospital planning, factors influencing the formulation of hospital plan, instrumentality of MIS in planning, planning functional areas in hospitals, planning peripheral services, planning for health education. | **08** |
| **UNIT III** | **Hospital Organization and Departmentation:** Introduction, concept of organizing, concept of departmentation, structure of hospitals, an ideal organizational structure, departments in hospitals, functions of management based and medical based departments, material management, essential principles of materials, objectives of material management. | **08** |
| **UNIT IV** | **Record Management:** Introduction, hospital records, types of records, essentials of effective record management, forms of records, sections, dimensions of record management, significance, centralized and decentralized filing, problems and remedies of hospital records. | **07** |
| **UNIT V** | **Biomedical Ethics**: Theory, principles, rules and moral decisions, Belmont report, the principles of biomedical ethics, respect for autonomy, voluntariness, information & informed consent, competency, nonmaleficence, the rule of double effect, beneficence, | **08** |

| | | |
|---|---|---|
| | paternalism, justice, examples. | |

**Course Outcomes:**

| Sl. No. | Course Outcomes |
|---|---|
| **CO1** | Know the importance of management in the field of health care to provide quality service. |
| **CO2** | To project on different plans that makes the hospital environment work efficiently and to know classification and significance of hospital planning. |
| **CO3** | Know to manage different hospital services and records in a hospital environment. |
| **CO4** | Foster on the ethics to be follow while they work in health care environment. |

**Question Paper Pattern:**

Total 5 units of syllabus, 2 full questions from each unit (20marks each) and total 20 marks from each unit. Total 10 Questions for 100 marks, covers 100% syllabus, and student has to answer any 5 full questions (1 to1 choice). Each question carries maximum 4 subdivisions.

**Text Books:**

| SI No | Text Book title | Author | Volume and Year of Edition |
|---|---|---|---|
| 1 | Hospital Management | S M Jha | Himalaya Publishing House, 2011. |
| 2 | Principles of biomedical ethics: | D.H.Lawerance | Jones & Bartlett publishers, 2007 |

**Reference Books:**

| SI No | Text Book title | Author | Volume and Year of Edition |
|---|---|---|---|
| 1 | Hospital Administration | C M Francis | Jaypee Brothers, edition 2, 1995. |
| 2 | Management by objectives in Action | Humble John | McGraw Hill publications, 1970. |

**Subject Name: Rehabilitation Engineering** **Semester: VIII**
**Subject Code: 18ML8PE22** **L-T-P-C: 3-0-0-3**
**Course Objectives:**

| Sl. No. | Course Objectives |
|---|---|
| 1. | To introduce the students to the different types of devices that can be used for assisting the people with different types of disability |

| Unit | Course content | Teaching hrs |
|---|---|---|
| UNIT I | **Prosthetic And Orthotic Devices:** Hand and arm replacement, Different types of models for externally powered limb prosthetics, Lower limb, Upper limb orthotics, Material for prosthetic and orthotic devices, Mobility aids. | 08 |
| UNIT II | **Auditory And Speech Assist Devices:** Types of deafness, Hearing aids, Application of DSP in hearing aids, Cochlear implants, Voice synthesizer, Speech trainer. | 08 |
| UNIT III | **Visual Aids:** Ultra sonic and laser canes, Intra ocular lens, Braille Reader, Tactile devices for visually challenged, Text voice converter, screen readers. | 08 |
| UNIT IV | **Medical Stimulator:** Muscle and nerve stimulator, Location for Stimulation, Functional Electrical Stimulation, sensory Assist Devices, Design issues. | 07 |
| UNIT V | **Rehabilitation Medicine and Advocacy:** Physiological aspects of Function recovery, psychological aspects of Rehabilitation therapy, Legal aspect available in choosing the device and provision available in education, job and in day-to-day life. | 08 |

**Course Outcomes:**

| Sl. No. | Course Outcomes |
|---|---|
| CO1 | Assess the importance of different types of Arm and Limb prosthesis. |
| CO2 | Interpret the concepts behind the design of devices used for assisting people with auditory and speech impairment. |
| CO3 | Interpret the concepts behind the design of devices that can assist people with visual impairment. |
| CO4 | Interpret the design and working of stimulating devices and to express the importance of legal aspects related to rehabilitation device design and selection. |

**Question Paper Pattern:**

Total 5 units of syllabus, 2 full questions from each unit (20marks each) and total 20 marks from each unit. Total 10 Questions for 100 marks, covers 100% syllabus, and student has to answer any 5 full questions (1 to1 choice). Each question carries maximum 4 subdivisions.

**Text Books:**

| SI No | Text Book title | Author | Volume and Year of Edition |
|---|---|---|---|
| 1 | An Introduction to Rehabilitation Engineering | Rory A Cooper | CRC press, 2006 |

**Reference Books:**

| SI No | Text Book title | Author | Volume and Year of Edition |
|---|---|---|---|
| 1 | Physical Medicine and Rehabilitation Digest | Susan B, O'Sullivan | Jaypee Brothers Medical Publishers, 2019. |
| 2 | Exercise in Rehabilitation Medicine | Walter R. Frontera, David M. Dawson | Human Kinetics Publishers, 1999. |

**Subject Name: Smart Wearable Sensors** **Semester: VII**

**Subject Code: 18ML8PE23** **L-T-P-C: 3-0-0-3**

**Course Objectives:**

| Sl. No. | Course Objectives |
|---|---|
| **1.** | Extensive efforts have been made in both academia and industry in the research and development of smart wearable systems (SWS) for health monitoring (HM). Primarily influenced by skyrocketing healthcare costs and supported by recent technological advances in micro- and nanotechnologies, miniaturisation of sensors, and smart fabrics, the continuous advances in SWS will progressively change the landscape of healthcare by allowing individual management and continuous monitoring of a patient's health status. Consisting of various components and devices, ranging from sensors and actuators to multimedia devices, these systems support complex healthcare applications and enable low-cost wearable, non-invasive alternatives for continuous 24-h monitoring of health, activity, mobility, and mental status, both indoors and outdoors. Our objective has been to examine the current research in wearable to serve as references for researchers and provide perspectives for future research |

| Unit | Course content | Teaching hrs |
|---|---|---|
| **UNIT I** | **Introduction** : What is Wearable Systems, Need for Wearable Systems, Drawbacks of Conventional Systems for Wearable Monitoring, Applications of Wearable Systems, Recent developments – Global and Indian Scenario, Types of Wearable Systems, Components of wearable Systems, Physiological Parameters commonly monitored in wearable applications, Smart textiles, & textiles sensors, Wearable Systems for Disaster management, Home Health care, Astronauts, Soldiers in battle field, athletes, SIDS, Sleep Apnea Monitoring. | **08** |
| **UNIT II** | **Smart Sensors& Vital Parameters :** Vital parameters monitored and their significances, Bio-potential signal recordings (ECG, EEG, EMG), Dry Electrodes design and fabrication methods, Smart Sensors – textile electrodes, polymer electrodes, non-contact electrodes, MEMS and Nano Electrode Arrays, Cuff-less Blood Pressure Measurement, PPG, Galvanic Skin Response (GSR), Body Temperature Measurements, Activity Monitoring for Energy Expenditure, Respiratory parameters. | **08** |
| **UNIT III** | **Wearable Computers :** Flexible Electronics, Wearable Computers, Signal Processors, Signal Conditioning circuits design, Power Requirements, Wearable Systems Packaging, Batteries and | **08** |

| | | |
|---|---|---|
| | charging, Wireless Communication Technologies and Protocols, Receiver Systems, Mobile Applications based devices. | |
| **UNIT IV** | **Wireless Body Area Networks:** Wireless Body Area Networks – Introduction, Personal Area Networks (PAN), Application in Vital Physiological Parameter monitoring, Design of Sensor & Sink Nodes, Architecture, Communication & Routing Protocols, Security, Power and Energy Harvesting. | **07** |
| **UNIT V** | **Data Processing And Validation :** Classification Algorithms, Data Mining and Data Fusion, Signal Processing Algorithms in wearable Applications, Issues of wearable physiological monitoring systems, Statistical Validation of Parameters, Certifications of Medical Devices and Patenting. | **08** |

**Course Outcomes:**

| Sl. No. | Course Outcomes |
|---|---|
| **CO1** | Understand the basic foundations on biological and artificial neural network and the importance of neuron models for pattern classification |
| **CO2** | Demonstrate the process of forming association between related patterns through associative networks |
| **CO3** | Apply the principles of back propagation supervised learning for error minimization |
| **CO4** | Understand and analyze the various competition based learning algorithms and importance of resonance based network learning algorithms. |

**Question Paper Pattern:**

Total 5 units of syllabus, 2 full questions from each unit (20marks each) and total 20 marks from each unit. Total 10 Questions for 100 marks, covers 100%syllabus, and student has to answer any 5 full questions (1 to1 choice). Each question carries maximum 4 subdivisions.

**Text Books:**

| SI No | Text Book title | Author | Volume and Year of Edition |
|---|---|---|---|
| 1 | Wearable Monitoring Systems | Annalisa Bonfiglo, Danilo De Rossi, | Springer, 2011 |
| 2 | Wearable Sensors: Fundamentals, Implementation and Applications | Edward Sazonov, Micheal R Neuman | Elseiver, 2014. |

**Reference Books:**

| SI No | Text Book title | Author | Volume and Year of Edition |
|---|---|---|---|
| 1 | Wearable Electronics: Design, Prototype | Kate Hartman, Make | Maker Media, |

| | | | |
|---|---|---|---|
| | and wear your own interactive garments, | | 2015 |
| 2 | Wearable Technology | Elijah Hunter | Kindle Edition, 2015 |
| 3 | Body Sensor Networks | Guang Zhong Yang | Springer, 2009 |
| 4 | Understanding Smart Sensors | Randy Frank | 2nd Edition, Artech House Publications, 2000 |

**Subject Name: IOT in Healthcare** **Semester: VIII**

**Subject Code: 18ML8PE31** **L-T-P-C: 3-0-0-3**

**Course Objectives:**

| Sl. No. | Course Objectives |
|---|---|
| **1.** | Understand the definition and significance of the Internet of Things. |
| **2.** | Discuss the architecture, operation, and business benefits of an IoT solution. |
| **3.** | Explore the relationship between IoT, cloud computing, and big data. |
| **4.** | Know the application of IoT in different fields. |

| Unit | Course content | Teaching hrs |
|---|---|---|
| **UNIT I** | **Introduction to IoT**: Sensing, Actuation, Networking basics, Communication Protocols, Sensor Networks, Machine-to-Machine Communications, definition & characteristics of IoT, Physical Design of IoT, Logical Design of IoT, IoT Enabling Technologies, IoT Levels. | **08** |
| **UNIT II** | **IoT System Management**: Introduction, Machine-to-Machine (M2M), Difference between IoT and M2M, SDN and NFV for IoT, Need for IoT System Management, SNMP, Network Operator Requirements, NETCONF, YANG, IoT Systems Management with NETCONF-YANG. | **08** |
| **UNIT III** | IoT platform Design Technology: Introduction, purpose and requirement specification, process specification, domain model specification, information model specification, service specification, IoT level specification, functional and operational view specification, device and component integration, application development. | **08** |
| **UNIT IV** | **Domain Specific IoTs:** Applications, Home Automation, Cities, Environment, Energy, Retail, Logistics, Agriculture, Industry, health & Lifestyle | **07** |
| **UNIT V** | **Applications of IoT in health care: Introduction,** Architecture of Healthcare IoT (HIoT), HIoT Technologies, Services and Application of HIoT: ambient assisted devices, wearable devices, child health monitoring, adverse drug reation, ECG, oxygen saturation, temperature, BP, asthama monitoring, wheel chair management, medication management, challenges and limitations. | **08** |

**Course Outcomes:**

| Sl. No. | Course Outcomes |
|---|---|
| **CO1** | Identify the basic design and requirements of IoT. |
| **CO2** | Identify the importance of different types of protocols and models used with IoT. |
| **CO3** | Use different platforms for design technologies. |
| **CO4** | Use the applications of IoT in health care and other fields. |

**Question Paper Pattern:**

Total 5 units of syllabus, 2 full questions from each unit (20marks each) and total 20 marks from each unit. Total 10 Questions for 100 marks, covers 100% syllabus, and student has to answer any 5 full questions (1 to1 choice). Each question carries maximum 4 subdivisions.

**Text Books:**

| SI No | Text Book title | Author | Volume and Year of Edition |
|---|---|---|---|
| 1 | Internet of Things – A hands-on approach | Arshdeep Bahga and Vijay Madisetti | Universities Press (India) Private Ltd., 2015 |
| 2 | IoT-Based Applications in Healthcare Devices | Bikash Pradhan, Saugat Bhattacharyya and Kunal Pal | Hindawi, Journal of Healthcare Engineering Volume 2021, Article ID 6632599, https://doi.org/10.1155/2021/6632599 |

**Reference Books:**

| SI No | Text Book title | Author | Volume and Year of Edition |
|---|---|---|---|
| 1 | Rethinking the Internet of Things: A Scalable Approach to Connecting Everything | Francis daCosta and Byron Henderson | Apress Open, Intel Publication. 2014 |
| 2 | Learning Internet of Things | Peter Waher | PACKT Publishing, 2015 |
| 3 | IoT Applications in Healthcare | Qi Lin, Qiuhong Zhao | International Series in Operations Research & Management Science book series, 2009 |

**Subject Name: Biostatistics and Biomechanics** **Semester: VIII**

**Subject Code: 18ML8PE32** **L-T-P-C: 3-0-0-3**

**Course Objectives:**

| Sl. No. | Course Objectives |
|---|---|
| **1.** | To learn the statistical data analysis and bio statistical analysis. |
| **2.** | Quantitative and qualitative analysis of human motion and performance. |
| **3.** | Understand how biomechanical principles can be applied to examine human activities such as sport and orthopedic rehabilitation. |
| **4.** | Understand the relationship between mechanical properties and anatomical functions. |

| Unit | Course content | Teaching hrs |
|---|---|---|
| **UNIT I** | **INTRODUCTION TO BIOSTATISTICS:** Introduction, Some basic concepts, Measurement and Measurement Scales, Simple random sample, Computers and biostatistical analysis. **DESCRIPTIVE STATISTICS:** Introduction, ordered array, grouped data-frequency distribution, descriptive statistics – measure of central tendency, measure of dispersion, measure of central tendency computed from grouped data, variance and standard deviation-grouped data. | **08** |
| **UNIT II** | **BIO-FLUID MECHANICS:** Newton's laws, stress, strain, elasticity, Hook's-law, viscosity, Newtonian Fluid, Non-Newtonian fluid, viscoelastic fluids. Vascular tree. Relationship between diameters, velocity and pressure of blood flow, Resistance against flow | **08** |
| **UNIT III** | **VISCOELASTIC FLUID:** Viscoelasticity, Viscoelastic Models: Maxwell, Voigt and Kelvin Models Response to harmonic variation. Use of viscoelastic models. | **08** |
| **UNIT IV** | **ORTHOPEDIC MECHANICS:** Mechanical properties of cartilage. Diffusion properties of articular, cartilage, Mechanical properties of bone. Kinetics and Kinematics of joints, Lubrication of joints. Fundamental concepts of Gait analysis. | **07** |
| **UNIT V** | **Measuring principles of**: Cutometer, Durometer, Electrodynamometer, Microindentometer & Ballistometer. | **08** |

**Course Outcomes:**

| Sl. No. | Course Outcomes |
|---|---|
| **CO1** | Understand the statistical data analysis and bio statistical analysis. |
| **CO2** | Understand the concepts of bio-fluids and the various viscoelastic models. |
| **CO3** | Understand the concept of orthopaedic mechanics. |
| **CO4** | Understand the principles of various biomechanics measuring equipment. |

**Question Paper Pattern:**

| |
|---|
| Total 5 units of syllabus, 2 full questions from each unit (20marks each) and total 20 marks from each unit. Total 10 Questions for 100 marks, covers 100% syllabus, and student has to answer any 5 full questions (1 to1 choice). Each question carries maximum 4 subdivisions. |

**Text Books:**

| SI No | Text Book title | Author | Volume and Year of Edition |
|---|---|---|---|
| 1 | Biostatistics-A Foundation for Analysis in the Health Sciences | Wayne W. Daniel | John Wiley & Sons Publication, 6th Edition, 2008 |
| 2 | Biomechanics, Mechanical Properties of Living Tissues | Y.C Fung | Springer Verlag, Edition2, 1993. |
| 3 | Introduction to Biomechanics of Joints & Joint Replacement Mechanical Engg | D.Dowson | V Wright publication, 1987. |

**Reference Books:**

| SI No | Text Book title | Author | Volume and Year of Edition |
|---|---|---|---|
| 1 | Principles of Biostatistics | Marcello Pagano and Kimberlee Gauvreu | Thomson Learning Publication, 2006. |
| 2 | The Biomedical Hand Book | Predko | CRC Press, 2nd Edition,2000. |
| 3 | Introduction to Biostatistics | Ronald N Forthofer and Eun Sul Lee | Academic Press, 2009 |

**Subject Name: Biomedical Therapeutic Equipments** **Semester: VIII**

**Subject Code: 18ML8PE33** **L-T-P-C: 3-0-0-3**

**Course Objectives:**

| Sl. No. | Course Objectives |
|---|---|
| **1.** | Introduce the students to the application of biomedical instrumentation used in surgery. |
| **2.** | to familiarize the students with physiotherapy and electrotherapy instruments and various machines used in ICU. |
| **3.** | It includes brief study of different types of ventilators. |
| **4.** | to design a automated drug delivery unit depends on the requirement of patient. |

| Unit | Course content | Teaching hrs |
|---|---|---|
| **UNIT I** | **Instruments for Surgery:** Principles of surgical diathermy, surgical diathermy Machine, safety aspects in electro- surgical units, surgical diathermy Analyzer. | **08** |
| **UNIT II** | **Physiotherapy and Electrotherapy Equipment's:** High frequency heat therapy, Shortwave diathermy, microwave diathermy, ultrasound therapy unit, Electro diagnostic therapeutic apparatus, pain relief through electrical Stimulation, bladder and cerebella stimulators. | **08** |
| **UNIT III** | **Hemodialysis Machine:** Artificial kidney, dialyzer, Membranes for hemodialysis. Lithotripters: Stone disease problems, lithotripter machine, extra-corporeal Shock wave therapy.<br>**Anesthesia Machine:** Need for anesthesia, anesthesia Machine | **08** |
| **UNIT IV** | **Ventilators:** Artificial ventilation, ventilators, types of ventilators, ventilators terms,<br>classification of ventilators. Modern ventilators. Humidifiers, Nebulizers and Aspirators | **07** |
| **UNIT V** | **Automated Drug Delivery Systems:** Infusion pumps, components of drugs infusion systems and implantable infusion systems. Closed Loop Control Infusion Pumps. | **08** |

**Course Outcomes:**

| Sl. No. | Course Outcomes |
|---|---|
| **CO1** | Understand the working principle of Instruments for surgery and physiotherapy, electrotherapy instruments. |
| **CO2** | Understand the working of kidney, design of artificial kidney. Advantages and need of anesthesia machine. |
| **CO3** | Understand the principles of ventilators, study about different types of ventilators. |
| **CO4** | Analyzing the concepts of Automated Drug delivery Systems. |

**Question Paper Pattern:**

| |
|---|
| Total 5 units of syllabus, 2 full questions from each unit (20marks each) and total 20 marks from each unit. Total 10 Questions for 100 marks, covers 100% syllabus, and student has to answer any 5 full questions (1 to1 choice). Each question carries maximum 4 subdivisions. |

**Text Books:**

| SI No | Text Book title | Author | Volume and Year of Edition |
|---|---|---|---|
| 1 | Handbook of Biomedical Instrumentation | R.S.Khandpur | 2nd Ed., McGraw Hill, 2003. |

**Reference Books:**

| SI No | Text Book title | Author | Volume and Year of Edition |
|---|---|---|---|
| 1 | Patient-Monitoring Systems | Reed M. Gardner | Springer Publications, 2012. |
| 2 | Computer-based patient monitoring systems | Arthur D Little | University of Michigan Library, 2012. |
| 3 | IP Based Patient Monitoring Systems | Syed Mohammed Yasir Jafri | Lambert Publications, 2014. |