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| **Walchand College of Engineering, Sangli**  *(Government Aided Autonomous Institute)* | | | | | | | | |
| **AY 2023-24** | | | | | | | | |
| **Course Information** | | | | | | | | |
| **Programme** | | | | B. Tech. (Electronics Engineering) | | | | |
| **Class, Semester** | | | | Third Year B. Tech., Sem V | | | | |
| **Course Code** | | | | 6OE365 | | | | |
| **Course Name** | | | | Open Elective- Biomedical Engineering | | | | |
| **Desired Requisites:** | | | | Electronics Measurement and Instrumentation | | | | |
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| **Teaching Scheme** | | | | **Examination Scheme (Marks)** | | | | |
| **Lecture** | | | 3 Hrs/week | **MSE** | **ISE** | **ESE** | **Total** | |
| **Tutorial** | | | - | 30 | 20 | 50 | 100 | |
|  | | |  | **Credits: 3** | | | | |
|  | | | | | | | | |
| **Course Objectives** | | | | | | | | |
| **1** | To explain the basics body cell structure and different types of transducers | | | | | | | |
| **2** | To explain the different types of patient monitoring system | | | | | | | |
| **3** | Understand the design concept of different Medical instruments | | | | | | | |
| **4** | To demonstrate different medical instruments | | | | | | | |
| **Course Outcomes (CO) with Bloom’s Taxonomy Level** | | | | | | | | |
| At the end of the course, the students will be able to, | | | | | | | | |
| **CO1** | Understand CNS-PNS and Cardio pulmonary system | | | | | | | Understand |
| **CO2** | Apply proper sensors for sensing biomedical signals to biomedical instrumentation setup | | | | | | | Apply |
| **CO3** | Design ECG,EEG and EMG amplifier | | | | | | | Create |
| **CO4** | Explain block diagram of patient monitoring systems, X-ray machine, CT scan and Ultrasonography machine. | | | | | | | Understand |
|  | | | | | | | | |
| **Module** | | **Module Contents** | | | | | | **Hours** |
| I | | **Fundamentals of Medical Instrumentation**  Physiological Systems of the body, Sources of Biomedical signals, Basic Medical Instrumentation system, Micro-Electro-Mechanical System (Mems), Wireless Connectivity in Medical Instruments, General Constraints in design of Medical Instrumentation Systems | | | | | | 8 |
| II | | **The Origin of Bio potentials, Bio potential Electrodes & Biosensors**  Electrical activity of Excitable Cells, Functional Organization of the Peripheral NervousSystem,Electrocardiogram(ECG),Electromogram(EMG), Electroencephalogram(EEG), Electroretinogram(ERG) and their recording  system, Biomedical signal Analysis and Processing Techniques. | | | | | | 4 |
| III | | **Patient Monitoring Systems**  System Concepts, Cardiac Monitor, Bedside patient Monitoring Systems, Central Monitors, Measurement of Heart rate, Measurement of Temperature,  Measurement of respiration Rate, Biomedical Telemetry Systems | | | | | | 4 |
| IV | | **Modern Imaging Systems**  X-ray machines And Digital Radiography, X-ray Computed Tomography, Nuclear Medical Imaging Systems, Magnetic Resonance Imaging Systems,  Ultrasonic Imaging Systems and Thermal Imaging Systems. | | | | | | 8 |
| V | | **Assisting and Therapeutic Equipment’s**  Cardiac Pacemakers, Defibrillators, Diathermy, Hemodialysis Machines, Ventilators | | | | | | 8 |
| VI | | **Laser Application in Biomedical Field**  The Laser, Types of Lasers, Laser Application, Laser Safety | | | | | | 7 |
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| **Textbooks** | | | | | | | | |
| 1 | | John. G. Webster, “Medical Instrumentation”, John Wiley, 2009 | | | | | | |
| 2 | | Goddes& Baker, “Principles of Applied Biomedical Instrumentation”, John Wiley, 2008 | | | | | | |
| 3 | | Carr & Brown, “Biomedical Instrumentation & Measurement”, Pearson, 2004 | | | | | | |
| 4 | |  | | | | | | |
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| **References** | | | | | | | | |
| 1 | | R.S. Khandpur, “Hand book of Medical instruments”, TMH, New Delhi, 1987. | | | | | | |
| 2 | | Sanjay Guha,”Medical Electronics and Instrumentation”, University Publication, 200. | | | | | | |
| 3 | | Edwand J. Bukstein, “Introduction to Biomedical electronics” , Sane and Co. Inc, 1973 | | | | | | |
| 4 | |  | | | | | | |
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| **Useful Links** | | | | | | | | |
| 1 | |  | | | | | | |
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| **CO-PO Mapping** | | | | | | | | | | | | | | |
|  | **Programme Outcomes (PO)** | | | | | | | | | | | | **PSO** | |
|  | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 1 | 2 |
| **CO1** | 3 |  |  |  |  |  |  |  |  |  |  |  | 2 |  |
| **CO2** |  |  |  |  | 3 | 2 |  |  |  |  |  |  | 2 |  |
| **CO3** |  |  | 3 |  |  |  |  |  |  |  |  |  | 2 |  |
| **CO4** |  |  |  |  |  |  |  |  | 3 |  |  |  | 2 |  |
| The strength of mapping is to be written as 1: Low, 2: Medium, 3: High  Each CO of the course must map to at least one PO. | | | | | | | | | | | | | | |

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| **Assessment** |
| The assessment is based on MSE, ISE and ESE.  MSE shall be typically on modules 1 to 3.  ISE shall be taken throughout the semester in the form of teacher’s assessment. Mode of assessment can be field visit, assignments etc. and is expected to map at least one higher order PO.  ESE shall be on all modules with around 40% weightage on modules 1 to 3 and 60% weightage on modules 4 to 6.  For passing a theory course, Min. 40% marks in (MSE+ISE+ESE) are needed and Min. 40% marks in ESE are needed. (ESE shall be a separate head of passing) |