

**RAJIV GANDHI PROUDYOGIKI VISHWAVIDYALAYA, BHOPAL**

**New Scheme Based On AICTE Flexible Curricula**

**Biomedical Engineering, V-Semester**

**BM501- Microprocessors**

**Unit-I**

Introduction: Evolution of microprocessor, Organization of microcomputer, computers & micro controllers. Various microprocessor families –a comparative study. Architecture: Architecture & programming of Intel 8085. Addressing modes, instruction set and timing diagrams.

**Unit-II**

Interfacing memory and I/O devices. Memory mapped I/O and I/O mapped I/O, address space partitioning, Data transfer-synchronous, asynchronous, interrupt driven etc. Direct memory access data transfer (DMA), serial data transfer,

**Unit-III**

Interfacing with peripheral devices: Interfaces like 8155, 8255, 8259, USART 8251, timer 8254, keyboard and display controller 8279, Feature and applications.

**Unit-IV**

Interfacing with data converters .RS232C interface. Various data transfer schemes.

**Unit-V**

Introduction of 8086 Architectures, theory and addressing modes. An introduction to microcontroller 8051, important operational features of 8051.

Application of microprocessor and microcontroller in Biomedical:

- a. ECG monitoring, EEG Monitoring
- b. Temperature, Respiratory rate, pulse monitoring etc.

**Text Books:**

1. **Microprocessor Architecture Programming and Application with the 8085/8088**, by R. S. Gaonkar, Willey Eastern ltd.
2. **Microprocessor & Interfacing**, by Douglas Hall, Tata McGraw Hill.

**Reference:**

1. **Microprocessor &Peripheral Handbook**, by Intel Corporation.
2. **Microcontroller 8051 architecture & programming handbook** by Mazzidi.,PHI

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**Biomedical Engineering, V-Semester**

**BM502- Biomaterials**

**Unit-I**

Introduction: Definition and classification of biomaterial, properties of material, Host reaction to biomaterials, Introductory overview of some existing prosthetic devices, Discussion of some design considerations of specific implants/organs, the fundamentals of biocompatibility. Metallic, Ceramic and Polymeric implant material, Testing of Implants, Sterilization of Implants, Degradation of Materials in biological environment

**Unit-II**

Mechanical Behavior of Materials: Stress-Strain curve characteristics, Visco elasticity, Mechanical properties & remodeling of biological materials: Bone, Cartilage, Muscle, Tendon, and Ligament. Some specific implant-materials.

**Unit-III**

Testing of biomaterials: introduction, in vitro and in vivo assessment of tissue compatibility, implant associated infection.

**Unit-IV**

Application of material in medicine and dentistry: sutures, orthopedic application, cardiovascular application & dental application.

**Unit-V**

Host reaction to biomaterial and their evaluation: immunology and complementary system, systemic toxicity and blood coagulation, sterilization of implants, tumor genesis and biomaterials.

**Text book:**

1. **The Biomedical Engineering Handbook**, Second Edition, Joseph Bronzino, Editor in chief, CRC Press. This book has a chapter in the second volume on artificial internal organs.
2. **Biomechanics of the Musculoskeletal System** by Nigg and Herzog, Wiley Publishers, second edition.

**Reference book:**

1. **Biocompatibility of Orthopedic Implants**, (two volumes) by David Williams, CRC Press, 1982.

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**Biomedical Engineering, V-Semester**

**Departmental Elective BM- 503 (A) Industrial Electronics**

**Unit-I**

Static power devices: Thyristor family, two transistor analogy of SCR, construction, characteristics, parameters, turn on and turn off methods, firing circuits, isolation and amplifier circuits, synchronization circuits.

**Unit-II**

Converters: AC to DC converters, single phase rectifier circuits with different load, various quadrant operation, basic principle and power circuits of dual converter and cycloconverter.

**Unit-III**

DC to DC converter: Basic principle of chopper circuits, various chopper circuits and their working, step up chopper, performance analysis.

**Unit-IV**

Inverters: CSI and VSI inverters, single phase inverters, principle of operation, voltage and frequency control techniques.

**Unit-V**

Industrial: Application of Power Electronics, SMPS, UPS, AC and DC drives, Power Supplies.

**Text Books**

Recommended: Semiconductor Power Electronics, C.M. Pauddar, Jain Brothers Power Electronics, M.H. Rashid, Pearson Education Limited

Power Electronics, Ned Mohan, John Wiley & Sons Inc Sea Pvt. Ltd.

**Reference Books**

Recommended: Power Electronics, P.C. Sen, Tata Mcgraw Hill Publishing Co Ltd

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## **New Scheme Based On AICTE Flexible Curricula**

### **Biomedical Engineering, V-Semester**

#### **Departmental Elective BM- 503 (B) Analog And Digital Communication**

##### **Unit-I**

Fourier series, Fourier Transform and its properties, Probability, random variables & their Moments, their significance, convolution, auto correlation, cross Correlation & power spectral density, Gaussian & Rayleigh probability density Function, mean, variance & standard deviation, central limit theorem, voltage & Power decibel scales. Signal Processing : Types of signal, deterministic & random, periodic & non Periodic, analog & discrete, energy & power signals, Representation of sinusoid in different forms & their conversion

##### **Unit-II**

Need of modulation in a communication system, block schematic of a typical Communication system. AM modulation system, modulation index, generation & detection of AM wave, side bands & power content in an AM wave, DSB-SC, SSB, their methods of generation & detection, vestigial side Band modulation, AM transmitter block diagram, comparison of various AM system, modulation & demodulation circuits. Relationship between phase & freq. modulation, FM wave & its spectrum, phasor diagram of a narrow band FM signal, wide band FM, methods of generation & detection of FM, discriminators, pre-emphasis & de-emphasis, Stereophonic FM broadcasting, FM transmitters.

##### **Unit-III**

TRF receiver & its limitations, necessity of heterodyning, super heterodyning Receivers, IF amplifiers, selection of intermediate frequency. RF amplifiers, detectors, AGC, AVC, FM receivers, AFC.

##### **Unit-IV**

Nyquist sampling theorem, TDM, pulse modulations & PCM, quantization error, necessity of non linear quantizer, A-law,  $\mu$ -law, FSK & PSK, QPSK, QAM. Source of noise, noise figure, noise bandwidth, effective noise temperature, performance of AM, FM & digital system in presence of noise.

##### **Unit-V**

Satellite system block diagram, satellite freq. bands, satellite multiple access Format like TDMA, FDMA, transponders, earth station & satellite eclipses, Link calculation

##### **References:**

1. Taub & shilling, Communication System, TMH
2. Singh & Sapre, Communication System, TMH
3. B.P. Lathi, Modern Digital and ana communication system,
4. Simon Haykins, Communication System. John Willy
5. Wayne Tomasi, Electronic Communication system.
6. Schaum outline Series, Analog and digital communication
7. Martin S. Roden, Analog & Digital Communication System., Discovery Press.
8. Frank R. Dungan, Electronic Communication System, Thomson/Vikas
9. John G. Prokis, Masoud Salehi, Gerhard Bauch, Contemporary communication sytems using MATLAB,

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## **New Scheme Based On AICTE Flexible Curricula**

### **Biomedical Engineering, V-Semester**

#### **Departmental Elective BM- 503 (C) Therapeutic Instruments**

##### **Unit-I**

Cardiac Pacemakers & Defibrillators: Effects of electric field on cardiac muscles and laws of stimulation. External and internal pacemakers - programmable pacemakers - power sources - Design of encapsulation of leads - pacing system analyzers - defibrillators - basic principle and comparison of output wave forms of different DC defibrillators - energy requirements - synchronous operation - implantable defibrillators -defibrillator analyzers - RF ablation treatment for arrhythmia.

##### **Unit-II**

Ventilators: Basic principles - Different generators , Inspiratory phase, Different cycling mechanism -Expiratory phase - Different ventilatory adjuncts - study of typical ventilator - Ventilator testing – Anesthetic machines

##### **Unit-III**

Electrical stimulators. Nerve and muscle stimulators - stimulators for pain and relief - functional electrical stimulation - Ultrasonic stimulators - surgical diathermy - principles and design of systems - Burn and shock hazards - electro surgical analyzers - principles of short wave diathermy Physics and engineering of ultrasonic Lithotripter - basic principle of extracorporeal shock wave lithotripter.

##### **Unit-IV**

Basic principles of Bio-medical lasers - various application of CO<sub>2</sub>, He -Ne, Nd - YAG lasers - Application of laser in surgery, Angioplasty and endoscopy.

##### **Unit-V**

Design and application of various types of endoscopes, cystoscopes , laparoscopes - Fiber optic endoscopes and endoscopes with integral TV cameras - infusion pumps, peristaltic pumps - Dialysis equipments - Heart lung machines.

##### **Text Books:**

- 1) R S Khandpur, “Handbook of Bio medical Instrumentation”, Tata McGraw Hill

##### **Reference :**

- 1) Mushin, “Automatic Ventilation of Lung”, Black Well
- 2) Goldman, “Bio medical Lasers”, Springer Verlag
- 3) Massey & Meredith, “Fundamental Physics of Radiology”, Wright, Bristol
- 4) J A S Carruth & A L McKenzie, “Medical Lasers “, Adam Hilger, Bristol

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## **New Scheme Based On AICTE Flexible Curricula**

### **Biomedical Engineering, V-Semester**

#### **Open Elective BM- 504 (A) Medical Equipment design**

##### **Unit-I**

Review: general human physiology, generation and transmission of action potential, Depolarization and repolarization, Evoked potentials. Physiology of heart, heart as pump, various typed of electrodes and their construction, performance and application, bioelectrical signals and their recording. Physiological transducers.

##### **Unit-II**

Measurement and recording of physiology signals: Signal condition and processing circuits for medical recording system. Bedside monitor, ECG machine and cardio scope Blood flow meters, Blood pressure and cardiac output measurement, Measurement of heart sounds, Plethysmography. Patient care and monitoring .central monitoring systems. Electrical safety of medical equipments.

##### **Unit-III**

Therapeutic equipments: pacemakers –Theory and design aspects Defibrillators, Laser applications in biomedical field. Artificial kidney and dialyzers, X-ray machines and competent tomography, Magnetic resonance and Ultrasonic imaging systems, Ultrasound in medicines, Introduction to Thermography.

##### **Unit-IV**

Advanced Microprocessor and PC based Biomedical instruments. Biomedical Telemetry. Introduction about Body area network,

##### **Unit-V**

Analytical Techniques: Electromagnetic radiation and its interaction with matter. Various components of optical spectroscopic instruments. Laws of spectroscopy. Absorption spectroscopy for UV, Visible and IR region. Various sources and detectors and instrument designs. FTIR and its distinct applications. NMR spectroscopy and X- ray analysis, Ion sensitive electrodes and their measurement Chemistry analyzers. Introduction to Chromatography: Gas & Liquid.

##### **Books & references recommended:**

- 1.Cromwell L., Weilbell F.J and Pfeiffer E.A “Biomedical instrumentation and measurement”, Pearson Education
- 2.Khandpur R.S., “Handbook of Biomedical Instrumentation”, TMH.
3. Carr and Brown, Introduction to medical equipment technology, Pearson education.
- 4.Willard merit & dean, “Instrumental methods of analysis”.

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## **New Scheme Based On AICTE Flexible Curricula**

### **Biomedical Engineering, V-Semester**

#### **Open Elective BM- 504 (B) Data Structures**

##### **Unit-I**

Basic Concept: Data Structure and algorithm preliminaries: Definitions; Data types, Time and Space analysis of Algorithms; Time and space trade-off, Pointers and dynamic memory allocation; Recursion.

##### **Unit-II**

Arrays and Structure: Concepts of Linear Search, Binary Search, Evaluation of Polynomial, Polynomial representation, Polynomial Addition, Structures: Internal representation of structure, Self-referential structure, Array: Definitions of Arrays and Lists, Strings, Row/Column major representation of Arrays.

##### **Unit-III**

Stack and Queues: Introduction to Stack, Static and Dynamic Representation, Operation, Application of Stack, Evaluation of Expression, postfix expression, Infix, prefix, Queue, Static and Dynamic Representation, Operation, Priority Queue, Circular Queue.

##### **Unit-IV**

Linked List and Trees: Introduction to Linked List: Singly linked list, circular linked list, doubly linked list, operations on linked list, Introduction to Tree: Definition, Terminology, Generalised tree representation, Binary tree definitions and properties, Representation, Binary Tree Traversal In order, Pre order, Post order, Introduction to Binary Search Tree.

##### **Unit-V**

Graphs; Searching & Sorting: Introduction to Graphs: Representation, Adjacency Matrix and List, Indegree, out degree of Graph, Graphs Operation, DFS & BFS, Spanning Tree, Shortest path. Searching and Sorting Methods: Various Searching and Sorting algorithms with complexity analysis.

#### **TEXT BOOKS:**

##### **References**

1. E Balagurusamy, **Data Structures Using C**, Tata McGraw Hill Education
2. N.K. Tiwari, Jitendra Agrawal, Shishir K. Shandilya, **Data Structures**, I K International Publishing House
3. Achuthsankar S. Nair & T. Mahalekshmi, **Data Structures in C**, PHI
4. R. Venkatesan & S. Lovelyn Rose, **Data Structures**, Wiley India
5. Rajesh K. Shukla, **Data Structures Using C & C++**, Wiley India
6. Langsam, Augenstein & Tenenbaum, **Data Structures Using C & C++**, Pearson
7. Dharmender Singh Kushwaha & Arun Kumar Mishra **Data Structures: A Programming Approach with C**, PHI