SCHEME OF INSTRUCTION & EXAMINATION
B.E. IV YEAR
(BIO-MEDICAL ENGINEERING)

SEMESTER-I

<table>
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<tr>
<th>S.No.</th>
<th>Syllabus / Ref. No.</th>
<th>SUBJECT</th>
<th>Scheme of Instruction</th>
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<td>BM401 UE</td>
<td>Advanced Medical Equipment</td>
<td>4 - 3</td>
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<td>2.</td>
<td>BM402 UE</td>
<td>Medi embedded systems and RTOs</td>
<td>4 - 3</td>
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<td>3.</td>
<td>BM403 UE</td>
<td>Telemedicine</td>
<td>4 - 3</td>
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<td>4.</td>
<td>EC421 UE</td>
<td>Digital Signal Processing*</td>
<td>4 - 3</td>
<td>3</td>
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<td>5.</td>
<td>BM 404 UE</td>
<td>Microprocessors and Microcontrollers in Medical Applications</td>
<td>4 - 3</td>
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<td>6.</td>
<td>Elective II</td>
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PRACTICAL

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<td>BM431 UE</td>
<td>Medi Embedded Systems Lab</td>
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<td>Project Seminar</td>
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*Syllabus same as EC 351 UE

ELECTIVE II:

BM  405UE  Prosthetic Engineering
CS  408UE  Database Management Systems
EC  423UE  VLSI Technology
EE  405UE  Optimization Techniques
ME  409UE  Entrepreneurship
ME  412UE  Finite Element Analysis
## Scheme of Instruction & Examination

### B.E. IV Year

#### (Bio-Medical Engineering)

**Service Courses Offered to Other Departments**

### Semester-I

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<tr>
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<th>Scheme of Examination</th>
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<td>1</td>
<td>BM406 UE CE/CSE/ ECE/EEE/ME</td>
<td>Medical Instrumentation (Elective – II)</td>
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*With effect from the academic year 2010-2011*
BM 401 UE

ADVANCED MEDICAL EQUIPMENT

Instruction: 4 Periods per week
Duration of University Examination: 3 Hours
University Examination 75 Marks
Sessional: 25 Marks
Credits 4

OBJECTIVES:

a. To familiarize the latest technologies of modern medicine
b. To make learners able to use new and updated diagnostic methodologies
c. To make learners capable enough of adopting the methods of recovery and improving health with a service approach

UNIT I
Hospital power distribution system: Design and layout, power factor improvement, maximum demand, safety, metering, booster transformers, isolators. Electrical Safety: physiological affects of electricity, macro-shock and micro-shock hazards, electrical safety codes and standards, electrical safety analyzers, testing the electric systems.

UNIT II
Electrosurgical Equipment: ESU, principles of cutting and coagulation, spark gap, valve and solid state generators, safety features. Introduction to Lithotripsy-Principles and Applications, Physiotherapy Equipment-Short Wave, Microwave and Ultrasound Diathermy, Ophthalmic Instruments-Intraocular Pressure Measurement Contacting and Non-Contacting Types, Refractometer, Ophthalmoscope, Retinoscope, Keratometer.

UNIT III
Audiometry: Common tests and procedures, audiometer. Hearing Aids: Different types, comparison of microphones receivers and amplifiers, cochlear Implants.
Neonatal instrumentation: incubators, aproea monitor, photo-therapy devices.
Haemodialyzer: qualitative requirements, general scheme of operation, types of exchangers, block diagram, electronic control and monitoring.
General anesthesia: information about medical gases and vacuum systems, anesthesia equipment Liquid medical–O2 systems, Theatre sterility practices.

UNIT IV
Imaging Equipment: Ultrasound, computer aided tomography, magnetic resonance imaging, SPECT, PET: Basic Principle of Operation and Applications. Introduction to Radionuclide Instrumentation-Gamma camera, rectilinear scanner, radioisotopes, mobile C-ARM radiotherapy equipment fMRI.

UNIT V
Photonics: Optic fibers: optical fiber waveguides, wave propagation, types of optical fibers, attenuation and dispersion in optical fibers, applications in Endoscopy.

Suggested reading:
BM 402 UE

MEDI EMBEDDED SYSTEMS AND RTOS

Instruction: 4 Periods per week
Duration of University Examination: 3 Hours
University Examination 75 Marks
Sessional: 25 Marks
Credits 4

OBJECTIVES:

a. Able to write programs to interface with 8085/8086
b. Able to write programs to interface with 8051
c. Know the concept of interfacing PIC microcontroller.

UNIT I
Embedded Systems: Basic concepts, requirements, categories, design challenges Embedded operating system –Types, Hardware architecture, Software architecture, application software, communication software, process of generating executable image, development/testing tools

UNIT II
Embedded System Development --The development process, requirements engineering, design, implementation, integration and testing, packaging, configuration management, management of development projects

UNIT III
The execution environment-memory organization, system space, code space, data space, unpopulated memory space, i/o space, system start up, interrupt response cycle, Functions Calls & Stack Frames, run time environment.

UNIT IV
Architecture of Kernel, Tasks and Task Scheduler - Task States, Content Switching, Scheduling Algorithms, Rate Monotonic Analysis, Task Management Function Calls. Interrupt Service Routines, Semaphores, mutex, mailboxes, message queues, event registers, pipes, signals, timers, memory management, Priority Inversion Problem

UNIT V
Design methodologies and design flows, case studies- fetal heart rate monitor, versatile drop foot stimulator, myoelectric arm, telemonitoring system

Suggested Reading:
With effect from the academic year 2010-2011

BM 403 UE

TELEMEDICINE

Instruction: 4 Periods per week
Duration of University Examination: 3 Hours
University Examination: 75 Marks
Sessional: 25 Marks
Credits: 4

OBJECTIVES:

a. Know Scope, Benefits and Limitations of Telemedicine.

b. Know Security and Standards and their use in Telemedicine Applications

c. Explain basic parts of Teleradiology Systems like Image Acquisition System, Display System, Communication Network, Interpretation.

d. Describe the need of Various Communication Networks, Antennas in Designing the Telemedicine System

UNIT I

History of Telemedicine, Block diagram of telemedicine system, Definition of telemedicine, Tele health, Tele care, origins and Development of Telemedicine, Scope, Benefits and limitations of Telemedicine.

UNIT II

Types of information: Audio, Video, still Images, text and data, Fax.
Types of Communication and Network: PSTN, POTS, ATN, ISDN, Internet, Wireless Communications: GSM, satellite and Micro Wave. Different modulation techniques, Types of antennas depending on requirements, Integration and Operational issues: system integration, Store-and-forward operation, real-time Telemedicine.

UNIT III


UNIT IV

Ethical and legal aspects of Telemedicine: Confidentiality and Law, patient rights and consent, access to medical Records, Consent treatment, jurisdictional Issues, Intellectual property rights.

UNIT V

Tele radiology: Basic parts of Teleradiology system: Image Acquisition system, Display system, Communication network, Interpretation. Tele Pathology: Multimedia databases, color images of sufficient resolution: Dynamic range, spatial resolution, compression methods, Interactive control of colour, Controlled sampling, security and confidentiality tools. Tele cardiology, Teleoncology, Telesurgery.

Suggested Reading:

EC 421 UE

DIGITAL SIGNAL PROCESSING

Instruction: 4 Periods per week
Duration of University Examination: 3 Hours
University Examination: 75 Marks
Sessional: 25 Marks
Credits: 4

OBJECTIVES:

a. To know the difference between DFT and FFT
b. Differences between FIR and IIR.
c. Design of FIR and IIR filters.
d. Architecture of DSP processors and types of DSP processor.

UNIT I

UNIT II

UNIT III

UNIT IV

UNIT V
DSP Processors: Computer architecture for signal processing, General purpose DSP processors, TMS 320C 54XX processor – Architecture, addressing modes, Instruction set

Suggested Readings:
MICROPROCESSORS AND MICROCONTROLLERS IN MEDICAL APPLICATIONS

Instruction: 4 Periods per week
Duration of University Examination: 3 Hours
University Examination 75 Marks
Sessional: 25 Marks
Credits 4

OBJECTIVES:
a. Distinguish between microprocessors and microcontrollers and their applications.
b. To know the hardware circuitry of each processors and microcontroller.
c. To know the assembly level language programming on microprocessors and Microcontroller in medical applications.

UNIT I
8085 Microprocessor: Architecture, Instruction cycle, basic timing diagrams, Addressing Modes, Instruction Set, Memory and I/O interfacing, interrupts, i/o ports and data transfer concepts

UNIT II
Peripheral Interfacing: Programmable peripheral interface chip (8255), Programmable communicator chip (8251), Programmable Internal timer chip (8253), Programmable interrupt controller (8259), DMA (8257) controller Introduction to 32-Bit Microprocessors.

UNIT III
Programming of 8085 Microprocessor: General Programmes, debugging of Programmes, interfacing with 8085- ADC, DAC, seven Segment display, stepper motor, traffic control, digital multiplexer, digital demultiplexer, square wave generation using micro processor

UNIT IV

UNIT V
Interfacing of medical sensor circuits: Carbon dioxide and oxygen sensors, respiration, force, flow, differential voltage and current probes and humidity sensors.

Suggested Reading:
BM 405 UE

PROSTHETIC ENGINEERING

Instruction: 4 Periods per week
Duration of University Examination: 3 Hours
University Examination 75 Marks
Sessional: 25 Marks
Credits 4

OBJECTIVES:

a. To extend knowledge of the amputee, of lost and remaining functions affecting locomotion, and to collect information on the best possible medical treatment.
b. To improve fitting techniques and practices, including training, so that existing devices might be used with greater comfort and function.
c. To develop improved lower-extremity devices.

UNIT – I

UNIT – II

UNIT – III

UNIT – IV

UNIT – V

Suggested Reading:
DATA BASE MANAGEMENT SYSTEMS

Instruction: 4 Periods per week
Duration of University Examination: 3 Hours
University Examination 75 Marks
Sessional: 25 Marks
Credits 4

OBJECTIVES:

a. Knowledge of DBMS, both in terms of use and implementation/design
b. Experience with SQL
c. Increased proficiency with the programming language C++
d. Experience working as part of team

e. Experience with analysis and design of (DB) software

UNIT I

UNIT II
Relational Model: Structure of related databases, Relational Algebra, Extended Relational Algebra Operators, Extended relational algebra operations, Modification of the database, Views, the Tuple relational calculus, The Domain relational calculus. Structured Query Languages: Basic Structure, Set operations, Aggregate functions, Null values, Nested sub queries, Views, Complex Queries, Modification of the database, Joined relations, Data-definition languages, Embedded SQL, Dynamic SQL.

UNIT III

UNIT IV
Indexing and Hashing: Basic Concepts, Ordered indices, B+ Tree index files, B-Tree index files, Hashing, Dynamic Hashing, comparison of ordered and Hashing, Index definition in SQL, Multiple-Key Access. Transactions: Transaction concept, Transaction state, implementation of atomicity and durability, Concurrent executions, Serializability, Recoverability, Implementation of isolation, transaction definition in SQL, Testing for serializability.

UNIT V
Suggested Reading:
With effect from the academic year 2010-2011

EC 423 UE

VLSI TECHNOLOGY

Instruction: 4 Periods per week
Duration of University Examination: 3 Hours
University Examination 75 Marks
Sessional: 25 Marks

OBJECTIVES:
a. Professional training to the students of computer Science, computer applications, computer engineering, physics and electronics students in VLSI Technology and Hardware Description Language

UNIT I
Overview of CMOS & BiCMOS technologies, MOS & BiCMOS Transistor Models, IC fabrication, MOS inverter characteristics.

UNIT II
IC Layout Design of basic structures & simulation, static MOS Gate circuits.

UNIT III
Sub-system Design: Arithmetic circuits in CMOS and ROM, SRAM & DRAM Arrays.

UNIT IV
Process Technology – I

UNIT V
Process Technology – II
Polysilicon Film Deposition, Diffusion, Ion implantation and Metallization VLSI Process Integration-CMOS IC technology.

Suggested Reading:
OPTIMIZATION TECHNIQUES

Instruction: 4 Periods per week
Duration of University Examination: 3 Hours
University Examination 75 Marks
Sessional: 25 Marks
Credits 4

OBJECTIVES:
a. Provide students with the tools and mentality of optimization.
b. Present classic and recent research topics in optimization of communication systems.
c. Introduce the tools just in time for the application topics.
d. Train the ability to do original research in academia or industry through final projects that are closely related to students’ own research interests.

UNIT I
Introduction to Classical Optimization Techniques: Statement of optimization problem, Objective function, Classification of Optimization problem.

UNIT II
Linear Programming: Standard form, formulation of the LPP, Solution of simultaneous equations by pivotal condensation, Graphical methods, Simplex algorithm, Big M Method, Two phase Simplex method, Duality principle, Dual Simplex method.

UNIT III
Non-linear Programming:

UNIT IV
Gradient Method: Steepest Descent, conjugate Gradient and Quasi-Newton method, Fletcher-Reeves method of Conjugate gradients.

UNIT V

Suggested Reading:
ME 409 UE

ENTREPRENEURSHIP

Instruction: 4 Periods per week
Duration of University Examination: 3 Hours
University Examination: 75 Marks
Sessional: 25 Marks
Credits 4

OBJECTIVES:
a. The purpose of this paper is to prepare a ground where the students view entrepreneurship as a desirable and feasible career option. In particular the paper seeks to build the necessary competencies and motivation for a career in entrepreneurship.

UNIT I
Indian Industrial Environment – competence; Opportunities and Challenges, entrepreneurship and Economic growth, Small Scale Industry in India, Objectives, linkages among small, medium and heavy industries and forms enterprises.

UNIT II
Identification and characteristics of Entrepreneurs, Emergence of First generation entrepreneurs, environmental influence and women entrepreneurs. Conception and evaluation of ideas, their sources and decision making, Choice of Technology – Collaborative interaction for Technology development.

UNIT III
Project formulation, Analysis of marked demand, Demand supply gap, Financial and Profitability analysis and Technical analysis. Project financing in India.

UNIT IV
Project Management during construction phase, project organization, project planning and control using CPM-PERT techniques. Human aspects of project management. Assessment of tax burden.

UNIT V
Time Management: Various approaches of time management, their strengths and weaknesses. The urgency addiction and the time management matrix.

Suggested Reading:
ME 412 UE

**FINITE ELEMENT ANALYSIS**

Instruction: 4 Periods per week
Duration of University Examination: 3 Hours
University Examination 75 Marks
Sessional: 25 Marks

**OBJECTIVES:**

a. Understand the basic assumptions of Linear Static Finite Element Analysis (FEA)
b. Understand basic FEA terminology
c. Be familiar with some of the limitations of Linear Static FEA
d. Comprehend considerations of the solid or planar CAD model relevant to the FEA model
e. Be able to run a basic FEA analysis

**UNIT I**

**UNIT II**
Analysis of trusses and frames: Element stiffness matrix for a truss member. Analysis of Plane truss with number of unknowns not exceeding two at each node. Analysis of frames with two translations and a rotational degree of freedom at each node. Analysis of Beams: Element stiffness matrix for two nodded, two degrees of freedom per node beam element.

**UNIT III**
Finite element modeling of two dimensional stress analysis with constant strain triangles and treatment of boundary conditions. Finite element modeling of Axisymmetric solids subjected to Axisymmetric loading with triangular elements.

**UNIT IV**
Two dimensional four nodded isoparametric elements and numerical integration. Steady state heat transfer analysis: One dimensional analysis of a fin and two dimensional analysis of this plate. Analysis of a uniform shaft subjected to torsion.

**UNIT V**

**Suggested Reading:**
With effect from the academic year 2010-2011

BM 406 UE

MEDICAL INSTRUMENTATION
(Elective for CE/CSE/ECE/EEE/ME)

Instruction: 4 Periods per week
Duration of University Examination: 3 Hours
University Examination 75 Marks
Sessional: 25 Marks

OBJECTIVES:

a. Understand the operation, application, and underlying physiological principles associated with a variety of diagnostic, therapeutic and analytical medical devices used routinely in hospitals.
b. Know the basic electrical and electronic components and circuit behavior.
c. Understand applicable codes, standards, and the intrinsic hazards associated with many of these devices.

UNIT I
Origin of bio-potentials – ECG, EEG, EMG, EOG, ENG, ERG, EGG.
Bio-potential Electrodes: Half cell potential, Offset voltage, Types of External, internal and Microelectrodes.
Biosensors – Enzyme-based biosensors, immuno sensors, microbial sensors.

UNIT II
Medical display devices and recorders, Basic requirements for the display and recording of biopotentials signals. PMMC writing systems, General features of ink-jet, thermo-sensitive and optical recorders, Oscilloscopes – Medical, multi-beam & non-fade display systems.

UNIT III
Analytical Instrumentation, Methods of Chemical analysis, Absorption Photometry, Emission Photometry, Fluorometry, chromatography for blood gas analysis, Colorimeters, Spectrophotometers, electrophoresis, auto analyzer.

UNIT IV
ECG: Block diagram & circuits, electrode placement, lead configuration, Types of ECG recorders, Blood pressure measurement: Direct and indirect methods, Blood flow measurement: Electromagnetic & Ultrasonic techniques. Heart sounds: Origin, phonocardiography

UNIT V
ECG: Block diagram & circuits, electrode placement, Evoked potentials and their measurement. EMG- Block diagram & circuits, electrode placement, Nerve conduction velocity determination, EMG stimulators.
Suggested Reading:
BM 431 UE

MEDI EMBEDDED SYSTEMS LAB

Instruction: 3 Periods per week
Duration of University Examination: 3 Hours
University Examination: 50 Marks
Sessional: 25 Marks

1. Interfacing with 8085 microprocessor and 8051 microcontroller
   a) Traffic light controller
   b) 7-segment display
   c) Analog to Digital Converter
   d) Matrix keyboard
   e) LCD display
   f) Digital to Analog Converter
   g) Stepper motor
   h) DC- motor

2. Interfacing of matrix sensors to PIC microcontroller
   a) Heart rate monitor
   b) ECG sensor
   c) Carbon dioxide and oxygen sensors
   d) Ion selective sensors
   e) Analog interfacing of rabbit core modules
   f) OP 7200 LCD display controller
BM 432 UE

PROJECT SEMINAR

Instruction: 3 Periods per week
Sessional: 25 Marks

The Objective of the project seminar is to actively involve the student in preparation of the final year project with regard to following components

- Problem definition and specifications
- Literature survey, familiarity with research journals
- Board knowledge of available techniques to solve a particular problem.
- Planning of the work, preparation of bar (activity) charts.
- Presentation - Oral and Written.

The Department can initiate the work related to project allotment at the end of III year 2nd semester and finalize it in the first two weeks of the IV year 1st semester.

First 4 weeks of IV year 1st semester will be spend on special lectures by faculty members, research scholars and PG students of the department and invited lectures by engineers from industries and R&D institutions. The objective of these preliminary talks will be to expose students to real life practical problems, and methodology to solve the technical problems.

Seminar schedule will be prepared by the coordinator for all the students from 5th week to the last week of the semester which should be strictly adhered to.

Each student will be required to

1. Submit a one page synopsis before the seminar for display on notice board.
2. Give a 20 minutes presentation followed by 10 minutes discussion.
3. Submit a technical write-up on the talk delivered.
4. Actively participate in the seminars.

At least two teachers will be associated with the evaluation of the project seminar for the award of the Sessional marks, which should be on the basis of performance on all the three items stated above.

Note: Three periods will be assigned to each project guide irrespective of the number of projects guided.