With effect from the academic year 2009-2010

SCHEME OF INSTRUCTION & EXAMINATION
B.E. III/IV
(BIOMEDICAL ENGINEERING)

<table>
<thead>
<tr>
<th>S.NO</th>
<th>Syllabus Ref. No</th>
<th>SUBJECT</th>
<th>SCHEME OF INSTRUCTION</th>
<th>SCHEME OF EXAMINATION</th>
<th>CREDITS</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td>PERIODS PER WEEK</td>
<td>DURATION IN HOURS</td>
<td>MAXIMUM MARKS</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>L/T D/P</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1.</td>
<td>BM 301 UE</td>
<td>Biological control systems</td>
<td>4 - 3</td>
<td>75</td>
<td>25</td>
</tr>
<tr>
<td>2.</td>
<td>BM 302 UE</td>
<td>Biomechanics</td>
<td>4 - 3</td>
<td>75</td>
<td>25</td>
</tr>
<tr>
<td>3.</td>
<td>BM 303 UE</td>
<td>Cardio Pulmonary Equipment</td>
<td>4 - 3</td>
<td>75</td>
<td>25</td>
</tr>
<tr>
<td>4.</td>
<td>EC 321 UE</td>
<td>Digital Electronics</td>
<td>4 - 3</td>
<td>75</td>
<td>25</td>
</tr>
<tr>
<td>5.</td>
<td>MT 301 UE</td>
<td>Mathematics-IV*</td>
<td>4 - 3</td>
<td>75</td>
<td>25</td>
</tr>
<tr>
<td>6.</td>
<td>ELECTIVE I</td>
<td></td>
<td>4 - 3</td>
<td>75</td>
<td>25</td>
</tr>
</tbody>
</table>

**PRACTICALS**

<table>
<thead>
<tr>
<th>S.NO</th>
<th>Syllabus Ref. No</th>
<th>SUBJECT</th>
<th>SCHEME OF INSTRUCTION</th>
<th>SCHEME OF EXAMINATION</th>
<th>CREDITS</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td>PERIODS PER WEEK</td>
<td>DURATION IN HOURS</td>
<td>MAXIMUM MARKS</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>L/T D/P</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1.</td>
<td>BM 331 UE</td>
<td>Biomedical Equipment Laboratory</td>
<td>- 3</td>
<td>3</td>
<td>50</td>
</tr>
<tr>
<td>2.</td>
<td>EC 341 UE</td>
<td>Digital Electronics Laboratory</td>
<td>- 3</td>
<td>3</td>
<td>50</td>
</tr>
</tbody>
</table>

**TOTAL**: 24 6 550 200 28

* Syllabus same as MT 251 UE

**ELECTIVE-I**:
1. BM 304 UE  Medical Informatics
2. BM 305 UE  Biomaterials
3. BM 306 UE  Bio Transport Processes
BM 301 UE

BIOLOGICAL CONTROL SYSTEMS

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

UNIT-I

UNIT-II

UNIT-III

UNIT-IV

UNIT-V

Suggested Reading:
1. Ogata Katsuhi, Modern Control Engineering, 2nd Ed., Prentice Hall of India, 1992
5. R.P.Van Wijk van Brienvingh and D.P.F.Moller(Eds.), Biomedical Modeling and Simulation on a PC-A Workbench for Physiology and Biomedical Engineering, Springer-Verlag, 1993.
With effect from the academic year 2009-2010

BM 302 UE

BIOMECHANICS

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

UNIT-I

UNIT-II
Statics in biomechanics: Analysis of rigid bodies in equilibrium, conditions for equilibrium, free body diagrams, General procedure to analyze systems in equilibrium, Types of support or joint with biomechanical examples. Analysis of joints in various postures. Basic assumptions and limitations, Biomechanical analysis of elbow, shoulder, spinal column, hip, knee and ankle.

UNIT-III

UNIT-IV:
Pulmonary mechanics: Mechanism of air flow, Respiratory cycle, Lung Ventilation model, Methods of determining pressure, flow-rate and volume-Spirometry, Respiratory plethysmography, Diagnostic significance of the lung-ventilation model, static and dynamic respiratory mechanics tests.

UNIT-V:
Orthopedic implants: Design process of an orthopedic implant, typical specifications for an prosthetic joint, Biocompatibility, Requirements of a biomaterial, Characteristics of different types of biomaterials, manufacturing process of implants, fixation of implants-Mechanical fixation, cements and adhesives, porous materials.

Suggested Reading:
With effect from the academic year 2009-2010

BM 303 UE

CARDIO-PULMONARY EQUIPMENT

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

UNIT-I
Defibrillators: D.C. Defibrillators of Capacitive discharge and delay line capacitive discharge with circuit diagrams. Types of electrodes and their features. Testing and safety.

UNIT-II
Cardiac Pacemakers: Types-Asynchronous and Synchronous(demand), Mode of Operation External and implantable.
Asynchronous pacemakers: Working principle, block diagram circuit diagram of blocking oscillator.
Synchronous/Demand Pacemaker: Working principles. Modes of triggering-ventricular triggered(QRS triggered)and atrio-ventricular synchronized pacemaker(P wave triggered)
Implantable Pacemaker: Technical and qualitative requirements of power supplies, lead wires and electrodes. Transcutaneous R.F. powered cardiac pacemaker system. Susceptibility of implanted pacemaker to electrical interference and remedial measure.

UNIT-III
Assist devices of the heart: Principles of external counter pulsation techniques. Intra-aortic Balloon pump. Auxiliary ventricle and schematic for temporary by-pass of left ventricle. Prosthetic Heart: Qualitative requirements. Categories-Mechanical; and tissue Valves. Types of mechanical valves: Ball and Cage, tilting disc and Bileaflet valves. Types of Tissue valves: Homografts or Allografts(human adaver)and Heterografts or Xenografts(Porcine or Bovine). In vitro performance testing of prosthetic heart valves using a pulse duplicator.

UNIT-IV
Heart lung Machine: Governing principles. Qualitative requirements. Functional details of Bubble, Thin Film and membrane-type of blood oxygenators.
Respiratory measurements and aids: Principles and techniques of impedance Pnuemography and pneumotachograph. Ventilators.
Parameters: System concepts, Flow gauges, Valves, Humidifiers, Bird’s Ventillator.

UNIT-V

Suggested Reading:
With effect from the academic year 2009-2010

EC 321 UE

DIGITAL ELECTRONICS

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

UNIT-I

UNIT-II

UNIT-III

UNIT-IV
Basic computer Organization: Instruction codes, Computer registers, Timing and control, Instruction cycle, Input-output Configuration, Interrupt cycle. Introduction to microprocessors and microcontrollers.

UNIT-V
Memories: Types of memories, Memory Addressing, ROM, PROM, EPROM, SRAM, DRAM, DDRAM, NVRAM, flash memory. Programmable Logic Devices: PLAs, PALs, PLLs. Applications: Digital Clock, Frequency counter, Time measurement, Displays.

Suggested Reading:
With effect from the academic year 2009-2010

MT 251 UE

MATHEMATICS-IV

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

UNIT-I
Functions of complex Variables: Limit and continuity of function-analytic function Cauchy-Reimann equations-Complex integration, Cauchy’s theorem-Derivative of Analytic functions-Cauchy’s integral formula and its applications.

UNIT-II

UNIT-III
Statistics: Random variable, distributions, Density functions-conditional distributions-Baye’s theorem-Mathematical exception expected values moments and Moment Generating functions.

UNIT-IV
Distributions: Poisson, Normal, Gamma and chi-square distribution-fitting these curves of the data.

UNIT-V
Curve fitting by method of Least squares: Correlation and Regression-Lines of Regression Tests of Significance, Chi-Square, F and T tests.

Recommended Text Books:

Reference Books:
With effect from the academic year 2009-2010

BM 331 UE

BIOMEDICAL EQUIPMENT LAB

<p>| | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Instruction</td>
<td>3 Periods per week</td>
</tr>
<tr>
<td>Duration of University Examination</td>
<td>3 Hours</td>
</tr>
<tr>
<td>University Examination</td>
<td>50 Marks</td>
</tr>
<tr>
<td>Sessionals</td>
<td>25 Marks</td>
</tr>
<tr>
<td>Credits</td>
<td>2</td>
</tr>
</tbody>
</table>

I. List of Experiments:
DC Defibrillator
Pacemakers-Asynchronous and Synchronous
ECG Recorder and Monitor
Syringe Pump
Pulse Oximeter
Ventilator
Pneumotachograph
Impedance Pneumograph
Spirometer
Airway Resistance Measurement

II. Mini Project and Design exercises:

Mini project is to be executed batch-wise. Design exercises are to be carried out individually.
With effect from the academic year 2009-2010

BM 341 UE

DIGITAL ELECTRONICS LAB

Instruction: 3 Periods per week
Duration of University Examination: 3 Hours
University Examination: 50 Marks
Sessionals: 25 Marks
Credits: 2

I. List of Experiments:
- Clippers and Clampers-Series and Parallel
- Astable, Monostable and Bistable Multivibrators
- Logic Gates-AND, OR, NOT, NAND, NOR
- Half Adder, Full Adder, Half Subtractor, Full Subtractor
- Flip Flops-SR, JK, D, T, JK-Master Slave
- A/D and D/A converters
- Multiplexers and Demultiplexers
- Shift register-Series/Parallel-in to Series/Parallel-out
- CMOS-TTL and TTL-CMOS interfacing
- BCD-7 segment Display
- PLL and Voltage Controlled Oscillator
- Counters-Decade, Binary, Divide-by-N

II. Mini Project and Design exercises:

Mini project is to be executed batch-wise. Design exercises are to be carried out individually.
With effect from the academic year 2009-2010

BM 304 UE

MEDICAL INFORMATICS

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

UNIT I
Planning and designing of hospital systems: Financial aspects, Equipment, Building, Organization of the hospital, various medical services in a hospital, BME services and technical aspects: role and responsibilities. Layout, setting and Functions of Biomedical Engineering Department in a Hospital
Biomedical equipment Management: Procurement process, Training to Medical staff on technical capabilities, Biomedical Equipment maintenance procedures.

UNIT II
Database Management (DBMS): Introduction to Data structures, Elements, Arrays, Records, Sets, Tables, Singly and Doubly linked data, stacks, Queues and Trees, Need for a database, Architecture of DBMS. Representation of data, physical Record Interface, Data models, Relational, Hierarchical and Network approach.

UNIT III

UNIT IV

UNIT V
Applications of Artificial Intelligence in medicine
Telemetry Applications in Medicine: Telemetry circuits, modulation systems, single and multi-channel telemetry systems, implantable telemetry system, wireless telemetry, video conferencing, Tele-surgery, Virtual Reality.

Suggested Reading:
With effect from the academic year 2009-2010

BM 304 UE

BIOTRANSPORT PROCESSES

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

Unit I
System concepts for transport processes. Effort variables, flow vs variables, relationship between flow and effort variables. Chemical balances, force balances, general flow balances, Kirchoff’s laws, system applications.

UNIT II

UNIT III

UNIT IV
Mass transfer principles. Mass balance, molecular diffusion, convection, mass generation and mass storage, mixed mode mass transfer, simultaneous heat and mass transfer. Mass transfer in kidneys, lungs and in artificial organs(dialysers and oxygenators)

UNIT V
Compartmental models. Approaches to pharmacokinetic modeling and drug delivery, one and two compartmental models. Physiological applications-intravenous injection, constant intravenous infusion, determination of regional blood flow volumes and blood flow rates.

Suggested Reading:
With effect from the academic year 2009-2010
BM 304 UE

BIOMATERIALS

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

UNIT I

UNIT II
Testing biomaterials: Intro assessment of tissue compatibility, assay methods, direct contact tests, agar diffusion test, elution test. Invivo assessment of tissue compatibility, evaluation of tissue reaction, mechanical testing, criteria for assessing acceptability of the tissue response, testing of blood-materials interaction. Degradation of biomaterials.

UNIT III

UNIT IV

UNIT V

Suggested Reading: