

GUJARAT TECHNOLOGICAL UNIVERSITY

DIPLOMA IN BIOMEDICAL ENGINEERING

TEACHING SCHEME (w.e.f. 18th July '2011)

SEMESTER- V

SR. NO	SUB. CODE	SUBJECT	TEACHING SCHEME (HOURS)			CREDITS
			THEORY	TUTORIAL	PRACTICAL	
1	2350301	Micro Controller & Its Application in Medical Instrumentation	3	0	2	5
2	2350302	Medical Imaging Technology	4	0	2	6
3	2350303	Critical Care Instrumentation	3	0	4	7
4	2350304	Therapeutic Medical Instrumentation	4	0	4	8
5	2350305	Project-I	0	0	4	4
		Total	14	0	16	30

GUJARAT TECHNOLOGICAL UNIVERSITY

DIPLOMA IN BIO - MEDICAL ENGINEERING

Semester – V

Subject Code : **2350301**

Subject Name : **Micro Controller & Its Application in Medical Instrumentation**

Sr. No.	Subject Content	Hrs.
1.	Microprocessors and Micro Controllers: 1.1. Microprocessor : general idea and block diagram 1.2. Block diagram of a micro controller 1.3. Introduction to micro controller 1.4. Operating principle 1.5. Comparison between microprocessor and micro controller	7
2.	8051 Micro Controller Hardware: 2.1 Introduction 2.2 8051 micro controller hardware 2.3 8051 block diagram 2.4 Function of each block 2.5 8051 Programming model 2.6 8051 DIP Pin assignment 2.7 8051 oscillator and clock 2.8 Ceramic resonator oscillator circuit 2.9 Program counter and data pointer 2.10 A and B CPU registers 2.11 Flags and the program status word PSW 2.12 Internal memory 2.13 Internal RAM <ul style="list-style-type: none"> • Internal RAM organization 2.14 Stack and stack pointer 2.15 Special function registers 2.16 Internal ROM 2.17 Input / output Pins Ports and circuits <ul style="list-style-type: none"> • Port 0 Pin configuration • Port 1 pin configuration • Port 2 pin configuration • Port 3 pin configuration 2.18 External memory <ul style="list-style-type: none"> • Connecting external memory 2.19 Counters and timer <ul style="list-style-type: none"> • TCON and TMOD function registers 	8

	<ul style="list-style-type: none"> • TCON (Timer control) function registers • TMOD Time mode control Function Register • Timer counter interrupts • Timer mode 1, 2 & 3 2.20 Serial Data input / output 2.21 Interrupts <ul style="list-style-type: none"> • Introduction • Types of interrupts 	
3.	Moving Data: 3.1 Introduction 3.2 Addressing Modes 3.3 External Data Moves 3.4 Code memory Read-only Data Moves 3.5 Push and Pop opcodes 3.6 Data exchanges 3.7 Example programs	6
4.	Logical Arithmetic Operations: 4.1 Introduction 4.2 Byte Level Logical Operation 4.3 Bit Level Logical Operation 4.4 Rotate and Swap Operation 4.5 Flags 4.6 Incrementing and Decrementing 4.7 Additions 4.8 Subtraction 4.9 Multiplications and Division 4.10 Decimal Arithmetic 4.11 Example Programs 4.12 Jump and Call Program Range 4.13 Calls and Subroutines 4.14 Interrupts and Returns	7
5.	8051 Micro Controller Design: 5.1 Introduction 5.2 Micro controller specifications 5.3 A micro controller design <ul style="list-style-type: none"> • External memory and memory space decoding • Reset and clock circuit • Expanding I/O 5.4 Timing Subroutines 5.5 Lookup table for 8051 5.6 Serial data transmission	7
6.	Applications: 6.1 Introduction	7

	6.2 Interface keyboards to 8051 based micro controller 6.3 Interface LED & LCD display 6.4 Interface the micro controller system to A/D and D/A converters 6.5 8051 Data communications modes example programmes 6.6 Data acquisition systems	
	Total	42

Suggestive Implementation Strategies:

1) Microprocessor and Micro Controller

1. Demonstration
2. Transparencies
3. Seminar
 - i. Handouts
 - ii. Microprocessor kits
 - iii. Software with PC

2) 8051 Micro Controller Hardware

1. Demonstration
2. Transparencies
3. Group Discussion
 - i. Handouts
 - ii. Micro controller kit 8051
 - iii. Magazines

3) Moving Data

1. Demonstration
2. Transparencies
3. Seminar
 - i. Software with PC
 - ii. Handouts
 - iii. Programming with C

4) Logical and Arithmetic Operations

1. Demonstration
2. Transparencies
3. Practice Work
4. Seminar
 - i. Software with PC
 - ii. Handouts
 - iii. Programming

5) 8051 Micro Controller Design

1. Seminar
2. Group Discussion
3. Demonstration
 - i. Magazine
 - ii. Model

- iii. Reference Books

6) Applications

- 1. Industrial Visit
- 2. Demonstration
 - i. Magazines
 - ii. Handouts
 - iii. Models

<u>Laboratory Experiences:</u>	<u>Hrs.</u>
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1. 8051 Oscillator circuit and timing	2
2. Timer / counter control logic	2
3. External memory circuit	2
4. Interrupts circuits	2
5. Assembly language programming	2
6. Programming the 8051 - 8051 instruction syntax	2
7. Use commands to move data	2
8. Addition programming	2
9. Subtraction programming	2
10. Multiplication and division programming	2
11. Byte and bit logical operation	2
12. Interface LED display	2
13. A to D converter	2
14. D to A converter	2
Total	28

Reference Books:

- 1. The 8051 Micro controller Architecture, Programming and Applications, Kenneth J. Ayala.
- 2. Microprocessor and Micro controllers, B. P. Singh.

GUJARAT TECHNOLOGICAL UNIVERSITY

DIPLOMA IN BIO - MEDICAL ENGINEERING

Semester – V

Subject Code : 2350302

Subject Name : **Medical Imaging Technology**

Sr. No.	Subject Content	Hrs.
1.	Basic Physics of Radiology: 1.1 Electromagnetic radiation, types of radiation, wavelengths and properties 1.2 Introduction to X-rays 1.3 X-ray spectrum, properties, production techniques	7
2.	X-RAY Techniques: 2.1 Fluoroscopy : Image, performance parameters, and operating system with feedback control, specifications 2.2 Radiography: Image, contrast & image quality, MA, KV & seconds controls	8
3.	X-RAY Equipment : 3.1 Types of X-ray tubes (Stationary & Rotating Anodes), construction & specifications, operation; X-ray tube rating - electrical & thermal. 3.2 X-ray generator (1Ø & 3Ø) supply frequency, high frequency generator 3.3 Control circuit: High voltage (kv), filament control & tube current (mA), exposure timing & switching, interlocks of circuits 3.4 X-RAY machine: X-ray tube, head assembly, grid & collimators, X-ray table, Bucky trays, cassettes, dark room, film processing., technical specifications and block diagram	8
4.	Catheterization Laboratory: 4.1 Typical instrumentation layout in a Catheterization laboratory, 4.2 pressure measurements and application	5
5.	Image Intensifier and Angiography: 5.1 Types of fluoroscopy, image intensifier, television camera, image recording on VHS/VCD , Block diagram of fluoroscopy system. 5.2 Angiography techniques, block diagram.	8
6.	CT & MRI: 6.1 Principles of CT, CT numbers, X-ray detection & data acquisition. Block diagram of CT machine. 6.2 Basic Physics of MRI- NMR, MRI image, MRI scanner, block diagram	10

7.	Ultrasound: 7.1 Introduction, properties of ultrasound & its limitations, Ultrasound transducer & its types (Sequential/linear & phased array transducers), pulse-echo technique 7.2 Ultrasound imaging: - <ul style="list-style-type: none"> • A-scan, B-scan, TM-scans & real time B-scan. 7.3 Technical specifications, block diagram of ultrasound scanner.	10
	Total	56

Laboratory Experiences:

	Hrs
1. To Demonstrate front panel control and operation of Xray machine	2
2. To Identify components of x-ray machine and interconnection	2
3. To Identify of different P.C.B cards and their function, testing, circuit tracing	2
4. To perform Fault finding in x-ray machine	2
5. To Develop x-ray films in dark room	2
6. To perform Demonstration of front panel and rear panel control and operation of Ultrasonic machine.	2
7. To Identify different PCB cards used in the ultrasonic machine	2
8. To demonstrate performance of different Ultrasonic probes (sector and electronic)	2
9. To perform Demonstration and operation of computercontrolled ultrasonic scanner (Color Doppler)	2
10. To perform Troubleshooting of various common faults in Color Doppler Machine	2
11. To perform Demonstration of working of CT scanners in Hospital	2
12. To perform Demonstration Demonstration of MRI in Hospital diagnostic center	4
13. To study General fault finding and trouble shooting technique	2

Total	28

Reference Books:

1. Cheney's equipment for student radiographer- Peter Carter, Audry Paterson, Mike Thornton, Andrew Hyatt.
2. The physics of diagnostic imaging- A. Kenny, R. Eugene Johnnton.
3. Medical Electronics- A.G. Patil.
4. Introduction to physics of diagnostic radiology- Christen Sen's Thomas S. Curry Jamis E Dowdey Robert C.Murry.
5. Medical electrical equipment- Robert E. Molleoy.
6. Medical instrumentation application& design- John G. Webster, Eiditor.

GUJARAT TECHNOLOGICAL UNIVERSITY

DIPLOMA IN BIO - MEDICAL ENGINEERING

Semester – V

Subject Code : 2350303

Subject Name : Critical Care Instrumentation

Sr. No.	Subject Content	Hrs.
1.	Introduction to Critical Care: 1.1 Concepts of ICU, ICCU, NICU 1.2 General Design and layout 1.3 Draw the Gas piping layout.	6
2.	Patient Monitoring Systems & Telemetry: 2.1 Need of bed side & central monitoring system 2.2 Multi-parameter monitor 2.3 Technical specifications , block diagram & principle of operation of patient monitor and central monitoring system 2.4 Principle of telemetry & types 2.5 Technical specifications, block diagram & principle of operation of single & multi channel telemetry systems	8
3.	Defibrillator: 3.1 Fibrillation of heart, need of defibrillator, application techniques, instant & sync modes, types of electrodes 3.2 Technical specifications & principle of DC -Defibrillator 3.3 Simplified circuit diagrams of charging & discharging sections of DCDefibrillator	8
4.	Pacemaker: 4.1 Cardiac arrhythmias - Heart block and need of cardiac pacemaker 4.2 Types of pacemaker with its characteristics – Internal & external; fixed, demand driven and programmable 4.3 Endocardial & myocardial leads 4.4 Technical specifications, block diagrams, circuit diagrams of fixed internal pacemaker 4.5 Technical specifications, block diagram and principle of external pacemaker with fixed and demand modes	8
5.	Ventilator, Nebulizer and Suction Apparatus: 5.1 Anatomy & physiology of respiration & Apnea, need and application techniques of respirator / ventilator, nebulizer, suction apparatus and anesthesia apparatus	6

	5.2 Technical specifications constructional block diagram and principle of operation of ventilators/ respirator, nebulizer, suction apparatus and boils apparatus.	
6.	LIFE SUPPORT EQUIPMENT 6.1 Need of heart - lung machine, oxygenator, artificial heart pump and heat exchanger Inta-aurotic balloon pump 6.2 Working Principle, block diagram,application of heart - lung machine, oxygenator, artificial heart pump and heat exchanger Inta-aurotic balloon pump	6
	Total	42

Laboratory Experiences:

Hrs.

1. Study construction of pacemaker leads	6
2. Testing & measurement on external pacemaker with dummy patient	6
3. Study of construction of defibrillator assembly	6
4. Study of construction of defibrillator assembly	6
5. Testing of charging, discharging & energy control in dc defibrillators with instant & sync mode	6
6. Monitoring of ECG on patient and study of its controls	6
7. Temperature control characteristic of baby incubator	4
8. Installation and testing of single channel telemetry	6
9. To perform and testing of blood leak detector	6
10. Study of construction of bubble oxygenator	4

Total	56

Demonstration (Any Three):

1. Demonstration of suction apparatus
2. Demonstration of nebulizer
3. Demonstration of central monitor
4. Demonstration of boils apparatus / anesthesia system
5. Demonstration of hemodialysis system
6. Demonstration of ventilator

References Books:

1. Medical instrumentation application & design, John G. Webster, Editor.
2. Introduction to biomedical equipment technology, Carr Joseph J., Brown J.M.
3. Handbook of biomedical instrumentation, R. S. Khandpur.
4. Biomedical instrumentation & measurements, Lesli P Cromwell, Fred Jeibell, Erich A. Pfeiffer.
5. Medical Electronics, A.G. Patil.

GUJARAT TECHNOLOGICAL UNIVERSITY

DIPLOMA IN BIO - MEDICAL ENGINEERING

Semester – V

Subject Code : 2350304

Subject Name : **Therapeutic Medical Instrumentation**

Sr. No.	Subject Content	Hrs.
1.	Thermo and Laser Therapy: 1.1 Physics of IR & UV , Effect of IR & UV on human body, hyperemia, pain relief through IR & UV. 1.2 Construction & working of IR lamp. 1.3 Construction, assembly, circuit and principle of operation of UV lamp. 1.4 Application of lasers on human body, He -Ne & diode lasers, safety Aspects	7
2.	Ultrasound Therapy & Short Wave Diathermy: 2.1 Effect of ultrasound on human body 2.2 Construction of ultrasound therapy transducer 2.3 Technical specifications, circuit diagram & principal of operation of ultrasound therapy machine 2.4 Effect of SW on human body, capacitive & inductive field, applications techniques 2.5 Technical specifications, circuit diagram and principle of operation of short wave diathermy	7
3.	Electrotherapy: 3.1 Effect of electric current on nerves & muscles, stimulation of nerves & muscles. 3.2 Application techniques of electrotherapy, technical specifications, circuit diagram, principle of operation of nerve & muscle stimulator. 3.3 Principle of interference therapy.	7
4.	Traction & CPM (Continuous Passive Motion): 4.1 Need of traction unit 4.2 Construction, block diagram, principle of operation of cervical & lumbar traction units. 4.3 Continuous passive movement, introduction to knee & shoulder CPM units.	6
5.	Electro Surgery: 5.1 Effect of electric current on human tissue, principle of electro surgery, unipolar & bipolar modes.	8

	5.2 Methods of cutting & coagulation. 5.3 Technical specifications, circuit diagram & principle of operation of Valve type cautery. 5.4 Principle, technical specifications, block diagram of solid-state cautery machine. 5.5 Patient's safety in cautery machine. 5.6 Different types of cutting & coagulation electrodes	
6.	Infusion Pump: 6.1 Types of infusion pumps. 6.2 Working principle , constructional block diagram 6.3 Applications	7
7.	Dialysis Machine: 7.1 Need, type & Principle of dialysis. 7.2 Artificial kidney, 7.3 Function and working of dialyzer, Block diagram and working of hemo dialysis machine. Blood leak detector, portable kidney machine – working and flow diagram.	7
8.	Neonatal Therapy (Incubator): 8.1 Physiological heat balance, heat production and heat loss methods, phototherapy devices.	7
	Total	56

Laboratory Experiences:

	Hrs.
1. To perform Testing & study of UV lamp & its circuit.	6
2. To Study the construction of ultrasound therapy transducer.	4
3. To verify Performance testing of ultrasound therapy machine & study of its circuit.	4
4. To perform application technique of short wave diathermy in condenser/ inductive fields & its controls.	6
5. To observe various waveforms of nerve & muscle stimulator on dummy patient.	4
6. To demonstrate performance of electrodes of Electro-surgical Unit (ESU).	6
7. To verify the Performance testing of ESU on dummy patient with unipolar & bipolar modes.	6
8. To verify Performance testing of Generation & testing of coagulation/cutting waveforms of solid-state cautery.	4
9. To verify performance testing generation of IG & faradic waveforms using electronic circuit.	6
10. To verify Performance testing of Generation of 1MHz frequency waveform for ultrasound therapy using electronic circuit.	4
11. To demonstrate the performance of Infusion pump.	6
Total	----- 56

Reference Books:

1. Handbook of biomedical instrumentation R.S. Khandpur PUB: Tata Mcgraw- New Delhi
2. Introduction to biomedical equipment and technology Carr and Brown PUB: Pearson Education-Asia
3. Medical instrumentation John Webster. PUB: John Wiley and sons-New York.

GUJARAT TECHNOLOGICAL UNIVERSITY

DIPLOMA IN BIO - MEDICAL ENGINEERING

Semester – V

Subject Code : **2350305**

Subject Name : **Project - I**

Sr. No.	Subject Content
1.	Project search from industries/societies
2.	Selection and define project task
3.	Procuring circuit / diagram/engg. drawing
4.	Modification/construction/working as per requirement
5.	Surveying and procuring
6.	Developing printed circuit board and interfacing/ software development (if any)
7.	Cabinet Design, Front Panel Layout, Display, Switches and other components of application
8.	Testing and troubleshooting (hardware and software)
9.	Defending project with seminar

Project Work:

Project should be selected from the entire curriculum of subjects they have Studied and the students group (2 to 3 maximum) should do the following work for their project work.

Evaluation Based on:

1. Interest in project, involvement and interaction within group and outside
2. Building, testing hardware/software of project work
3. Seminar presentation with basic knowledge of the project and presentation ability