1902BM501	BIOMEDICAL EQUIPMENT'S	L	T	P	C
		3	0	0	3

Course Objectives:

1. To Introduce the various mechanical techniques that will help failing heart.
2. To study the functioning of the unit which does the clearance of urea from the blood.
3. To Understand the tests to assess the hearing loss and development of electronic devices to compensate for the loss.
4. To develop the various orthotics devices and prosthetic devices to overcome orthopedic problems.
5. To expose electrical stimulation techniques used in clinical applications

UNIT I	**CARDIAC ASSIST DEVICES**	**9 Hours**

Principle of External counter pulsation techniques, intra aortic balloon pump, Auxiliary ventricle and schematic for temporary bypass of left ventricle, prosthetic heart valves.

UNIT II	**HEMODIALYSERS**	**9 Hours**

Artificial kidney, Dialysis action, haemodialyser unit, membrane dialysis, portable dialyser monitoring and functional parameters

UNIT III	**HEARING AIDS**	**9 Hours**

Common tests – audiograms, air conduction, bone conduction, masking techniques, SISI, Hearing aids – principles, drawbacks in the conventional unit, DSP based hearing aids.

UNIT IV	**PROSTHETIC AND ORTHODIC DEVICES**	**9 Hours**

Hand and arm replacement – different types of models, externally powered limb prosthesis, feedback in orthodic system, functional electrical stimulation, sensory assist devices.

UNIT V	**RECENT TRENDS**	**9 Hours**

Transcutaneous electrical nerve stimulator, bio-feedback.

Total:	**45 Hours**

Further Reading:

- Learn about ECG,EEG and its applications

Course Outcomes:

On successful completion of the course, the student will be able to:

1. Explain the functioning and usage of electromechanical units which will restore normal functional ability of particular organ that is defective temporarily or permanently.
2. Understand what is meant by assistive technology
3. Recognise different forms of assistive technology
4. Understand some students" experiences of using assistive technology.
5. Discuss the Importance of Recent Technologies.

(Skill development / Entrepreneurship)

Text Books:

1. John G. Webster, —Medical Instrumentation Application and Design‖, 4th edition, Wiley India PvtLtd,New Delhi, 2015.
2. Joseph J. Carr and John M. Brown, —Introduction to Biomedical Equipment Technology‖, Pearson education, 2012.

References:

1. Levine S.N. (ed), "Advances in Bio-medical Engineering and Medical physics", Vol. I, II, IV, inter university publications, New York, 1968 (Unit I, IV, V).
2. Kopff W.J, "Artificial Organs", John Wiley and sons, New York, 1976. (Unit II).
3. Albert M.Cook and Webster J.G, "Therapeutic Medical Devices", Prentice Hall Inc., New Jersey,1982 (Unit III).
4. D.S. Sunder, "Rehabilitation Medicine", 3rd Edition, Jaypee Medical Publication, 2010

ATTESTED
Dr. S. RAMABALAN, M.E., Ph.D.,
PRINCIPAL
E.G.S. Pillay Engineering College,
Thethi, Nagore - 611 002.
Nagapattinam (Dt) Tamil Nadu.

1902BM502	MEDICAL OPTICS	L	T	P	C
		3	0	0	3

Course Objectives:

1. To Discuss the optical properties of the tissues and the interactions of light with tissues.
2. To understand the instrumentation and components in Medical Optics.
3. To describe the Medical Lasers and their applications
4. To explain the optical diagnostic applications
5. To know the emerging optical diagnostic and therapeutic techniques

UNIT I	OPTICAL PROPERTIES OF THE TISSUES	9 Hours

Refraction, Scattering, absorption, light transport inside the tissue, tissue properties, Light interaction with tissues, optothermal interaction, fluorescence, speckles.

UNIT II	INSTRUMENTATION IN PHOTONICS	9 Hours

Instrumentation for absorption, scattering and emission measurements, excitation light sources – high pressure arc lamp, solid state LEDs, Lasers, optical filters, polarizer, solid state detectors, time resolved and phase resolved detectors.

UNIT III	APPLICATIONS OF LASERS	9 Hours

Lasers in ophthalmology, Dermatology, Dentistry, Urology, Otolaryngology, Tissue welding and Soldering.

UNIT IV	OPTICAL TOMOGRAPHY	9 Hours

Optical coherence tomography, Elastrography, Doppler optical coherence tomography, Application towards clinical imaging.

UNIT V	SPECIAL OPTICAL TECHNIQUES	9 Hours

Near field imaging of biological structures, in vitro clinical diagnostic, fluorescent spectroscopy, photodynamic therapy.

Total:	45 Hours

Further Reading:

- Learn about laser Characteristics as applied to medicine and biology
- Non thermal diagnostic applications

Course Outcomes:

At the end of the course, the students should be able to:

1. Demonstrate knowledge of the fundamentals of optical properties of tissues – (skill development)
2. Analyze the components of instrumentation in Medical Photonics and Configurations
3. Describe surgical applications of lasers.
4. Describe photonics and its diagnostic applications. – (skill development)
5. Investigate emerging techniques in medical optics

Text Books:

1. Tuan Vo Dirh, —Biomedical Photonics – Handbook‖, CRC Press, Bocaraton, 2014.
2. Paras N. Prasad, —Introduction to Biophotonics‖, A. John Wiley and Sons, Inc. Publications, 2003

References:

1. Markolf H.Niemz, —Laser-Tissue Interaction Fundamentals and Applications‖, Springer, 2007
2. G.David Baxter —Therapeutic Lasers – Theory and practice‖, Churchill Livingstone publications Edition-2001.
3. Leon Goldman, M.D., & R.James Rockwell, Jr., —Lasers in Medicine‖, Gordon and Breach, Science Publishers Inc., 1975.

ATTESTED

Dr. S. RAMABALAN, M.E., Ph.D.,
PRINCIPAL
E.G.S. Pillay Engineering College,
Thethi, Nagore - 611 002.
Nagapattinam (Dt) Tamil Nadu.

1902BM503	MICROPROCESSOR AND ITS APPLICATIONS	L	T	P	C
		3	2	0	3

Course Objectives:

1. To introduce the basic concepts of microprocessor
2. To explain the knowledge of Programming of 8085 processor
3. To educate the fundamentals of Peripheral Interfacing.
4. To describe about the RISC Processor, ARM Processor
5. To gain the basic knowledge about advanced processors

UNIT I **MICROPROCESSOR-8085** **9 Hours**

Evolution & Importance of microprocessor, Microprocessor-8085: Functional block diagram - Signals– Memory interfacing – I/O ports and data transfer concepts – Timing Diagram – Interrupt structure, 8086 Architecture

UNIT II **PROGRAMMING OF 8085 PROCESSOR** **9 Hours**

Instruction format and addressing modes – Assembly language format – Data transfer, data manipulation & control instructions – Programming: Loop structure with counting & Indexing - Look up table - Subroutine instructions stack.

UNIT III **PERIPHERAL INTERFACING** **9 Hours**

Interfacing: Memory- and I/O- interfacing- Programmable Peripheral Interface (PPI)-8255:Pin diagram, block diagram, and operating modes- USART: Pin diagram, block diagram, and command word- Programmable Interrupt Controller (PIC)-8259A: Pin diagram, block diagram, interrupt sequence, and cascading- Keyboard/Display Controller-8279: Pin diagram, block diagram, operating modes.

UNIT IV **ARCHITECTURE OF ADVANCED PROCESSORS** **9 Hours**

Multiprocessor configurations – Intel 80286 – Internal Architectural – Register Organization – Internal Block Diagram – Architectural features and Register Organization of i386, i486 and Pentium processors. ARM architecture.

UNIT V **APPLICATIONS IN MEDICINE** **9 Hours**

Mobile phone based bio signal recording, microprocessor based vision architecture for integrated diagnostic helping devices, Microprocessor based remote health monitoring system: Concept and systems, and system operation.

Total: **45 Hours**

Further Reading:

- Intel Core i3, i5 and i7

Course Outcomes:

On successful completion of the course, the student will be able to:

1. Apply knowledge of microprocessor based systems and interfacing techniques.
2. Identify CPU and memory timing parameters.
3. Draw a bus timing diagram for a simplex CPU-memory interface – (Employability | Entrepreneurship)
4. Identify the critical read and write cycle paths on a bus timing diagram.

Text Books:

1. Sunil Mathur &Jeebananda Panda, "Microprocessor and Microcontrollers", PHI Learning Pvt. Ltd, 2016.
2. R.S. Gaonkar, „Microprocessor Architecture Programming and Application", with 8085, Wiley Eastern Ltd., New Delhi, 2013.
3. Muhammad Ali Mazidi & Janice Gilli Mazidi, R.D.Kinely „The 8051 Micro Controller and Embedded Systems", PHI Pearson Education, 5th Indian reprint, 2003.

References:

1. Douglas V Hall, "Microprocessors and interfacing, programming and hardware" TMH, 2006.
2. Ramesh S.Gaonkar "Microprocessor architecture, programming and its application with 8085", Penram Int. Pub. (India), Fifth edition, 2002.
3. Roy A.K, Bhurchandi K.M," "Intel Microprocessors Architecture, Programming and Interfacing", McGraw Hill International Second Edition, 2006.
4. Kenneth J. Ayala, "The 8086 Microprocessor: Programming & Interfacing The PC", Delmar Publishers, 2007.
5. A. K. Ray & K. M. Bhurchandi, "Advanced Microprocessors and peripherals- Architectures, Programming and Interfacing", TMH, 2002 reprint.

ATTESTED

Dr. S. RAMABALAN, M.E., Ph.D.,
PRINCIPAL
E.G.S. Pillay Engineering College,
Thethi, Nagore - 611 002.
Nagapattinam (Dt) Tamil Nadu.

1902BM504	BIOMEDICAL DIGITAL SIGNAL PROCESSING	L	T	P	C
		3	0	0	4

Course Objectives:

1. To study about a programmable Digital signal processor.
2. To learn discrete Fourier transform, properties and its computation
3. To know the characteristics of IIR filter and to learn the design of IIR filters for filtering undesired signals.
4. To Introduce the time frequency signal analysis methods
5. To understand Data reduction techniques

UNIT I	CLASSIFICATION OF SIGNALS AND SYSTEMS	9 Hours

Concept of signals - Classification of signals - Singularity functions - Classification of systems Representation of systems

UNIT II	DISCRETE FOURIER TRANSFORM AND COMPUTATION	9 Hours

Discrete Fourier Transform- properties, magnitude and phase representation -Computation of DFT using FFT algorithm – DIT &DIF using radix 2 FFT – Butterfly structure.

UNIT III	CONCEPTS OF DIGITAL FILTERING	9 Hours

Digital filters -Basics of signal averaging, Signal averaging as a digital filter FIR filter - IIR filter - Adaptive filters - Comparison of filters

UNIT IV	TIME FREQUENCY SIGNAL ANALYSIS METHODS	9 Hours

Trigonometric Fourier series -Fourier transform- Correlation- Convolution- Frequency domain analysis of ECG signal- Basic concept of wavelet - Wavelet transform- Applications of wavelet transform in biomedical instruments

UNIT V	DATA REDUCTION TECHNIQUES	9 Hours

Data reduction techniques -Types of data reduction techniques -Redundancy - Irrelevancy removal

Total:	45+15 Hours

Further Reading:

- Compare the digital filters over analog filters
- Apply the data reduction techniques in biomedical field.

Course Outcomes:

After completion of the course, Student will be able to:

1. Gain the knowledge about DSP Processors.
2. Apply DFT for the analysis of digital signals & systems. (Skill development / Employability)
3. Design of IIR filters for filtering undesired signals.
4. Describe the time frequency signal analysis methods (skill development / Employability)
5. Discuss the importance of Data reduction techniques.

Text Books:

1. John G. Proakis & Dimitris G.Manolakis, —Digital Signal Processing – Principles, Algorithms & Applications‖, Fourth Edition, Pearson Education / Prentice Hall, 2007.
2. Allan V.Oppenheim, S.Wilsky and S.H.Nawab, —Signals and Systems‖, Pearson, 2015

References:

1. Salivahanan S. ,Vallavaraj A., Gnanapriya C, Digital Signal Processing, Tata McGraw- Hill, New Delhi, 2008.
2. S.K. Mitra, „Digital Signal Processing – A Computer Based Approach", McGraw Hill Edu, 2013.
3. RangayannRangraj M, Biomedical Signal Analysis, IEEE Press, New York, 2002.
4. Tompkins Willis J., Biomedical Digital Signal Processing, PHI Learning, New Delhi, 2001
5. NajarianKayvan, Biomedical Signal and Image Processing, CRC Press, 2009

ATTESTED

Dr. S. RAMABALAN, M.E., Ph.D.,
PRINCIPAL
E.G.S. Pillay Engineering College,
Thethi, Nagore - 611 002.

1902BM505 **BIO PROCESS CONTROL**

L	T	P	C
3	0	0	3

Course Objectives:

1. To introduce technical terms and nomenclature associated with Process control domain
2. To familiarize the students with characteristics, selection, sizing of control valves.
3. To provide an overview of the features associated with Industrial type PID controller.
4. To make the students understand the various PID tuning methods.
5. To elaborate different types of control schemes such as cascade control, feed forward control and Model Based control schemes.

UNIT I PROCESS MODELLING AND DYNAMICS **9 Hours**

Need for process control – Mathematical Modeling of Processes: Level, Flow, Pressure and Thermal processes – Continuous and batch processes – Self regulation – Servo and regulatory operations – Lumped and Distributed parameter models – Heat exchanger – CSTR .

UNIT II FINAL CONTROL ELEMENTS **9 Hours**

Actuators: Pneumatic and electric actuators – Control Valve Terminology - Characteristic of Control Valves: Inherent and Installed characteristics - Valve Positioner – Modeling of a Pneumatically Actuated Control Valve – Control Valve Sizing: ISA S 75.01 standard flow equations for sizing Control Valves – Cavitation and flashing – Control Valve selection

UNIT III CONTROL ACTIONS **9 Hours**

Characteristic of ON-OFF, Proportional, Single speed floating, Integral and Derivative controllers – P+I, P+D and P+I+D control modes – Practical forms of PID Controller – PID Implementation Issues: Bumpless, Auto/manual Mode transfer, Anti-reset windup Techniques – Direct/reverse action.

UNIT IV PID CONTROLLER TUNING **9 Hours**

PID Controller Design Specifications: Criteria based on Time Response and Criteria based Frequency Response - PID Controller Tuning: Z-N and Cohen-Coon methods, Continuous cycling method and Damped oscillation method, optimization methods, Auto tuning – Cascade control – Feed-forward control

UNIT V MODEL BASED CONTROL SCHEMES **9 Hours**

Smith Predictor Control Scheme - Internal Model Controller – IMC PID controller — Three element Boiler drum level control - Introduction to Multi-loop Control Schemes – Control Schemes for CSTR, and Heat Exchanger - P&ID diagram.

Total: 45 Hours

Further Reading:

- Bio receptors and Bio detectors
- DNA Sequencing with nano pores

Course Outcomes:

1. Ability to understand technical terms and nomenclature associated with Process control domain. — (Skill development Entrepreneurship)
2. Ability to build models using first principles approach as well as analyze models. — ment
3. Ability to Design, tune and implement PID Controllers to achieve desired performance for various processes
4. Ability to Analyze Systems and design & implement control Schemes for various Processes. — (Skill development Entrepreneurship)
5. Ability to Identify, formulate and solve problems in the Process Control Domain

ATTESTED

Dr. S. RAMABALAN, M.E., Ph.D.,
PRINCIPAL
E.G.S. Pillay Engineering College,
Thethi, Nagore - 611 002.
Nagapattinam (Dt) Tamil Nadu.

1902BM551	BIOMEDICAL DIGITAL SIGNAL PROCESSING LABORATORY	L	T	P	C
		0	0	4	2

Course Objectives:

1. To make the students understand the behavior and response of the filter using different methods
2. To study the output response of the system, sampling rate conversion and FFT spectrum
3. To know the generation of the signals and arithmetic operations using TMS320C5X DSP Processor.
4. To compute the convolution and correlation of signals using DSP"s
5. To Implement the IIR filter using DSP"s

List of Experiments:

1. Generation of Signals
2. Properties of Discrete time Systems-Linearity, Stability, Causality &Time Variance.
3. Sampling of an audio signal with different sampling rate and reconstruct the sampled signal.
4. Computation of DFT of a signal using basic equation and FFT & power spectrum estimation using DFT
5. Design and Simulation of IIR filters.
6. Design and Simulation of FIR filters
7. Multirate signal processing-Down sampling , Up sampling , Decimation and Interpolation
8. Arithmetic operations in DSPs
9. Generation of waveforms using DSPs
10. Computation of convolution and correlation between signals using DSPs
11. Implementation of IIR Filters using DSPs
12. Implementation of FIR Filters using DSPs

Additional Experiments:

1. Basic experiments using ADSP processor

Course Outcomes:

After completion of the course, Student will be able to:

1. Design of digital filter and Generation of various signals, Analysis of signal and system properties. – (Skill development employability)
2. Computation of circular and linear convolution.
3. Determine the frequency transformation and Analysis of sampling rate.
4. Design of digital filters.
5. Analyze the power spectral density of the system.

References:

1. J.G. Proakis and D.G. Manolakis, „Digital Signal Processing Principles, Algorithms and Applications", Pearson Education, New Delhi, PHI. 2003.
2. S.K. Mitra, „Digital Signal Processing – A Computer Based Approach", McGraw Hill Edu, 2013.
3. B.Venkataramani and M.Bhaskar, "Digital Signal Processors – Architecture, Programming and Applications" – Tata McGraw – Hill Publishing Company Limited. New Delhi, 2003.

ATTESTED

Dr. S. RAMABALAN, M.E., Ph.D.,
PRINCIPAL
E.G.S. Pillay Engineering College,
Thethi, Nagore - 611 002.
Nagapattinam (Dt) Tamil Nadu.

1902BM552	BIOSENSORS AND TRANSDUCERS LAB	L	T	P	C
		0	0	4	2

Course Objectives:

1. To display and record signals using CRO.
2. To implement digital to analog converter.
3. To analyse step response of a thermometer and measure temperature using various temperature transducers.
4. To measure displacement using various displacement transducers.
5. To measure pressure using a pressure transducer.
6. To measure pH of a solution using pH electrodes

List of Experiments:

1. Study of Front panel of CRO
2. A to D converter
3. To study the dynamic behaviour of thermometer system.
4. To study the characteristics of a thermistor
5. To study thermistor linearization.
6. To study the characteristics of a light dependent resister.
7. To study the principle and working of a thermocouple
8. To study principle and working of LVDT
9. To study principle and working of a capacitive Transducer.
10. To study principle and working of a strain gage sensor.

Additional Experiments:

1. To study principle and working of a pressure sensor.
2. To study pH electrode.

Course Outcomes:

After completion of the course, Student will be able to:

1. Record and display signals using CRO.
2. Measure pH of a solution using pH electrodes.
3. Convert analog data into digital form → (Skill development / Employability)
4. Analyse step response of a thermometer and measure temperature using various temperature transducers.
5. Measure displacement using various displacement transducers
6. Measure pressure using a pressure transducer → (Skill development / Employability)

REFERENCES:

1. Principles of applied Biomedical Instrumentation by La Geddes and L.E. Baker..
2. Biomedical Instrumentation and Measurement by Leslie Cromwell, Fred. J. Weibell and Pfeiffer
3. Principles of Biomedical Instrumentation and Measurement, Richard Aston, Merril Publishing Co., Columbus, 1990.

ATTESTED
Dr. S. RAMABALAN, M.E., Ph.D.,
PRINCIPAL
E.G.S. Pillay Engineering College,
Thethi, Nagore - 611 002.
Nagapattinam (Dt) Tamil Nadu.

1904BM553	Microprocessor and its Applications Laboratory	L	T	P	C
		0	0	4	2

Course Objectives:

1. To Write ALP for arithmetic and logical operations in 8085
2. To Explain ALP for arithmetic and logical operations in 8086
3. To Differentiate Serial and Parallel Interface
4. To Interface different I/Os with Microprocessors
5. To experiment on Arduino processor.

8085 Programs using kits

1. Basic arithmetic and Logical operations
2. Sorting and Searching the given data.

8086 Programs using kits with MASM

3. Floating point operations

Peripherals and Interfacing Experiments

4. Traffic light control
5. Stepper motor and DC Motor control
6. Key board and Display
7. Serial interface and Parallel interface
8. Printer Interfacing
9. A/D and D/A interface and Waveform Generation

Total: 45 Hours

AdditionalExperiments:

10. Basic experiments using Arduino processor

Course Outcomes:

After completion of the course, Student will be able to:

1. Write ALP Programmes for fixed and Floating Point and Arithmetic
2. Interface different I/Os with processor — (Skill development | Employability | Entrepreneurship)
3. Generate waveforms using Microprocessors
4. Explain the difference between simulator and Emulator

References:

1. Ramesh Gaonkar "Microprocessor Architecture, Programming, and Applications with the 8085"- 5th edition Penram International Publishing-2000.
2. A. K. Ray & K. M. Bhurchandi, "Advanced Microprocessors and peripherals- Architectures, Programming and Interfacing", TMH, 2002 reprint.

ATTESTED

Dr. S. RAMABALAN, M.E., Ph.D.,
PRINCIPAL
E.G.S. Pillay Engineering College,
Thethi, Nagore - 611 002.
Nagapattinam (Dt) Tamil Nadu.

1904GE551	LIFE SKILLS: APTITUDE - I	L	T	P	C
		0	0	2	1

Course Objectives:

1. To brush up problem solving skill and to improve intellectual skill of the students
2. To be able to critically evaluate various real life situations by resorting to Analysis Of key issues and factors
3. To be able to demonstrate various principles involved in solving mathematical problems and thereby reducing the time taken for performing job functions.
4. To enhance analytical ability of students
5. To augment logical and critical thinking of Student

UNIT I	INTRODUCTION TO NUMBER SYSTEM, BASIC SHORTCUTS OF ADDITION, MULTIPLICATION, DIVISION	5 Hours

Classification of numbers – Types of Numbers - Divisibility rules - Finding the units digit - Finding remainders in divisions involving higher powers - LCM and HCF Models - Fractions and Digits – Square, Square roots – Cube, Cube roots – Shortcuts of addition, multiplication, Division.

UNIT II	RATIO AND PROPORTION, AVERAGES	5 Hours

Definition of Ratio - Properties of Ratios - Comparison of Ratios - Problems on Ratios - Compound Ratio - Problems on Proportion, Mean proportional and Continued Proportion Definition of Average - Rules of Average - Problems on Average - Problems on Weighted Average - Finding average using assumed mean method.

UNIT III	PERCENTAGES, PROFIT AND LOSS	5 Hours

Introduction Percentage - Converting a percentage into decimals - Converting a Decimal into a percentage - Percentage equivalent of fractions - Problems on percentages - Problems on Profit and Loss percentage- Relation between Cost Price and Selling price - Discount and Marked Price - Two different articles sold at same Cost Price - Two different articles sold at same Selling Price - Gain% / Loss% on Selling Price.

UNIT IV	CODING AND DECODING, DIRECTION SENSE	5 Hours

Coding using same set of letters - Coding using different set of letters - Coding into a number - Problems on R-model - Solving problems by drawing the paths - Finding the net distance travelled - Finding the direction - Problems on clocks - Problems on shadows - Problems on direction sense using symbols and notations.

UNIT V	NUMBER AND LETTER SERIES NUMBER AND LETTER ANALOGIES, ODD MAN OUT	5 Hours

Difference series - Product series - Squares series - Cubes series - Alternate series - Combination series - Miscellaneous series - Place values of letters - Definition of Analogy - Problems on number analogy - Problems on letter analogy - Problems on verbal analogy - Problems on number Odd man out - Problems on letter Odd man out - Problems on verbal Odd man out

	Total:	30 Hours

ASSESSMENT PATTERN :

1. Two tests will be conducted (25 * 2) - 50 marks
2. Five assignments will be conducted (5*10) - 50 Marks

ATTESTED

Dr. S. RAMABALAN, M.E., Ph.D.,
PRINCIPAL
E.G.S. Pillay Engineering College,
Thethi, Nagore - 611 002.
Nagapattinam (Dt) Tamil Nadu.

Course Outcomes:

After completion of the course, Student will be able to:

1. Learners should be able to understand number and solving problems least time using various shortcut – (Employability)
2. Solve problems on averages; compare two quantities using ratio and proportion.
3. Calculate concept of percentages, implement business transactions using profit and loss. – (Employability)
4. Workout concepts of Coding and Decoding, ability to visualize directions and understand the logic behind a sequence.
5. Learners should be able to find a series the logic behind a sequence.

References:

1. Arun Sharma, „How to Prepare for Quantitative Aptitude for the CAT", 7th edition, McGraw Hills publication, 2016.
2. Arun Sharma, „How to Prepare for Logical Reasoning for CAT", 4th edition, McGraw Hills publication, 2017.
3. R S Agarwal, „A modern approach to Logical reasoning", revised edition, S.Chand publication, 2017.
4. R S Agarwal, „Quantitative Aptitude for Competitive Examinations", revised edition, S.Chand publication, 2017.
5. Rajesh Verma, "Fast Track Objective Arithmetic", 3rd edition, Arihant publication, 2018.
6. B.S. Sijwalii and InduSijwali, "A New Approach to REASONING Verbal & Non-Verbal", 2nd edition, Arihnat publication, 2014.

ATTESTED

Dr. S. RAMABALAN, M.E., Ph.D.,
PRINCIPAL
E.G.S. Pillay Engineering College,
Thethi, Nagore - 611 002.
Nagapattinam (Dt) Tamil Nadu.

1901BM601		Diagnostic and Therapeutic Equipment - I	L	T	P	C
			3	2	0	3

Course Objectives:

1. To Gather basic knowledge about measurements of parameters related to respiratory system
2. To Learn measurement techniques of sensory responses
3. To Understand different types and uses of diathermy units
4. To Know ultrasound imaging technique and its use in diagnosis
5. To discuss the importance of patient safety against electrical hazard

Unit I	CARDIAC EQUIPMENT	9 Hours

Electrocardiograph, Normal and Abnormal Waves, Heart rate monitor, Holter Monitor, Phonocardiography, ECG machine maintenance and troubleshooting, Cardiac PacemakerInternal and External Pacemaker– Batteries, AC and DC Defibrillator- Internal and External,Defibrillator Protection Circuit, Cardiac ablation catheter

Unit II	NEUROLOGICAL EQUIPMENT	9 Hours

Clinical significance of EEG, Multi-channel EEG recording system, Epilepsy, Evoked Potential– Visual, Auditory and Somatosensory, MEG (Magneto Encephalo Graph). EEG Bio Feedback Instrumentation. EEG system maintenance and troubleshooting.

Unit III	MUSCULAR AND BIOMECHANICAL MEASUREMENTS	9 Hours

Recording and analysis of EMG waveforms, fatigue characteristics, Muscle stimulators, nerve stimulators, Nerve conduction velocity measurement, EMG Bio Feedback Instrumentation. Static Measurement – Load Cell, Pedobarograph. Dynamic Measurement – Velocity, Acceleration, GAIT, Limb position.

Unit IV	RESPIRATORY MEASUREMENT SYSTEM	9 Hours

Instrumentation for measuring the mechanics of breathing – Spirometer -Lung Volume and vital capacity, measurements of residual volume, Pneumotachometer – Airway resistance measurement, Whole body Plethysmograph, Intra-Alveolar and Thoracic pressure measurements, Apnoea Monitor. Types of Ventilators – Pressure, Volume, and Time controlled. Flow, Patient Cycle Ventilators, Humidifiers, Nebulizers, Inhalators.

Unit V	SENSORY MEASUREMENT	9+3 Hours

Psychophysiological Measurements – polygraph, basal skin resistance (BSR), galvanic skin resistance (GSR), Sensory responses - Audiometer-Pure tone, Speech, Eye Tonometer, Applanation Tonometer, slit lamp, auto refractometer.

	Total:	45 Hours

Further Reading:

Understand the concepts of ultrasound equipment
Identify the electrical hazards and Implement methods of patient safety.

Course Outcomes:

After the Completion of the course, the student will be able to

1. Describe the measurement techniques of sensory responses
2. Analyse different types and uses of diathermy units
3. Discuss ultrasound imaging techniques and its usefulness in diagnosis
4. Outline the importance of patient safety against electrical hazard
5. Explain about measurements of parameters related to respiratory system

(Skill development / Employability / Entrepreneurship)

Text books:

1. John G. Webster, —Medical Instrumentation Application and Designl, 4th edition, Wiley India PvtLtd,New Delhi, 2015.
2. Joseph J. Carr and John M. Brown, —Introduction to Biomedical Equipment Technologyl, Pearson education, 2012.

ATTESTED
Dr. S. RAMABALAN, M.E., Ph.D.,
PRINCIPAL
E.G.S. Pillay Engineering College,
Thethi, Nagore - 611 002.
Nagapattinam (Dt) Tamil Nadu.

1902BM602	Analog and Digital Communication	L	T	P	C
		3	0	0	3

Course Objectives:

1. To understand the building blocks of digital communication system.
2. To understand the building blocks of Angle modulation
3. To apply mathematical background for communication signal analysis.
4. To understand and analyze the signal flow in a digital and analog communication system.
5. To analyze error performance of a digital communication system in presence of noise and other interferences

Unit I	AMPLITUDE MODULATION	9 Hours

Introduction to communication system-Need for modulation - Amplitude modulation -Signals and Spectral Analysis of AM, DSB-SC, SSB & VSB- Modulators and transmitters - signal-to- noise ratio (SNR) calculations for amplitude modulation (AM) -Receivers for continuous wave modulation - Super heterodyne Receivers. Digital Multiplexers (TDM,FDM).

Unit II	ANGLE MODULATION	9 Hours

Basic concepts of frequency modulation .single tone frequency modulation, spectrum Analysis of sinusoidal FM wave -Narrow band FM -Wide band FM, Constant Average power Transmission band width of FM wave - comparison of FM and PM-Generation and Detection of FM and PM-Source- Noise, Frequency-domain Representation of Noise ,Superposition of Noises, Linear Filtering of Noise.

Unit III	BASE BAND PULSE TRANSMISSION	9 Hours

Sampling and Quantization process, Binary, M-ary systems, bits and symbols, textual encoding-PCM- Delta Modulation and types, base band pulse transmission, ISI and Nyquist criterion, Generation, Detection, Signal space diagram, bit error probability -Bit error rate(BER),Additive white Gaussian noise (AWGN) and its effects on BER.

Unit IV	PASS BAND PULSE TRANSMISSION	9 Hours

Amplitude Shift Keying (ASK) – Frequency Shift Keying (FSK) Minimum Shift Keying (MSK) –Phase Shift Keying (PSK) – BPSK – QPSK – 8 PSK – 16 PSK - Quadrature Amplitude Modulation (QAM) – 8 QAM – 16 QAM – Bandwidth Efficiency– Comparison of various Digital Communication System (ASK– FSK – PSK – QAM).

Unit V	SPREAD SPECTRUM SYSTEMS	9 Hours

Review of digital communication concepts, direct sequence and frequency hop spread spectrum systems. Hybrid direct sequence/frequency hop spread spectrum. Complex envelop representation of spread spectrum signals. Sequence generator fundamentals, Maximum length sequences. Gold and Kasami codes, Nonlinear Code generators. Spread spectrum communication system model, Performance of spread spectrum signals in jamming environments, Performance of spread spectrum communication systems with and without forward error correction. Diversity reception in fading channels, Cellular radio concept

	Total:	45 Hours

Further Reading:

Understand concept of spread spectrum communication system

Course Outcomes:

On successful completion of the course, the student will be able to

1. Describe and analyse the mathematical techniques of generation, transmission and reception of amplitude modulation (AM) , frequency modulation (FM) and phase modulation (PM) signals.
2. Evaluate the performance levels (Signal-to-Noise Ratio) of AM, FM and PM systems

ATTESTED
Dr. S. RAMABALAN, M.E., Ph.D.
PRINCIPAL
E.G.S. Pillay Engineering College
Thethi, Nagore - 611 002.
Nagapattinam (Dt) Tamil Nadu

→ Skill development / Employability

(Skill development/ Employability)

		in the presence of additive white noise.
	3.	Convert analog signals to digital format using sampling and quantization techniques.
	4.	Describe and analyse the methods of transmission of digital data using baseband and carrier modulation techniques.
	5.	Evaluate the performance level (Signal-to-Noise Ratio) of digital data transmission (binary PCM) in the presence of additive white noise.

Text books:

1. Wayne Tomasi, —Advanced Electronic Communication Systems‖, 6th Edition, Pearson Education, 2009.

References:

1. Principles of Communication Systems – H Taub & D. Schilling, Gautam Sahe. TMH, 2007 III Edition
2. Principles of Communication Systems - Simon Haykin. John Wiley, II Edition.
3. John G.Proakis, "Digital Communication" McGraw Hill 3rd Edition, 2008. 6.
4. Sam K.Shanmugam "Analog & Digital Communication" John Wiley.2006 .
5. Taub& Schilling, "Principles of Digital Communication " Tata McGraw-Hill" 28th Reprint, 2003.
6. . Bernard Sklar, "Digital Communication, Fundamental and Application" Pearson Education Asia, 2nd Edition, 2001.
7. Lathi B.P., "Modern Digital and Communication Systems", Holt and Reinhart Publishers, 1995.
8. R. L. Peterson, R. E. Zeimer and D. E. Borth, "Introduction to Spread Spectrum Communications", Pearson, 1995

ATTESTED
Dr. S. RAMABALAN, M.E., Ph.D.
PRINCIPAL
E.G.S. Pillay Engineering College,
Thethi, Nagore - 611 002.
Nagapattinam (Dt) Tamil Nadu.

1902BM603		Biomaterials	L	T	P	C
			3	0	0	3

Course Objectives:	The student should be made to:	
	1. To Learn characteristics and classification of Biomaterials	
	2. Tio Understand different metals, ceramics and its nanomaterials characteristics as biomaterials	
	3. To Learn polymeric materials and its combinations that could be used as a tissue replacement implants	
	4. To Get familiarized with the concepts of Nano Science and Technology	
	5. To Understand the concept of biocompatibility and the methods for biomaterials testing	
Unit I	**INTRODUCTION TO BIO-MATERIALS**	**9 Hours**
Definition and classification of bio-materials, mechanical properties, visco elasticity, biomaterial performance, body response to implants, wound healing, blood compatibility, Nano scale phenomena.		
Unit II	**METALLIC AND CERAMIC MATERIALS**	**9 Hours**
Metallic implants – Stainless steels, co-based alloys, Ti-based alloys, shape memory alloy, nanostructured metallic implants, degradation and corrosion, ceramic implant – bio inert, biodegradable or bioresorbable, bioactive ceramics, nanostructured bio ceramics.		
Unit III	**POLYMERIC IMPLANT MATERIALS**	**9 Hours**
Polymerization, factors influencing the properties of polymers, polymers as biomaterials, biodegradable polymers, Bio polymers: Collagen, Elastin and chitin. Medical Textiles, Materials for ophthalmology: contact lens, intraocular lens. Membranes for plasma separation and Blood oxygenation, electro spinning: a new approach.		
Unit IV	**TISSUE REPLACEMENT IMPLANTS**	**9 Hours**
Small intestinal sub mucosa and other decullarized matrix biomaterials for tissue repair: Extra cellular Matrix. Softtissue replacements, sutures, surgical tapes, adhesive, Percutaneous and skin implants, maxillofacial augmentation, Vascular grafts, hard tissue replacement Implants, joint replacements, tissue scaffolding and engineering using Nano biomaterials.		
Unit V	**TESTING OF BIOMATERIALS**	**9 Hours**
Biocompatibility, blood compatibility and tissue compatibility tests, Toxicity tests, sensitization, carcinogenicity, mutagenicity and special tests, Invitro and Invivo testing; Sterilisation of implants and devices: ETO, gamma radiation, autoclaving. Effects of sterilization.		
	Total:	**45 Hours**

Further Reading:	
Biopolymers	
Course Outcomes:	
	At the end of the course, the student should be able to
	1. Analyze different types of Biomaterials and its classification and apply the concept of nanotechnology towards biomaterials use.
	2. Identify significant gap required to overcome challenges and further development in metallic and ceramic materials
	3. Identify significant gap required to overcome challenges and further development in polymeric materials – (Skill development/ Employability)
	4. Create combinations of materials that could be used as a tissue replacement implant.
	5. Understand the testing standards applied for biomaterials. – (Skill development/ Employability)
Text books:	

1. Sujata V. Bhatt, —Biomaterials|, Second Edition, Narosa Publishing House, 2005.
2. Sreeram Ramakrishna, MuruganRamalingam, T. S. Sampath Kumar, and Winston O. Soboyejo,

ATTESTED
Dr. S. RAMABALAN, M.E., Ph.D.,
PRINCIPAL
E.G.S. Pillay Engineering College,
Thethi, Nagore - 611 002.
Nagapattinam (Dt) Tamil Nadu.

1903BM006		Bio Analytical methods and Instruments	L	T	P	C
			3	0	0	3
		(For B.E.,BME)				

Course Objectives:	The student should be made to:
	1. To understand the theory and operational principles of instrumental methods for identification and quantitative analysis of chemical substances by different types of spectroscopy.
	2. To impart fundamental knowledge on gas chromatography and liquid chromatography.
	3. To integrate a fundamental understanding of the underlining principles of physics as they relate to specific instrumentation used for gas analyzers and pollution monitoring instruments.
	4. To impart knowledge on the important measurement in many chemical processes and laboratories handling liquids or solutions.
	5. To understand the working principle, types and applications of NMR and Mass spectroscopy.

UNIT I	**SPECTROPHOTOMETRY**	**9 Hours**
Spectral methods of analysis – Beer-Lambert law – UV-Visible spectroscopy – IR Spectrophotometry – FTIR spectrophotometry – Atomic absorption spectrophotometry – Flame emission and atomic emission photometry – Construction, working principle, sources detectors and applications.		
UNIT II	**CHROMATOGRAPHY**	**9 Hours**
General principles – classification – chromatographic behavior of solutes – quantitative determination – Gas chromatography – Liquid chromatography – High-pressure liquid chromatography – Applications.		
UNIT III	**INDUSTRIAL GAS ANALYZERS AND POLLUTION MONITORING**	**9 Hours**
Gas analyzers – Oxygen, NO2 and H2S types, IR analyzers, thermal conductivity detectors, analysis based on ionization of gases.Air pollution due to carbon monoxide, hydrocarbons, nitrogen oxides, sulphur dioxide estimation – Dust and smoke measurements.		
UNIT IV	**pH METERS AND DISSOLVED COMPONENT ANALYZERS**	**9 Hours**
Selective ion electrodes – Principle of pH and conductivity measurements – dissolved oxygen analyzer – Sodium analyzer – Silicon analyzer – Water quality Analyzer.		
UNIT V	**NUCLEAR MAGNETIC RESONANCE AND MASS SPECTROMETRY**	**9 Hours**
Basic principles – Continuous and Pulsed Fourier Transform NMR spectrometer – Mass Spectrometry – Sample system – Ionization methods – Mass analyzers – Types of mass spectrometry.		
	Total:	**45 Hours**

Course Outcomes:	
	After completion of the course, Student will be able to
	1. Ability to understand the fundamental principles of selective analytical instruments used in medical diagnosis, quality assurance & control and research studies.
	2.Ability to assess and suggest a suitable analytical method for a specific purpose, and evaluate sensitivity, important sources of interferences and errors, and also suggest alternative analytical methods for quality assurance.
	3.Ability to critically evaluate the strengths and limitations of the various instrumental methods.
	4.Ability to develop critical thinking for interpreting analytical data.
	5.Ability to understand the working principle, types and applications of NMR and Mass spectroscopy
Further	

Skills development

Employability

ATTESTED

Dr. S. RAMABALAN, M.E., Ph.D.,
PRINCIPAL
E.G.S. Pillay Engineering College,
Thethi, Nagore - 611 002,
Nagapattinam (Dt) Tamil Nadu.

1902BM651	Diagnostic and Therapeutic Equipment Laboratory	L	T	P	C
		0	0	4	2

Course Objectives:	The student should be made to:
	To demonstrate recording and analysis of different Bio potentials
	To analysis of different Bio potentials
	To examine different therapeutic modalities.
	To understand the continuous Signals.
	To Measure various physiological signals

List of Experiments:

1. Measurement of visually evoked potential
2. Galvanic skin resistance (GSR) measurement
3. Study of shortwave and ultrasonic diathermy
4. Measurement of various physiological signals using biotelemetry
5. Study of hemodialysis model 6. Electrical safety measurements
6. Measurement of Respiratory parameters using spirometry.
7. Study of medical stimulator
8. Analyze the working of ESU – cutting and coagulation modes
9. Recording of Audiogram
10. Study the working of Defibrillator and pacemakers
11. Analysis of ECG, EEG and EMG signals
12. Study of ventilators

Additional Experiments:

1. Study of Ultrasound Scanners
2. Study of heart lung machine model

Total: 45 Hours

Course Outcomes:	
	Measure different bioelectrical signals using various methods
	Assess different non-electrical parameters using various methodologies
	Illustrate various diagnostic and therapeutic techniques
	Examine the electrical safety measurements
	Analyze the different bio signals using suitable tools.

Skill development
Employability / Entrepreneurship

References:

1. John G. Webster, —Medical Instrumentation Application and Design‖, 4th edition, Wiley India PvtLtd,New Delhi, 2015
2. Joseph J. Carr and John M. Brown, —Introduction to Biomedical Equipment Technology‖, Pearson education, 2012.
3. Leslie Cromwell, —Biomedical Instrumentation and measurement‖, 2nd edition, Prentice hall of India, New Delhi, 2015.
4. Richard Aston —Principles of Biomedical Instrumentation and Measurement‖, Merril Publishing Company, 1990.
5. L.A Geddas and L.E.Baker —Principles of Applied Biomedical Instrumentation‖ 2004.
6. Khandpur R.S, —Handbook of Biomedical Instrumentation‖, 3rdedition,Tata McGraw-Hill, New Delhi, 2014.

ATTESTED
Dr. S. RAMABALAN, M.E., Ph.D.,
PRINCIPAL
E.G.S. Pillay Engineering College,
Thethi, Nagore - 611 002.
Nagapattinam (Dt) Tamil Nadu.

1902BM652		Analog and Digital Communication Laboratory	L	T	P	C
			0	0	4	2

Course Objectives:

1. Understand the basics of analog communication.
2. Study the different modulators.
3. Know the noise performance in communication system.
4. To generate AM and FM using MATLAB
5. To Examine Pacemaker circuit and industrial Instrumentation Amplifier

List of Experiments:

1. Generation and Demodulation of AM.
2. Generation and Demodulation of FM.
3. FM modulation using PLL.
4. Study of PAM,PWM and PDM
5. Study of FDM and TDM.
6. Generation of AM using MATLAB.
7. Generation of FM using MATLAB.
8. Study of Super heterodyne receiver.
9. Performance analysis of noise in Communication system.
10. Removal of noise in AM and FM.

Additional Experiments:

1. Pace Maker Circuit
2. Industrial Instrumentation amplifier

Total 45 Hours

Course Outcomes:

After completion of the course, Student will be able to

1. Design of AM and FM Circuits.
2. Design of AM and FM Circuits using MATLAB.
3. Determine the different multiplexing technique.
4. Design of Super Heterodyne receiver.
5. Compute the noise performance in communication system.

} Employability / Skill development.

References:

1. J.G. Proakis, "Digital Communications", McGraw Hill, 5th edition, 2007
2. Simon Haykin, Communication Systems, John Wiley, 2001.
3.Jack Quinn, 'Digital Data Communication", Prentice Hall; 1st edition,-199)
3. P.Michael Fitz, Fundamentals of Communication System, Tata McGraw-Hill -2008.
4. P.Rama Krishna rao, Analog Communication, Tata McGraw-Hill -2011
5. Taub and Schilling, Principles of communication systems, Tata McGraw-Hill, 1995.
6. Bruce Carlson et al, Communication systems, McGraw-Hill,2002.
7. Roddy and Coolen, Electronic communication, PHI, 2003.

ATTESTED

Dr. S. RAMABALAN, M.E., Ph.D.,
PRINCIPAL
E.G.S. Pillay Engineering College,
Thethi, Nagore - 611 002.
Nagapattinam (Dt) Tamil Nadu.

1904GE651		LIFE SKILLS: APTITUDE - II	L	T	P	C
			0	0	2	1

Course Objectives:

1. To brush up problem solving skill and to improve intellectual skill of the students
2. To be able to critically evaluate various real life situations by resorting to Analysis Of key issues and factors
3. To be able to demonstrate various principles involved in solving mathematical problems and thereby reducing the time taken for performing job functions.
4. To enhance analytical ability of students
5. To augment logical and critical thinking of Student

Unit I	Partnership, Mixtures and Allegations, Problem on Ages, Simple Interest, Compound Interest	5 Hours

Introduction Partnership - Relation between capitals, Period of investments and Shares- Problems on mixtures - Allegation rule - Problems on Allegation – Problems on ages - Definitions Simple Interest - Problems on interest and amount - Problems when rate of interest and time period are numerically equal - Definition and formula for amount in compound interest - Difference between simple interest and compound interest for 2 years on the same principle and time period.

Unit II	Blood relations, , Clocks, Calendars	5 Hours

Defining the various relations among the members of a family - Solving Blood Relation puzzles - Solving the problems on Blood Relations using symbols and notations - Finding the angle when the time is given - Finding the time when the angle is known - Relation between Angle, Minutes and Hours - Exceptional cases in clocks - Definition of a Leap Year - Finding the number of Odd days - Framing the year code for centuries - Finding the day of any random calendar date .

Unit III	Time and Distance, Time and Work	5 Hours

Relation between speed, distance and time - Converting kmph into m/s and vice versa - Problems on average speed - Problems on relative speed - Problems on trains - Problems on boats and streams - Problems on circular tracks - Problems on races - Problems on Unitary method - Relation between Men, Days, Hours and Work - Problems on Man-Day-Hours method - Problems on alternate days - Problems on Pipes and Cisterns.

Unit IV	Data Interpretation and Data Sufficiency	5 Hours

Problems on tabular form - Problems on Line Graphs - Problems on Bar Graphs - Problems on Pie Charts - Different models in Data Sufficiency - Problems on data redundancy

Unit V	Analytical and Critical Reasoning	5 Hours

Problems on Linear arrangement - Problems on Circular arrangement - Problems on Double line-up - Problems on Selections - Problems on Comparisons - Finding the Implications for compound statements - Finding the Negations for compound statements- Problems on assumption - Problems on conclusions - Problems on inferences - Problems on strengthening and weakening of arguments .

Total:	30 Hours

ASSESSMENT PATTERN :

1. Two tests will be conducted (25 * 2) - 50 marks
2. Five assignments will be conducted (5*10) - 50 Marks

Course Outcomes:

After completion of the course, Student will be able to

1. Solve problems on Partnership, Mixture & Allegation and ages least time using shortcuts and apply real life situations

ATTESTED

Dr. S. RAMABALAN, M.E., Ph.D.,
PRINCIPAL
E.G.S. Pillay Engineering College,
Thethi Nagore - 611 002.
Nagapattinam (Dt) Tamil Nadu.

	2. Workout family relationships concepts, ability to visualize clocks & calendar and understand the logic behind a Sequence.
	3. Calculate concepts of speed, time and distance, understand timely completion using time and work.
	4. Learners should be able to understand various charts and interpreted data least time.
	5. Workout puzzles, ability to arrange things in an orderly fashion. Employability

References:

1. Arun Sharma, 'How to Prepare for Quantitative Aptitude for the CAT', 7th edition, McGraw Hills publication, 2016.
2. Arun Sharma, 'How to Prepare for Logical Reasoning for CAT', 4th edition, McGraw Hills publication, 2017.
3. R S Agarwal, 'A modern approach to Logical reasoning', revised edition, S.Chand publication, 2017.
4. R S Agarwal, 'Quantitative Aptitude for Competitive Examinations', revised edition, S.Chand publication, 2017.
5. Rajesh Verma, "Fast Track Objective Arithmetic", 3rd edition, Arihant publication, 2018.
6. B.S. Sijwalii and InduSijwali, "A New Approach to REASONING Verbal & Non-Verbal", 2nd edition, Arihnat publication, 2014.

ATTESTED
Dr. S. RAMABALAN, M.E., Ph.D.,
PRINCIPAL
E.G.S. Pillay Engineering College,
Thethi, Nagore - 611 002.
Nagapattinam (Dt) Tamil Nadu.