SEMESTER V

S.No	Category	Course Code	Course Title	L	T	P	C
Theory							
1	PC	BM16501	Medical Instrumentation II	3	0	0	3
2	PC	BM16502	Microprocessor and Microcontroller	3	0	0	3
3	PC	BM16503	Biomedical Signal Processing	3	2	0	4
4	PC	BM16504	Biomechanics	3	0	0	3
5	PE	BM1615*	Professional Elective - I	3	0	0	3
Practicals							
6	PC	BM16505	Biomedical Signal Processing Laboratory	0	0	4	2
7	PC	BM16506	Microprocessor and Microcontroller Laboratory	0	0	4	2
8	PC	BM16507	Medical Instrumentation Laboratory	0	0	4	2
9	EE	EN16501	Career Development Laboratory I	0	0	2	1
TOTAL				**15**	**2**	**14**	**23**
		Cumulative Total					**123**

SEMESTER VI

S.No	Category	Course Code	Course Title	L	T	P	C
Theory							
1	HS	BA16151	Professional Ethics and Human Values	3	0	0	3
2	PC	BM16601	Diagnostic and Therapeutic Equipment	3	0	0	3
3	PC	BM16602	Biomaterials and Artificial organs	3	0	0	3
4	PC	BM16603	Medical Imaging Techniques	3	0	0	3
5	PE	BM1625*	Professional Elective - II	3	0	0	3
6	OE	*******	Open Elective - I	3	0	0	3
Practicals							
7	PC	BM16604	Diagnostic and Therapeutic Equipment Laboratory	0	0	4	2
8	EE	BM16605	Mini Project	0	0	4	2
9	EE	EN16601	Career Development Laboratory II	0	0	2	1
TOTAL				**18**	**0**	**10**	**23**
		Cumulative Total					**146**

PROFESSIONAL ELECTIVES (PE)

S.No.	Category	Course Code	Course Title	L	T	P	C
PE I							
1	PE	BM16151	Biomedical Informatics	3	0	0	3
2	PE	BM16152	Virtual Bioinstrumentation	3	0	0	3
3	PE	BM16153	BioMEMS	3	0	0	3
4	PE	BM16154	Medical Optics	3	0	0	3
PE II							
1	PE	BM16251	Telemedicine and PACS	3	0	0	3
2	PE	BM16252	Biomedical Laser Instruments	3	0	0	3
3	PE	BM16253	Pattern Recognition and Neural Networks	3	0	0	3
4	PE	BM16254	Advanced Bioanalyical and Therapeutic techniques	3	0	0	3

SEMESTER V

BM16501 **MEDICAL INSTRUMENTATION II** **3 0 0 3**

COURSE OBJECTIVES

To enable the students to

- describe the concept of defibrillator.
- outline the different components and working principle of pulmonary function measuring devices and Lithotriptors
- categorize the various display techniques and use of ultrasonic in several of medical.
- utilize the applications of diathermy principles.
- infer the knowledge of patient safety

UNIT I CARDIAC ASSIST DEVICES **9**

Right ventricular bypass pump, left ventricular bypass pump, Intra-aortic balloon pumping,synchronous counter pulsation,veno arterial pumping; Defibrillator: Implantable defibrillator, defibrillator analysers.

UNIT II PULMONARY FUNCTION ANALYZERS AND LITHOTRIPTORS **9**

Pulmonary function measurements, spirometry, pneumotachometers, measurement of volume, pulmonary function analysers; Lithotriptors-the stone disease problem, first lithotripter machine, modern lithotripter systems, extra corporeal shockwave therapy.

UNIT III ULTRASONIC TECHNIQUES FOR DIAGNOSIS **9**

Diagnosis: Tissue Reaction, Basic principles of Echo technique, display techniques-A, B, M modes, Doppler; Ultrasonic applied as diagnostic tool in ophthalmology, abdomen, obstetrics and gynecology. Real time applications of scanners, advantages & disadvantages & safety aspects of US.

UNIT IV PHYSIOTHERAPY AND ELECTROTHERAPY EQUIPMENTS **9**

Principles of High frequency heat therapy, IR and UV lamp – application, shortwave diathermy, microwave diathermy, ultrasonic therapy unit, surgical diathermy, and electrodiagnostic/therapeutic apparatus pain relief through electrical stimulation;Electro surgery machine. Electro surgical current level. Functional electrical stimulation.

UNIT V PATIENT SAFETY **9**

Patient safety- leakage currents, leakage measurement (leakage meter), Electrical safety codes and standards; Basic Approaches to protection against shock, Protection equipment design, electrical safety analyser, Precautions to minimize electric hazards, testing of Biomedical Equipment; Ground fault interrupter, line isolation monitors.

TOTAL PERIODS 45

COURSE OUTCOMES

At the end of the course, the students will be able to

- define the concept of cardiac assist devices
- summarize the different components and working principle of pulmonary function analysersand lithotriptors
- choose the various display techniques and use of ultrasonic in diagnosis
- select physiotherapy and electrotherapy equipment according to the usage.
- infer the knowledge of patient safety

TEXT BOOKS

1. Kandpur R.S, "Hand-book of Biomedical Instrumentation", Tata McGraw Hill, 3rd Edition, 2015.
2. Leslie Cromwell, Fred Weibell J, Erich Pfeiffer. A, "Biomedical Instrumentation and Measurements", Prentice-Hall India, 2nd Edition, 2014.

REFERENCES

1. John G. Webster, "Medical Instrumentation application and design", John Wiley, 5th Edition, 2020.
2. Carr, Joseph J, Brown, John.M "Introduction to Biomedical equipment technology", John Wiley and sons, New York, 4th Edition, 2010.
3. L.A Geddes and L.E.Baker, "Principles of Applied Biomedical Instrumentation", John Wiley and Sons, 3rd Edition, Reprint 2009.

CO-PO Mapping:

Mapping of course objectives with PO's and PSO's (1/2/3 indicates strength of correlation) 3-Strong, 2-Medium, 1-Weak														
COs	Programme Outcomes (Pos)													
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO1	3	3	3	3								3	3	2
CO2	3	3				3				3	3	3	2	2
CO3	3	3	3	3		3	3					3	2	2
CO4	3	3	3	3								3	2	3
CO5	3	3	3	3								3	3	3

BM16502 **MICROPROCESSOR AND MICROCONTROLLER** **3 0 0 3**

COURSE OBJECTIVES

To enable the students to

- explain the architecture of 8086microprocessor.
- learn the design aspects of i/o and memory interfacing circuits.
- Interface microprocessors with supporting chips.
- familiarize about arm microcontroller
- acquire knowledge on applications of microprocessor and microcontroller in biomedical domain.

UNIT I **OVERVIEW OF 8086 MICROPROCESSOR** **9**

Evolution of Microprocessor and its importance in biomedical domain, Architecture and signal description of 8086 Minimum and maximum mode, addressing modes, Instruction set ,Programs.

UNIT II **8051 MICROCONTROLLER** **9**

Introduction to 8 bit microcontroller, signal descriptions of 8051, Architecture of 8051, Register set of 8051,Instruction set, Addressing mode.

UNIT III **INTERFACING WITH I/O DEVICES** 9

Timer-serial communication-interrupts programming, Interfacing to external memory, Basic techniques for reading & writing from I/O port pins, Interfacing 8051 to ADC, Liquid crystal display (LCD), keyboard, Stepper motor.

UNIT IV **ARM MICROCONTROLLER** **9**

Fundamentals: registers, current program status register, Pipeline, exceptions, Interrupts and vector table, ARM architecture, ARM instruction set, thumb instruction set.

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

Mobile phone based bio signal recording, Design of pulse oximeter circuit using ARM microcontroller, Design of EOG based home appliances using ARM microcontroller, Design of heart rate monitoring circuit using ARM microcontroller.

TOTAL PERIODS **45**

COURSE OUTCOMES

After the completion of the course, the students will be able to

- relate any architecture and assembly language for a processor.
- comprehend the architectural and pipelining concepts for microprocessors.
- design and deploy the interfacing peripherals in real time scenario.
- design, develop and trouble shoot microcontroller-based system.
- implement microcontroller based systems in in biomedical domain.

TEXT BOOK

1. Ramesh S. Gaonkar, "Microprocessor Architecture, Programming and Applications with 8085". Penram International Publishing reprint, 6th Edition, 2017
2. Douglas V. Hall, "Microprocessors and Interfacing: Programming and Hardware", Glencoe, 2nd edition, 2010.

REFERENCES

1. Andrew N.Sloss,DonimicSymes, Chris Wright, "ARM System Developer's Guide", Elsevier, 1st edition, 2009.
2. Muhammad Ali Mazidi and JanicaGilliMazidi, 'The 8051 microcontroller and embedded systems', Pearson Education, 2nd edition Indian reprint, 2014.
3. A.K.Ray, K.M.Bhurchandi, "Advanced Microprocessor and Peripherals", Tata McGraw Hill, 3rd edition, 2015.

CO-PO Mapping:

Mapping of course objectives with PO's and PSO's (1/2/3 indicates strength of correlation) 3-Strong, 2-Medium, 1-Weak														
COs	**Programme Outcomes (Pos)**													
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO 2**
CO1	3	2	2	2	2								3	3
CO2	3	2	2	2	2								3	3
CO3	3	2	2	2	2	2	2						3	3
CO4	3	2	2	2	2								3	3
CO5	3	2	2	2	2	2	2						3	3

BM16503 BIOMEDICAL SIGNAL PROCESSING 3 2 0 4

COURSE OBJECTIVES

To enable the students to

- understand characteristics of some of the most commonly used biomedical signals.
- choose filters to remove noise and artifacts from biomedical signals.
- Analyze biosignals in time domain & to estimate the spectrum.
- apply methods to extract relevant information from biomedical signal measurements.
- illustrate various techniques for automated classification and decision making to aid diagnosis.

UNIT I FUNDAMENTALS OF SIGNAL PROCESSING 15

Basics- Sampling and aliasing, simple signal conversion systems, spectral analysis;FFT - Decimation In Time algorithm,Decimation in Frequency algorithm;Bioelectric signals and its basic characteristics-Bio signal Characteristics of Electrogastrogram (EGG), Electroneurogram (ENG), Event related potentials (ERPs), Phonocardiogram (PCG), Speech signal; Objectives of Biomedical signal analysis; Difficulties in Biomedical signal analysis.

UNIT II INFINITE IMPULSE RESPONSE FILTERS 15

Characteristics of practical frequency selective filters. characteristics of commonly used analogfilters - Butterworth filters, Chebyshev filters. Design of IIR filters from analog filters (LPF, HPF,BPF, BRF) - Approximation of derivatives, Impulse invariance method, Bilinear transformation. Frequency transformation in the analog domain. Structure of IIR filter - direct form I, direct form II, Cascade, parallel realizations.

UNIT III FINITE IMPULSE RESPONSE FILTERS 15

Design of FIR filters - symmetric and Anti-symmetric FIR filters - design of linear phase FIR filters using Fourier series method - FIR filter design using windows (Rectangular, Hamming and Hanning window), Frequency sampling method. FIR filter structures - linear phase structure, direct form realizations

UNIT IV CARDIOVASCULAR APPLICATIONS 15

Noise & Artifacts, ECG Signal Processing: Baseline Wandering, Power line interference, Muscle noise filtering – QRS detection, Adaptive noise canceling in ECG, improved adaptive filtering in FECG, Computation of diagnostic signal parameters of ECG like Heart rate and QRS detection using Multivariate analysis (PCA and ICA).

UNIT V NEUROLOGICAL APPLICATION AND SIGNAL CLASSIFICATION 15

EEG rhythms & waveforms, EEG applications- Epilepsy, sleep disorders, brain computer interface. Modeling EEG- linear, stochastic models - Nonlinear modeling of EEG - artifacts in EEG & their characteristics and processing – Nonparametric spectral analysis, Model based spectral analysis - EEG segmentation - Joint Time-Frequency analysis - correlation analysis of EEG channels - coherence analysis of EEG channels. Evoked potentials- noise characteristics, Noise reduction by linear filtering.Statistical signal classification- linear discriminant function, direct feature selection and ordering, Back propagation neural network; Analysis of EEG using Empirical mode decomposition (EMD).

TOTAL PERIODS 75

COURSE OUTCOMES

Upon completion of the course, the students will be able to

- preprocess the bio signals.
- analyze bio signals in time domain & to estimate the spectrum.
- extract the features using multivariate component analysis.
- apply wavelet detection techniques for bio signal processing.
- classify bio signals using neural networks and statistical classifiers.

TEXT BOOKS

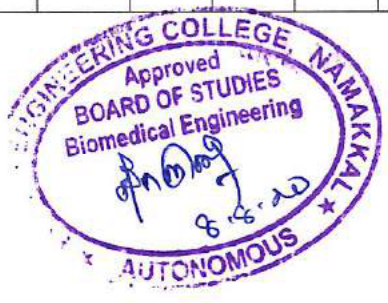
1. John G. Proakis & Dimitris G.Manolakis, —Digital Signal Processing – Principles, Algorithms & Applicationsl, Fourth Edition, Pearson Education / Prentice Hall, 2007 (UNIT I - III).
2. Rangaraj M. Rangayyan, "Biomedical Signal Analysis, A Case-Study Approach", John Wiley & Sons, Reprint 2016.(UNIT 1)
3. Semmlow, —Biosignal and Biomedical Image Processingl, Marcel Dekker, 2004(UNIT IV-V)
4. Sergio Cerutti Carlo Marchesi, "Advanced Methods of Biomedical Signal Processing" Wiley, 2011

REFERENCES

1. Arnon Cohen, "Bio-Medical Signal Processing Vol I and Vol II", CRC Press Inc., Boca Rato, Florida, 1999.
2. Reddy D.C, "Biomedical signal processing: Principles and techniques", Tata McGraw-Hill, New Delhi, 2nd edition, 2005.
3. Emmanuel C. Ifeachor, Barrie W.Jervis, "Digital Signal processing- A Practical Approach'',Pearson education Ltd., 2004.
4. Devasahayam, S. R. (2012). Signals and systems in biomedical engineering: signal processing and physiological systems modeling. Springer.

CO-PO Mapping:

Mapping of course objectives with PO's and PSO's (1/2/3 indicates strength of correlation) 3-Strong, 2-Medium, 1-Weak														
COs	**Programme Outcomes (Pos)**													
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO 2**
CO1	3	3	3		3			3	3			3	2	2
CO2	3	3	3		3			3	3			3	3	3
CO3	3	3	3		3			3	3			3	3	3
CO4	3	3	3		3			3	3			3	2	2
CO5	3	3	3		3			3	3			3	2	2



BM16504 **BIOMECHANICS** **3 0 0 3**

COURSE OBJECTIVES

To enable the students to

- explain the basic principles of mechanics in various applications
- discuss the mechanics of physiological systems.
- elaborate about biosolid mechanics.
- describe the structure, movements and various loads applied on the hip, knee, and soft tissues.
- illustrate the mathematical models used in the analysis of biomechanical systems

UNIT I INTRODUCTION TO MECHANICS **9**

Introduction – Scalars and vectors, Statics – Force types, Resolution and composition of forces, Moments of force and couple, Resultant force determination; Dynamics, Basic principles – Linear motion, Newton's laws of motion, Impulse and Momentum, Work and Energy Kinetics – Velocity and acceleration; Kinematics – Link segment models, Force transducers, Force plates; Introduction to Constitutive equations – Constitutive equations of Non viscous fluid, Newtonian Viscous fluid and Hookean Elastic solid;Anthropometry.

UNIT II BIOFLUID MECHANICS **9**

Intrinsic fluid properties – Density, Viscosity, Compressibility and Surface Tension; Viscometers – Capillary, Coaxial cylinder and cone and plate, Rheological properties of blood, Pressure-flow relationship for Non-Newtonian Fluids; Fluid mechanics in straight tube – Steady Laminar flow, Turbulent flow, Flow development, Viscous and Turbulent Sheer Stress, Effect of pulsatility, Boundary Layer Separation; Structure of blood vessels, Material properties and modeling of Blood vessels, Heart –Cardiac muscle characterization; Native heart valves – Mechanical properties and valve dynamics; Prosthetic heart valve fluid dynamics, shear stresses in extra-corporeal circuits.

UNIT III BIOSOLID MECHANICS **9**

Constitutive equation of viscoelasticity – Maxwell &Voight models, anisotropy, fatigue analysis;Hard Tissues – Definition of stress & strain-Deformation Mechanics-Bone structure & composition, mechanical properties of bone, cortical and Cancellous Bone, blood circulation, elasticity and strength, viscoelastic properties, functional adaptation.

Soft Tissues – Structure, functions, material properties and modeling of Soft Tissues – Cartilage, Tendons and Ligaments Skeletal Muscle – Hodin-huxley model, Mechanical testing of Soft tissue- Muscle action, Hill's models, mathematical modeling, Bone fracture mechanics, Implants for bone fractures.

UNIT IV BIOMECHANICS OF JOINTS **9**

Skeletal joints, forces and stresses in human joints, Analysis of rigid bodies in equilibrium, Free body diagrams, Structure of joints, Types of joints, Biomechanical analysis of elbow, shoulder, spinal column, hip, knee and ankle, Lubrication of synovial joints, parameterization and Gait analysis, Motion analysis using video.

UNIT V MATHEMATICAL MODELS 9

Introduction to Finite Element Analysis; Mathematical models - pulse wave velocities in arteries, measurement/estimation of in-vivo elasticity of blood vessel; dynamics of fluid filled catheters.

TOTAL PERIODS: 45

COURSE OUTCOMES

Upon the completion of the course, the students will be able to

- describe the use of mechanics in medicine.
- summarize the mechanics of physiological systems.
- design and develop the models specific to orthopedic applications.
- explain the structure, movements of hard and soft tissues.
- analyze the biomechanical systems using mathematical models.

TEXT BOOKS

1. Y. G. Fung, Biomechanics, Springer-verlag New York Inc, 2nd edition, 2010
2. Joseph D.Bronzino, "Biomedical Engineering Fundamentals", Taylor& Francis,4th edition, 2017.

REFERENCES

1. Susan J Hall, "Basics of Biomechanics'', McGraw Hill Publishing.co. New York, 8th Edition, 2019.
2. C. Ross Ether and Craig A.Simmons, "Introductory Biomechanics from cells to organisms", Cambridge University Press, New Delhi, 2013.
3. Paul Brinckmann, Wolfgang Frobin; Gunnar Leivseth; Burkhard Drerup, "Orthopaedic BioMechanics", 2nd edition, 2016.

CO-PO Mapping:

Course Outcomes (CO's)	Mapping of course objectives with PO's and PSO's (1/2/3 indicates strength of correlation) 3-Strong, 2-Medium, 1-Weak													
	Programme Outcomes (PO's)												Programme Specific Outcomes (PSO's)	
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO10	PO11	PO12	PSO 1	PSO 2
CO 1	3	3	3									3	3	3
CO 2	3	3	3		3	3	3	3	3	3		3	3	3
CO 3	3	3	3		3	3	3	3	3	3		3	3	3
CO 4	3	3	3		3	3	3	3	3	3		3	3	3
CO 5	3	3	3		3	3	3	3	3	3		3	3	3

BM16505 BIOMEDICAL SIGNAL PROCESSING LABORATORY 0 0 4 2

COURSE OBJECTIVES

To enable the students to

- basic discrete time signals and analyzes it
- realizing Linear and Circular Convolution
- designing the IIR and FIR filter
- analyzing various types of bio signals and study its characteristics
- signal processing using Matlab

LIST OF EXPERIMENTS

1. Representation of basic signals (ECG, EEG, EMG, SPEECH SIGNAL)
2. Sampling and Quantization (ECG, EEG, EMG, SPEECH SIGNAL)
3. Fast Fourier transform of the signals
4. Circular convolution and Linear convolution
5. Digital IIR filter (Butter worth &Chebyshev)
6. FIR filter design (Hamming &Hanning)
7. Correlation of the signals
8. EEG & ECG signal processing basics using MATLAB
9. Analysis of heart rate variability
10. Spectral analysis of EEG signals

TOTAL PERIODS 60

COURSE OUTCOMES

At the end of this course, the students will be able to

- ability to comprehend and appreciate the significance and role of this course in the present contemporary world.
- carry out simulation of DSP systems.
- demonstrate their abilities towards DSP processor-based implementation of DSP systems.
- analyze Finite word length effect on DSP systems.
- implement adaptive filters for various applications of DSP

CO-PO Mapping:

Mapping of course objectives with PO's and PSO's (1/2/3 indicates strength of correlation) 3-Strong, 2-Medium, 1-Weak														
COs	**Programme Outcomes (Pos)**													
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO 2**
CO1	3	3	3	2	2					2	2		2	2
CO2	3	2	3	2	2					2			2	3
CO3	3	3	3	3	3					2			3	3
CO4	3	2	3	3						2			3	3
CO5	3	2	3	3	2					2			3	3

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AUTO

BM16506	MICROPROCESSOR AND MICROCONTROLLER LABORATORY	0	0	4	2

COURSE OBJECTIVES

To enable the students to

- design the programming language of 8051
- develop skill in program writing for microprocessors and controllers.
- introduce microprocessor and microcontroller-based system design.
- ability to design, develop and trouble shoot microcontroller-based system.

LIST OF EXPERIMENTS

1. Programs for 8 / 16 bit Arithmetic, Sorting, Searching and String operations
2. Basic arithmetic and Logical operations
3. Programming using Bit Manipulation instructions of the 8051microcontroller.
4. Programming and verifying Timer, Interrupts and UART operations in 8051 microcontroller
5. Interfacing – DAC and ADC and 8051 based temperature measurement
6. Interfacing – Stepper motor and traffic light control system
7. Interfacing – LED and LCD
8. Basic programs using ARM controller
9. Learn and understand how to configure the PWM and ADC modules of the MSP-EXP430G2 Launchpad to control the DC motor using external analog input.
10. Implement Pulse Width Modulation to control the brightness of the on-board, green LED usin ARM Microcontroller

TOTAL PERIODS 60

COURSE OUTCOMES

At the end of this course, the students will be able to

- write program for various applications using 16-bit processor
- write assembly language programs for 8051 microcontrollers
- interface various peripherals with 8-bit microcontroller
- design microcontroller-based projects
- develop skill in simple program writing.

CO-PO Mapping:

Mapping of course objectives with PO's and PSO's (1/2/3 indicates strength of correlation) 3-Strong, 2-Medium, 1-Weak														
COs	**Programme Outcomes (Pos)**													
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO 2**
CO1	1		1	1							2		2	2
CO2	1	3	3	3							3	3	2	2
CO3	1	3	3	3							3	3	3	3
CO4	1	3	3	3							3	3	2	2
CO5	1	3	3	3							3	3	2	2

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BM16507 MEDICAL INSTRUMENTATION LABORATORY 0 0 4 2

COURSE OBJECTIVES

To enable the students to

- study and design Bio amplifiers.
- provide hands on training on Measurement of physiological parameters.
- demonstrate various measurements like PCG, pH, respiration rate etc.
- have basic knowledge on biotelemetry
- design of Isolation amplifiers

LIST OF EXPERIMENTS

1. Design of low noise pre-amplifier
2. Design of ECG amplifier and Measurement of heart rate.
3. Design of EMG amplifier
4. Measurement of heart sounds using PCG
5. Measurement of pulse-rate using Photo transducer
6. Measurement of respiration rate
7. Measurement of pH and conductivity
8. Characteristics of optical Isolation amplifiers
9. Measure Earth resistance using Resistance meter and find leakage current.
10. Recording of various physiological parameters using patient monitoring system and telemetry units
11. Study of Biotelemetry
12. Calibration of Medical Equipment (Eg: Thermometer, Glucometer)

TOTAL PERIODS 60

COURSE OUTCOMES

Upon the completion of the course, the students will be able to

- design the amplifier for bio signal measurements
- measure heart rate and heart sounds.
- record and analyze pulse rate and respiration rate
- measure blood pressure and blood flow
- know the importance of biotelemetry

CO-PO Mapping:

Mapping of course objectives with PO's and PSO's (1/2/3 indicates strength of correlation) 3-Strong, 2-Medium, 1-Weak														
COs	Programme Outcomes (Pos)													
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO 2
CO1	3			3	3	3				3		3	3	2
CO2	3				3					3		3	2	2
CO3	3					3	3	3		3		3	3	3
CO4	3	3	3	3		3	3	3		3		3	2	2
CO5	3	3			3					3		3	2	2

EN16501 CAREER DEVELOPMENT LABORATORY I 0 0 2 1

COURSE OBJECTIVES

To enable students to

- understand their capabilities and enhance their grooming and showcasing his/ her capabilities to a prospective employer
- provide opportunity for the students to become acquainted with corporate opportunities relevant to their academic learning
- articulate their thoughts on a given topic in English and also to make decent write ups in English on any given topic
- practice and score well in Aptitude tests conducted by corporate / prospective employers
- prepare for any group discussion evaluation or presenting their credentials during a face - to - face interview leading to selection and employment

UNIT I BASIC SELF ANALYSIS 6

Introduction - Self Explorations: Who Am I, Personal Attributes, Self Confidence and Self Esteem - Communication Skills : Introduction to communication, Flow of communication, Listening, Barriers of communications, How to overcome the barriers of communications - Leadership Qualities : Skills for a good Leader, Leadership styles, SWOT Analysis, - Time Management: Time is a resource, Identify Time wasters, Time Management Styles, Techniques for better time management - Group Dynamics/ Team Building : Importance of group in organizations, Team Building, Interaction with the team, How to build the good team

UNIT II PERSONALITY DEVELOPMENT 6

Motivation : Introduction, Relevance and types of motivation, Analysis of motivation - Attitude : Factors, Influencing Attitude, Challenges and lessons from attitude - Creativity : Out of box thinking, Lateral thinking - Goal Setting : Wish list ; Blue print for success; Short, long, life time goals

UNIT III QUANTITATIVE APTITUDE 6

Number System - LCM & HCF - Square root & Cube root - Percentage - Time speed & Distance

UNIT IV QUANTITATIVE APTITUDE 6

Trains - Boats & Streams - Average - Ages – Area

UNIT V LOGICAL AND VERBAL REASONING 6

Series Completion : Number Series, Letter series, Symbol Series -Blood Relation - Coding and decoding - Logical Sequence - Analogy - Character Puzzles – Classification -Data sufficiency

TOTAL PERIODS 30

COURSE OUTCOMES

Upon completion of the course, the students will be able to

- demonstrate aptitude and reasoningskills
- enhanceverbal and writtenability.
- improvehis/her grooming and presentationskills.
- interacteffectively on any recent event/happenings/ currentaffairs.
- be a knowledgeable person on the various evaluation processes leading to employment and face the same withConfidence.

TEXT BOOKS

1. Agarwal, R.S." A Modern Approach to Verbal & Non Verbal reasoning", S.Chand& co ltd, New Delhi.
2. Abhijitguha, "Quantitative Aptitude ", Tata - Mcgraw hill.
3. Word power made easy by normanlewis ,W.R.Goyal publications.
4. Johnson, D.W. Boston: Allyn and Bacon" reaching out – interpersonal effectiveness and self - actualization.
5. Agarwal, R.S." objective general English", S.Chand& co
6. "Infosys campus connect program – students" guide for soft skills.

CO-PO Mapping:

Course Outcomes (CO's)	Mapping of course objectives with PO's and PSO's (1/2/3 indicates strength of correlation) 3-Strong, 2-Medium, 1-Weak													
	Programme Outcomes (PO's)												Programme Specific Outcomes (PSO's)	
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO10	PO11	PO12	PSO 1	PSO 2
CO 1			3		3	2			2			2		3
CO 2		2	3	2	2		2		2					2
CO 3		2	2	2	3	3		2		3			2	
CO 4	2	2	3	2	3	3	1					3	3	
CO 5	2	3	3	2	3			2		2				2

SEMESTER VI

BA16151	PROFESSIONAL ETHICS AND HUMAN VALUES	3	0	0	3

COURSE OBJECTIVES

To enable the students to

- understand the basic human values for a professional
- discuss the significance of ethics in engineering and the theories related to it
- familiarize oneself with the role of engineer as responsible experimenters
- expose the students to their roles and responsibilities in assessing safety and reducing risks
- describe the global issues in ethics and role of engineers as manager and consultants

UNIT I HUMAN VALUES 9

Morals, values and ethics-Integrity-Work Ethic-Service Learning-Civic virtue-Respect for others-Living peacefully-caring-sharing-Honesty-Courage-Valuing time-cooperation-Commitment-Empathy-Self-confidence-Character-Spiruality

UNIT II ENGINEERING ETHICS 9

Senses of "Engineering Ethics"-variety of moral issues-types of inquiry-moral dilemmas-moral autonomy-Kohlberg's theory-Gilligan's theory-consensus and controversy-Models of Professional Roles-theories about right action-Self -interest-Customs and religion-uses of ethical theories.

UNIT III ENGINEERING AS SOCIAL EXPERIMENTATION 9

Engineering as experimentation-engineers as responsible experimenters-codes of ethics-a balanced outlook on law-the challenger case study

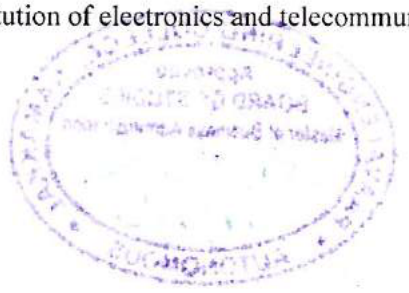
UNIT IV SAFETY, RESPONSIBILTIES AND RIGHTS 9

Safety and risk-assessment of safety and risk-risk benefit analysis and reducing risk-the Three Mile Island and Chernobyl case studies. Collegiality and loyalty-respect for authority-collective bargaining-confidentiality-conflicts of interest-occupational crime-professional rights-employee rights-Intellectual property rights(IPR)-discrimination

UNIT V GLOBAL ISSUES 9

Multinational corporations-Environmental ethics-computer ethics-weapons development-engineers as managers-consulting engineers-engineers as expert witnesses and advisors-moral leadership-sample code of Ethics like ASME, ASCE, IEEE, Institution of Engineers(India), Indian Institute of materials Management, Institution of electronics and telecommunication engineers(IETE), India,etc.

TOTAL PERIODS 45



COURSE OUTCOMES

Upon the completion of the course, the students will be able to

- describe the basic human values for a professional
- understand the significance of ethics in engineering and the theories related to it.
- be familiar with the role of engineer as responsible experimenters
- acquire knowledge about their roles and responsibilities in assessing safety and reducing risks
- discuss the global issues in ethics and role of engineers as manager and consultants

TEXT BOOKS

1. Charles E Harris, Michael S Pritchard and Michael J Rabins, "Engineering Ethics -Concepts and Cases", Thompson Learning, (2000).
2. Mike Martin and Roland Schinzinger, "Ethics in Engineering", McGraw Hill, New York (2005).

REFERENCES

1. Charles D Fleddermann, "Engineering Ethics", Prentice Hall, New Mexico, (1999).
2. John R Boatright, "Ethics and the Conduct of Business", Pearson Education, (2003).
3. Edmund G Seebauer and Robert L Barry, "Fundamentals of Ethics for Scientists and Engineers", Oxford University Press, (2001).
4. Prof. (Col) P S Bajaj and Dr. Raj Agrawal, "Business Ethics - An Indian Perspective",Biztantra, NewDelhi, (2004).
5. David Ermann and Michele S Shauf, "Computers, Ethics and Society", Oxford University Press, (2003).

CO-PO Mapping:

Mapping of course objectives with PO's and PSO's (1/2/3 indicates strength of correlation) 3-Strong, 2-Medium, 1-Weak													
COs	Programme Outcomes (Pos)												
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO 2
CO1	3	3	3	3		3		3	3	3		3	3	2
CO2	3	3	3	3		3		3	3	3		3	2	3
CO3	3	3		3		3		3	3	3		3	3	3
CO4	3	3		3		3		3	3	3		3	3	3
CO5	3					3		3		3		3	2	2

BM16601 DIAGNOSTIC AND THERAPEUTIC EQUIPMENT 3 0 0 3

COURSE OBJECTIVES

To enable the students to

- apply different medical devices in the measurement of parameters related to cardiology, neurology.
- measure and analyze signals generated by muscles.
- gain knowledge about measurements of parameters related to respiratory system
- understand the various sensory measurements that hold clinical importance.
- interpret biomedical laser principles and applications.

UNIT I CARDIAC AND NEUROLOGICAL EQUIPMENT 9

Electrocardiograph, Normal and Abnormal Waves, Heart rate monitor, Holter Monitor, Defibrillator Protection Circuit, Cardiac ablation catheter.

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

UNIT II MUSCULAR AND BIOMECHANICAL MEASUREMENTS 9

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 III RESPIRATORY MEASUREMENT SYSTEM 9

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

UNIT IV SENSORY MEASUREMENT 9

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.

UNIT V LASER BASED EQUIPMENTS 9

Lasers in Medicine – Types, Tissue reactions. Lasers in ophthalmology, Flow Cytometry, Endoscopy, Minimally Invasive Laparoscopy, Laser Micro irradiation, Laser Doppler Velocimetry, Neurosurgical Laser Techniques; Biomedical laser safety.

TOTAL PERIODS 45

COURSE OUTCOMES

Upon the completion of the course, the students will be able to

- describe the working and recording setup of all basic cardiac and neurological equipment.
- discuss the recording of diagnostic and therapeutic equipment 's related to EMG.
- explain about measurements of parameters related to respiratory system.
- summarize about the measurement techniques of sensory responses.
- appreciate the use of advanced laser technology in diagnosis and minimally invasive therapies.

TEXT BOOKS

1. John G. Webster, "Medical Instrumentation application and design", John Wiley, 5th Edition, 2020.
2. Joseph J. Carr and John M. Brown, —Introduction to Biomedical Equipment Technology‖, Pearson education, 2012.
3. R.S.Khandpur, 'Handbook of Bio-Medical instrumentation', Tata McGraw Hill Publishing Co Ltd., 3rd edition, 2014.

REFERENCES

1. L.A Geddes and L.E.Baker, "Principles of Applied Biomedical Instrumentation", John Wiley and Sons, 3rd Edition, Reprint 2009.
2. Leslie Cromwell, Fred Weibell J, Erich Pfeiffer. A, "Biomedical Instrumentation and Measurements", Prentice-Hall India, 2nd Edition, 2014.
3. Antony Y.K.Chan,"Biomedical Device Technology, Principles and design", Charles Thomas Publisher Ltd, Illinois, USA, 2nd edition, 2016.
4. B H Brown, R H Smallwood, D C Barber, P V Lawford and D R Hose," Medical Physics and Biomedical Engineering", 2nd Edition, IOP Publishers. 2018.

CO-PO Mapping:

Mapping of course objectives with PO's and PSO's (1/2/3 indicates strength of correlation) 3-Strong, 2-Medium, 1-Weak														
COs	Programme Outcomes (Pos)													
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO 2
CO1	3	3	3	3		3		3	3	3		3	3	2
CO2	3	3	3	3		3		3	3	3		3	2	3
CO3	3	3		3		3		3	3	3		3	3	3
CO4	3	3		3		3		3	3	3		3	3	3
CO5	3					3		3		3		3	2	2

BM16602 BIOMATERIALS AND ARTIFICIAL ORGANS 3 0 0 3

COURSE OBJECTIVES

To enable the students to

- choose the characteristics and classification of biomaterials.
- demonstrate the response of biomaterials in living system.
- analyze about the polymeric materials and composites in tissue replacements.
- make use of the compatibility and functioning of artificial organs inside the living system.

UNIT I STRUCTURE OF BIO-MATERIALS AND BIO-COMPATIBILITY 9

Definition and classification of bio-materials, mechanical properties, visco elasticity, wound- healing process, body response to implants, blood compatibility, HLA compatibility.

UNIT II IMPLANT MATERIALS 9

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 materials, bioactivity, bioactive ceramics, nanostructured bio ceramics.

UNIT III POLYMERIC IMPLANT MATERIALS 9

Polymerization, polyamides, Acryrilic polymers, Hydrogels, rubbers, high strength, thermoplastics, medical applications. Bio polymers: collagen and elastin. Medical Textiles: silica, chitosan, PLA, composites, Sutures, wound dressings; Materials for ophthalmology: contact lens, Intra ocular lens. Membranes for plasma separation and blood oxygenation.

UNIT IV TISSUE REPLACEMENT IMPLANTS 9

Small intestinal submucosa and other decellularized matrix biomaterials for tissue repair; Soft- tissue replacements, types of transplant by stem cell, sutures, surgical tapes, Tissue adhesive/glue. Percutaneous and skin implants, maxillofacial augmentation, Vascular grafts, hard tissue replacement Implants, joint replacements, Pancreas replacement; Scaffolds for tissue engineering.

UNIT V ARTIFICIAL HEART, LUNG AND KIDNEY DEVICES 9

Fundamentals of implants and medical devices-Use of patient's lung for gas exchange, the ideal heart lung device; Comparisons of natural and artificial lungs, Basic types of oxygenators, temperature maintenance, and gas flow rate requirements for artificial lungs-Drug delivery carriers;Basic methods of artificial waste removal, Hemodialysis, modeling of the patient, artificial kidney system.

TOTAL PERIODS 45

COURSE OUTCOMES

Upon the completion of the course, the students will be able to

- analyze different types of materials and its application in biomedical field.
- choose materials for design of implants in tissue replacement.
- evaluate response of biomaterials in living system.

- assess compatibility and functioning of artificial organs inside the living system.
- design and develop biomaterial-based scaffold for biomedical application.

TEXT BOOKS

1. Sujata V. Bhatt, "Biomaterials", Narosa Publishing House, 3rdEdition, 2017.
2. JoonB.Park Joseph D. Bronzino, "Biomaterials - Principles and Applications", CRC press, 2003.

REFERENCES

1. H.H.Willard,D.L.Merrit, " "Instrumental Methods of Analysis",CBS Publishers, 7th edition, 2012.
2. ParkJ.B., "Biomaterials Science and Engineering'', Plenum Press,2014.
3. Myer Kutz, "Standard Handbook of Biomedical Engineering & Design", McGraw-Hill, 2nd edition, 2010.
4. John Enderle, Joseph D.Bronzino, Susan M.Blanchard, ""Introduction to Biomedical Engineering", Elsevier, 4th edition, 2019.
5. AC Anand, JF Kennedy, M. Miraftab, S.Rajendran, "Medical Textiles and Biomaterials for Health Care'', Woodhead Publishing Limited, 2010.
6. D F Williams, "Medical and Dental Materials: A comprehensive Treatment-Volume 14", VCH Publishers, 1999.
7. BD Ratner, AS Hoffmann,FJ Schoen, JE Lemmons, "An introduction to Materials in Medicine", Academic Press, 3rd edition, 2013.
8. Joseph D.Bronzino, "Tissue Engineering and artificial Organs", Boca Raton: CRC Press, 2016.

CO-PO Mapping:

Mapping of course objectives with PO's and PSO's (1/2/3 indicates strength of correlation) 3-Strong, 2-Medium, 1-Weak														
COs	Programme Outcomes (Pos)													
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO 2
CO1	3		3				3	3	3	3	3	3	2	2
CO2		3	3	3			3	3	3	3	3	3	2	2
CO3			3				3	3	3	3	3	3	2	2
CO4			3				3	3	3	3	3	3	3	3
CO5		3	3	3			3	3	3	3	3	3	2	3

BM16603 **MEDICAL IMAGING TECHNIQUES** **3 0 0 3**

COURSE OBJECTIVES

To enable the students to

- summarize about the production of x-rays and its application in medical imaging.
- identify different types of radio diagnostic techniques.
- infer knowledge in special imaging techniques used for visualizing the cross sections of the body.
- outline the imaging techniques of ultrasound and thermography.
- conclude radiation therapy techniques and also radiation safety.

UNIT I X-RAYS AND COMPUTED TOMOGRAPHY **9**

Principle and production of X – Rays, Selection of anodes, heel pattern, Scattered Radiation, Porter-Bucky systems, Digital Radiography, principles of Angiography and Fluoroscopic Techniques, Image Intensifiers, digital subtraction angiography, mammography, dental X- ray units;Computerized Axial Tomography, Principle, Detectors, image reconstruction, Spiral CT,3D Imaging.

UNIT II EMISSION IMAGING **9**

Alpha, Beta, Gamma Emission, different types of Radiation Detectors, G.M. & Proportional Counters, Pulse Height Analyzers, Isotopic, Scanners, Principle of PET and SPECT, PET/CT.

UNIT III MAGNETIC RESONANCE IMAGING **9**

Principle of MRI, Relaxation processes and their measurements; Pulse sequencing and MR image acquisition, MRI instrumentation, Magnets, gradient coils; Imaging Different Sections of the Body, Tissue Characterization; MR Spectroscopy; Functional MRI.

UNIT IV ULTRASOUND IMAGING AND THERMOGRAPHY **9**

Diagnostic Ultrasound, Physics of Ultrasonic waves, Basic pulse-echo apparatus. Acoustic radiation fields, continuous and pulsed excitation, Transducers and imaging systems; Scanning methods, Imaging Modes-A, B & M, Principles and theory of image generation; Digital scan converters; Thermography-Principle, detectors and applications.

UNIT V THERAPY USING X – RAYS AND ISOTOPES **9**

Direct and Indirect effects of high energy radiation, Units for radiation Exposure, Depth Dose curves, Linear Accelerator Betatron, Cobalt and Cesium Therapy; Computation of Absorbed Dose Level, Automatic Treatment Planning, Hazardous Effects of Radiation, Radiation measuring units, Allowed Levels; ICRP regulation Protection Methods.

TOTAL PERIODS **45**

COURSE OUTCOMES

Upon the completion of the course, the students will be able to

- describe the production, principles of X-rays and CT imaging techniques.

- explain about different types of Radio diagnostic techniques
- analyze special imaging techniques used for visualizing the cross sections of the body
- make use of Ultrasound and Thermography techniques for diagnose.
- discover new in Radiation therapy techniques.

TEXT BOOKS

1. Khandpur R.S, "Hand-book of Biomedical Instrumentation", Tata McGraw Hill, 3rd Edition, 2015.

REFERENCES

1. Steve Webb, "The Physics of Medical Imaging", Adam Hilger, Philadelpia, 2nd edition, 2016.
2. Donald Graham, Paul Cloke, Martin Vosper –"Principles of Radiological physics", Churchill Livingston, 5th Edition, 2008.
3. Jerry L.Prince and Jnathan M.Links,"Medical Imaging Signals and Systems"- Pearson Education Inc. 2nd edition, 2015.

CO-PO Mapping:

Mapping of course objectives with PO's and PSO's (1/2/3 indicates strength of correlation) 3-Strong, 2-Medium, 1-Weak														
COs	**Programme Outcomes (Pos)**													
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO 2**
CO1	3	2	3	3	2					3		2	2	2
CO2	3	2	3	2	2	2					2		2	2
CO3	3	3	3	2	2	2	3				2		2	2
CO4	3	3	3	2	2	2	3				2		2	2
CO5	3	3	3	2	2	2	3				2		2	2

BM16604	DIAGNOSTIC AND THERAPEUTIC EQUIPMENT LABORATORY	0	0	4	2

COURSE OBJECTIVES

To enable the students to

- study the function of different therapeutic equipments
- provide practice on recording and analysis of different biopotentials
- formulate the measurement of respiratory parameters using diathermy
- formulate the skin resistance measurement and muscle stimulator

LIST OF EXPERIMENTS

- Simulation of ECG – detection of QRS complex and heart rate
- Recording of Audiogram.
- Recording and analysis of ECG signals.
- Recording and analysis of EMG signal and plotting of fatigue characteristics.
- Recording and Analysis of EEG Signals And Evoked Potential.
- Measurement of Respiratory parameters using spirometry
- Electrical safety measurements.
- Analyze the working of ESU – cutting and coagulation modes
- Analysis of characteristics of surgical diathermy.
- Galvanic skin resistance (GSR) measurement
- Study of muscle stimulator.

TOTAL PERIODS 60

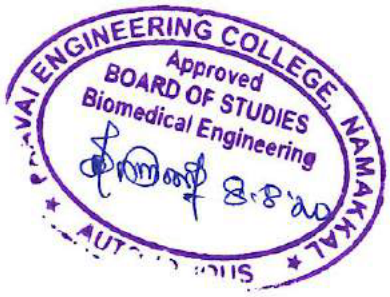
COURSE OUTCOMES

Upon the completion of the course, the students will be able to

- measure different bioelectrical signals using various methods
- examine the electrical safety measurements
- analyze the different bio signals using suitable tools.
- analyze the skin resistance measurement and muscle stimulator

CO-PO Mapping:

Mapping of course objectives with PO's and PSO's (1/2/3 indicates strength of correlation) 3-Strong, 2-Medium, 1-Weak														
COs	**Programme Outcomes (Pos)**													
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO 2**
CO1	3	3				3	3	3	3	3	3	3	2	2
CO2	3	3		3	3	3	3	3	3	3	3	3	2	2
CO3	3	3		3	3	3	3	3	3	3	3	3	2	2
CO4	3	3		3	3	3	3	3	3	3	3	3	2	2



BM16605 **MINI PROJECT** **0 0 4 2**

COURSE OBJECTIVES

To enable the students to

- improve the skills to formulate a technical project.
- explain the various tasks of the project and standard procedures.
- teach the use of new tools, algorithms and techniques required to carry out the projects
- analyze the various procedures for validation of the product and analyze the cost effectiveness
- examine the technical report of the project

GUIDELINE FOR REVIEW AND EVALUATION

The students may be grouped into 2 to 4 and work under a project supervisor. The device/system/component to be prototype may be decided in consultation with the supervisor. A project report to be submitted by the group and the prototype model, which will be reviewed and Evaluated for internal assessment by a Committee Constituted by the Head of the Department. At the end of the semester examination the project work is evaluated based on oral presentation and the Project report jointly by external and internal examiners constituted by the Head of the Department. It is highly desirable to publish their project in state/ national level conferences or Symposiums.

TOTAL PERIODS: 60

COURSE OUTCOMES

At the end of the course, the students will be able to

- formulate the real world problem, identify the requirement and develop the design solutions.
- identify the technical ideas, strategies and methodologies.
- use the new tools, algorithms, techniques that contribute to obtain the solution of the project
- analyze and validate through conformance of the developed prototype and analysis the cost effectiveness.
- explain the acquired knowledge through preparation of report and oral presentations.

COs	Programme Outcomes(POs)													
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	-	3	3	3	3	3	3	3	-	3	-	3	-
CO2	2	-	2	2	-	-	-	-	2	-	-	3	3	3
CO3	3	-	3	3	3	3	3	3	3	-	-	3	3	-
CO4	2	-	2	2	2	2	3	3	3	3	3	3	3	3
CO5	3	-	3	3	3	3	3	3	3	-	3	-	3	-

EN16601 CAREER DEVELOPMENT LABORATORY II 0 0 2 1

COURSE OBJECTIVES

To enable students to

- enhance career competency and employability skills
- demonstrate effective leadership and interpersonal skills
- improve professional capabilities through advanced study and researching current market strategy.
- develop problem solving and decision making capabilities
- prepare for any group discussion evaluation or presenting their credentials during a face -to - face interview leading to selection and employment

UNIT I CORPORATE READINESS 6

Business communication - Email, Paragraph, Letter Writing Skills; Public speaking skills - Rules of Public speaking skills, Extempore, JAM; Inter and intra personal skills – Introduction, Need for Inter and Intra personal skills in organizations; Stress management - Causes of stress and its impact, How to manage and distress, Circle of control, stress busters; Emotional Intelligence - What is emotional Intelligence, Why Emotional Intelligence Matters, Managing Emotions

UNIT II INTERVIEW SKILLS 6

Interview Basics - General Selection process, Grooming, Dress code, Supporting Documents to carry; Resume Building - Impact of Powerful CV, Do‟s and don‟ts in CV; Group Discussion - Introduction to GD, Important of Listening and Speaking skills, Do‟s and Don‟ts in GD ; Face to face interview / Hire me- Rules for face to face interview, body language; Self-Introduction ; Psychometric Assessment - Importance of Psychometric assessment, Why psychometric assessment

UNIT III QUANTITATIVE APTITUDE 6

Simplification ; Time and work; Pipes and cisterns; Ratio and Proportion; Partnership

UNIT IV QUANTITATIVE APTITUDE 6

Simple interest and Compound interest ; Profit and loss ; Permutation and combination Probability ; Calendar

UNIT V LOGICAL AND VERBAL REASONING 6

Seating arrangement; Direction; Arithmetic reasoning; Verbal reasoning – Syllogisms, Making Judgments, Statements and conclusions, Matching definition, Cause and effect

TOTAL PERIODS 30

COURSE OUTCOMES

Upon completion of the course, the students will be able to

- develop team work capabilities
- demonstrate aptitude and reasoning skills

- boost their problem solving skills.
- enhancethe transformation from college to corporate.
- be a knowledgeable person on the various evaluation processes leading to employment and face the same withConfidence.

TEXT BOOKS

1. Agarwal, R.S." A Modern Approach to Verbal & Non Verbal reasoning", S.Chand& co ltd, New Delhi.
2. Abhijitguha, "Quantitative Aptitude ", Tata - Mcgraw hill.
3. Word power made easy by normanlewis ,W.R.Goyal publications.
4. Johnson, D.W. Boston: Allyn and Bacon" reaching out – interpersonal effectiveness and self - actualization.
5. Mitra ,barun.K, " Personalaity Development &Softskills " , OxfordUniversity.
6. "Infosys campus connect program – students" guide for soft skills.

CO-PO Mapping:

Course Outcomes (CO's)	Mapping of course objectives with PO's and PSO's (1/2/3 indicates strength of correlation) 3-Strong, 2-Medium, 1-Weak													
	Programme Outcomes (PO's)												Programme Specific Outcomes (PSO's)	
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO1 0	PO1 1	PO1 2	PSO 1	PSO 2
CO 1			3		3	2			2			2		3
CO 2		2	3	2	2		2		2					2
CO 3		2	2	2	3	3		2		3			2	
CO 4	2	2	3	2	3	3	1					3	3	
CO 5	2	3	3	2	3			2		2				2

BM16151 **BIOMEDICAL INFORMATICS** **3 0 0 3**

COURSE OBJECTIVES

To enable the students to

- gain fundamental knowledge of hospital information system
- understand the theories and practices adopted in hospital information systems in the light of medical standards, medical data formats and recent trends in hospital information systems.
- explain how to manage medical databases
- gain Knowledge in ICT applications in medicine with an introduction to health informatics.
- study the concepts of telemedicine, its issues and reliability

UNIT I MEDICAL INFORMATICS **9**

Introduction - Medical Informatics – Bioinformatics – Health Informatics - Structure of Medical Informatics –Functional capabilities of Hospital Information System - On-line services and off – line services - History taken by computer, Dialogue with the computer.

UNIT II MEDICAL STANDARDS **9**

Evolution of Medical Standards – IEEE 11073 - HL7 – DICOM – IRMA - LOINC – HIPPA – Electronics Patient Records –Healthcare Standard Organizations – JCAHO (Join Commission on Accreditation of Healthcare Organization) - JCIA (Joint Commission International Accreditation) - Evidence Based Medicine - Bioethics.

UNIT III MEDICAL DATA ACQUISITION AND STORAGE **9**

Plug-in Data Acquisition and Control Boards – Data Acquisition using Serial Interface - Medical Data formats – Signal, Image and Video Formats – Medical Databases - Automation in clinical laboratories - Intelligent Laboratory Information System - PACS , Data mining.

UNIT IV HEALTH INFORMATICS **9**

Bioinformatics Databases, Bio-information technologies, Semantic web and Bioinformatics, Genome projects, Clinical informatics, Nursing informatics, Public health informatics -Education and Training.

UNIT V RECENT TRENDS IN MEDICAL INFORMATICS **9**

Medical Expert Systems, Virtual reality applications in medicine, Virtual Environment - Surgical simulation - Radiation therapy and planning – Telemedicine – virtual Hospitals - Smart Medical Homes – Personalized e-health services – Biometrics - GRID and Cloud Computing in Medicine.

TOTAL PERIODS 45

COURSE OUTCOMES

At the end of the course, the students will be able to

- discuss about health informatics and different ICT applications in medicine.
- explain the function of Hospital Information Systems.
- appreciate and adopt medical standards.
- understand the virtual reality tools.
- summarize the concept and need of different information systems.

TEXT BOOKS

1. R.D.Lele, "Computers in Medicine: Progress in Medical Informatics'', Tata McGraw Hill Publishing computers Ltd, New Delhi, 2005.
2. Mohan Bansal, "Medical informatics", Tata McGraw Hill Publishing Computers Ltd, New Delhi, 2003.

REFERENCES

1. N.Mathivanan, "PC-Based Instrumentation'', Prentice Hall of India Pvt Ltd – New Delhi, 2007.
2. Yi – Ping Phoebe Chen, "Bioinformatics Technologies'', Springer International Edition, New Delhi, 2014.
3. Hsinnchun Chen, "Medical Informatics: Knowledge Management and Data Mining in Biomedicine", Springer, 2010.

CO-PO Mapping:

Mapping of course objectives with PO's and PSO's (1/2/3 indicates strength of correlation) 3-Strong, 2-Medium, 1-Weak														
COs	Programme Outcomes (Pos)													
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO 2
CO1	3	3										3	3	2
CO2			3	3	3						3	3	2	3
CO3					3	3		3		3		3	2	2
CO4				3	3	3	3	3				3	2	2
CO5			3	3	3							3	3	3

BM16152 **VIRTUAL BIOINSTRUMENTATION** **3 0 0 3**

COURSE OBJECTIVES

To enable the students to

- understand what is Virtual instrumentation and to realize the architecture of VI.
- familiarize with the VI software and learn programming in VI.
- enlighten the concepts in programming, automation and measurement.
- study various Instrument Interfacing and data acquisition methods.
- design various analysis tools and develop programs for Process control applications.

UNIT I INTRODUCTION 9

History of Virtual Instrumentation (VI), advantages, block diagram and architecture of a virtual instrument, Programming paradigms – Virtual Instrumentation - LabVIEW software – LabVIEW basics – LabVIEW environment.

UNIT II PROGRAMMING TECHNIQUES 9

VIS and sub-VIS, loops & charts, arrays, clusters, graphs, case & sequence structures, formula modes, local and global variable, string & file input. Publishing measurement data in the web.

UNIT III DATA ACQUISITION AND CONTROL IN VI 9

Plug-in DAQ boards – Organization of the DAQ VI System – Performing analog input and analog output – Scanning multiple analog channels – Driving the digital I/Os – Buffered data acquisition – Simple problems

UNIT IV INSTRUMENT INTERFACES 9

Current loop, RS 232C/RS 485, GPIB, System basics, interface basics: USB, PCMCIA, networking basics for office & industrial application VISA & IVI, image acquisition & processing, Motion Control. ADC, DAC, DIO, DMM, waveform generator.

UNIT V APPLICATION OF VI 9

Design of virtual applications for Electrocardiography (ECG), Electromyography (EMG), Air Flow and Lung Volume, Heart Rate variability analysis, Noninvasive Blood Pressure Measurement, Biofeedback, Virtual Reality & 3D graphical modeling, Virtual Prototyping.

TOTAL PERIODS 45

COURSE OUTCOMES

At the end of the course, the students will be able to

- comprehend and appreciate the significance and role of this course in the present contemporary world.
- identify salient traits of a virtual instrument.
- understand the use of VI for data acquisition

- experiment, analyze and document different types of interfaces.
- apply the virtual instrumentation technologies for medical applications.

TEXT BOOKS

1. Kevin James, PC Interfacing and Data Acquisition: Techniques for Measurement, Instrumentation and Control, Newnes, 2003.
2. Gary Johnson, LABVIEW Graphical Programming, 4thEdition, McGraw Hill, 2006.

REFERENCES

1. Lisa K. Wells and Jeffrey Travis, LABVIEW for Everyone, PHI, 1997.
2. S. Gupta, J.P. Gupta, PC Interfacing for Data Acquisition and Process Control, ISA, 2nd Edition, 1994.
3. Sanjay Gupta and Joseph John, " Virtual Instrumentation using LabVIEW", Tata Mc Graw – Hill Publishing Company Limited, New Delhi, 1st Edition, 2010.
4. Technical Manuals for DAS Modules of Advantech and National Instruments.

CO-PO Mapping:

Mapping of course objectives with PO's and PSO's (1/2/3 indicates strength of correlation) 3-Strong, 2-Medium, 1-Weak													
COs	Programme Outcomes (Pos)												
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO 2
CO1	3	3			3							3	3	2
CO2	3	3	3		3							3	3	3
CO3		3	3	3	3							3	3	3
CO4		3	3	3	3							3	3	2
CO5				3	3	3				3	3	3	3	3

BM16153	BioMEMS	3 0 0 3

COURSE OBJECTIVES

To enable the students to

- analyze the working principle of MEMS & Microsystems in healthcare domain
- learn various MEMS fabrication techniques.
- understand different types of sensors and actuators and their principles of operation at the micro scale level.
- determine the working principles of Microsystems and Micro fluidic Systems
- illustrate the concepts of BioMEMS with suitable examples

UNIT I MEMS MATERIALS AND FABRICATION 9

Typical MEMs and Microsystems;Materials for MEMS - Active substrate materials, Silicon and its compounds, Silicon piezo resistors, Gallium Arsenide, quartz, polymers; Micromachining-photolithography, thin film deposition, doping, etching, bulk machining, wafer bonding, LIGA.

UNIT II MECHANICAL AND THERMAL - SENSORS AND ACTUATORS 9

Mechanics for MEMs design- Static bending of thin plates, mechanical vibration, thermo mechanics, fracture and thin film mechanics; Mechanical sensors and actuators – beam and cantilever,microplates, strain, pressure and flow measurements; Thermal sensors and actuators- Actuator based on thermal expansion, thermal couples, thermal resistor; Shape memory alloys - Inertia sensor, flow sensor.

UNIT III ELECTROSTATIC, PIEZOELECTRIC SENSORS AND ACTUATORS 9

Parallel plate capacitor- Pull in effect; Electrostatic sensors and actuators- Inertia sensor, Pressure sensor, flow sensor, tactile sensor, comb drive; Piezoelectric sensor and actuator- Properties of piezoelectric materials, inchworm motor, inertia sensor, flow sensor.

UNIT IV MICROSYSTEMS AND MICROFLUIDS 9

Microsystems - General principles, Microsensors, Actuators; Electrostatic forces - Piezoelectric crystals, Intelligent materials and structures; Fundamentals of micro fluids- Lab on a chip devices, Silicon and glass micromachining for micro total analysis systems, Surface chemistry in polymer microfluidic systems.

UNIT V APPLICATIONS OF BIOMEMS 9

CAD for MEMs; Drug delivery; micro total analysis systems (MicroTAS) detection and measurement methods; Microsystem approaches to polymerase chain reaction (PCR); DNA sensor; MEMS based drug delivery;Neural Prosthesis – shape memory implants; Introduction to 3D printing.

TOTAL PERIODS 45

COURSE OUTCOMES

At the end of the course, the students will be able to

- discuss various MEMS fabrication techniques.
- explain different types of sensors and actuators and their principles of operation at the micro scale level.
- comprehend the characteristics of fluid flow and actuation through micro channels.
- extend the need and use of CAD for MEMS design.
- design MEMS devices for different medical applications.

TEXT BOOKS

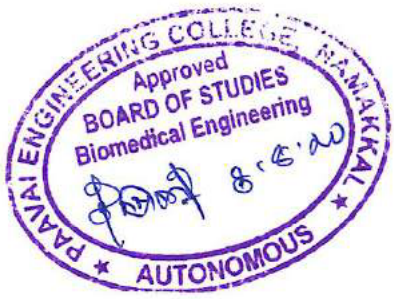
1. Tai Ran Hsu , "MEMS and Microsystems design and manufacture", Tata McGraw Hill Publishing Company, New Delhi, 2nd edition, 2008.
2. Chang Liu, " Foundations of MEMS", Pearson Education International, New Jersey, USA, 2nd Edition, 2014.

REFERENCES

3. Marc J. Madou, "Fundamentals of Microfabrication: the science of miniaturization'', CRC Press, 2nd edition 2007.
4. Wanjun Wang, Stephen A.Soper, "BioMEMS: Technologies and applications", CRC Press, New York, 2007
5. Malsch, NeelinaH., ed., Biomedical Nanotechnology, Washington, DC: CRC Press, 2019.

CO-PO Mapping:

Mapping of course objectives with PO's and PSO's (1/2/3 indicates strength of correlation) 3-Strong, 2-Medium, 1-Weak														
COs	Programme Outcomes (Pos)													
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO 2
CO1	3	3	3									3	3	2
CO2	3	3	3									3	2	3
CO3		3				3	3	3	3	3		3	2	3
CO4		3		3	3							3	3	3
CO5			3	3	3	3	3	3	3	3	3	3	3	3



BM16154 **MEDICAL OPTICS** **3 0 0 3**

COURSE OBJECTIVES

To enable the students to

- acquire knowledge about the impact and interaction of light with biological tissue.
- identify optical properties of the tissues and the interactions of light with tissues.
- list medical lasers and their applications
- summarize about optical diagnostic applications
- choose emerging optical therapeutic techniques

UNIT I INSTRUMENTATION IN PHOTONICS **9**

Review of basic properties of light – Reflection, Refraction, Scattering, fluorescence and phosphorescence. Instrumentation for absorption, Scattering and emission measurements, excitation light sources – high pressure arc lamp, LEDs, Lasers. Optical filters. Optical detectors - Time resolved and phase resolved detectors, optical tweezers.

UNIT II OPTICAL PROPERTIES OF THE TISSUES **9**

Light transport inside the tissue, optical properties of tissue. Laser Characteristics as applied to medicine and biology-Laser tissue Interaction-Chemical, Thermal, Electromechanical. Photo ablative processes.

UNIT III SURGICAL APPLICATIONS OF LASERS **9**

Lasers in ophthalmology- Dermatology –Dentistry-Urology-Otolaryngology- Tissue welding.

UNIT IV NON-THERMAL DIAGNOSTIC APPLICATIONS **9**

Optical coherence tomography, Elastography, Laser Induced Fluorescence (LIF)-Imaging, FLIM Raman Spectroscopy and Imaging, FLIM – Holographic and speckle application of lasers in biology and medicine.

UNIT V THERAPEUTIC APPLICATIONS **9**

Phototherapy, Photodynamic therapy (PDT) - Principle and mechanism - Oncological and non- oncological applications of PDT - Biostimulation effect – applications-Laser Safety Procedures.

TOTAL PERIODS 45

COURSE OUTCOMES:

At the end of the course, the students will be able to

- comprehend and appreciate the significance and role of this course in the present contemporary world.
- demonstrate knowledge of the fundamentals of optical properties of tissues.
- categorize surgical applications of laser.

- describe photonics and its therapeutic applications.
- apply the concepts of laser and light to understand the laser safety procedures.

TEXT BOOKS:

1. Markolf H.Niemz, "Laser-Tissue Interaction Fundamentals and Applications", Springer, 2007.
2. Paras N. Prasad, "Introduction to Bio photonics", A. John Wiley and sons, Inc. Publications, 2006.

REFERENCES:

1. Tuan Vo Dinh, "Biomedical photonics – Handbook", CRC Press LLC, 2015.
2. Mark E. Brezinski, "Optical Coherence Tomography: Principles and Applications", Academic Press, 2nd edition, 2013.
3. R. Splinter and B.A. Hooper, "An Introduction to Biomedical Optics", Taylor and Francis, 2007.
4. Helena Jelinkova, "Lasers for Medical Applications: Diagnostics, Therapy and Surgery'', Woodhead Publishing, 1st Edition, 2013.

CO-PO Mapping:

Mapping of course objectives with PO's and PSO's (1/2/3 indicates strength of correlation) 3-Strong, 2-Medium, 1-Weak														
COs	**Programme Outcomes (Pos)**													
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO 2**
CO1	2	3	3	3	3				2	2		3	3	2
CO2	3	2	3	3	2		2					2	3	3
CO3	3	3	3	3	3	2						2	3	2
CO4	3	2	3	2			2			2			2	2
CO5	3	2		2		2	2	2				2	2	2

BM16251 **TELEMEDICINE AND PACS** **3 0 0 3**

COURSE OBJECTIVES

To enable the students to

- know about the basics of telemedicine
- study about various types of communication and networking
- basic concepts of networks, network configuration and network security
- study of various applications of telemedicine
- know about picture archiving and communication system

UNIT I INTRODUCTION **9**

Fundamentals of Telemedicine, Block diagram of Telemedicine, History of telemedicine: Main phases of Telemedicine, Pre electronic Telemedicine, Electronic Telemedicine. Scope & Benefits and Limitation of Telemedicine.

UNIT II COMMUNICATION AND NETWORK **9**

Types of information: Audio, Video, Data, Fax, Still Image. Types of Communication and Networks: Overview of PSTN, POTS, ISDN, ATM, Videoconferencing, Wireless Communication – RF, GSM Satellite and Microwave, CDPD.

UNIT III DATA EXCHANGE AND NETWORK SECURITY **9**

Basic concepts of internet, Network Configuration, Circuit and Packet Switching, H.320 series, h.324 Protocols: TCP/IP, Standards for DICOM, Security: Encryption – DES, RSA, and Cryptography.

UNIT IV APPLICATIONS OF TELEMEDICINE **9**

Teleradiography – Basic parts of a Teleradiography System, Image acquisition and display system, Communication, Interpretation; Telepathology: Applications, Requirements, Security and Confidentiality tools, Telecytology: Applications, Telecardiology; Telehome – Care Home based Applications, Teleoncology: Applications; Telesurgery; Telepsychiatry; Teledermatology: Techniques.

UNIT V PICTURE ARCHIVING AND COMMUNICATION SYSTEM **9**

Picture Archiving and Communication System Components and Workflow; Communications and Networking; Integration of HIS, RIS, PACS, and ePR.

TOTAL PERIODS **45**

COURSE OUTCOMES

Upon the completion of the course, the students will be able to

- explain the development and transmission techniques used in telemedicine
- describe the types of communication and network systems
- explain the technologies used in data exchange and privacy of telemedicine
- illustrate the current system of tele-health and mobile health
- describe the currents and futures perspective of telemedicine

TEXT BOOKS

1. Olga (EDT), Ferrer – Roca, M. Sosa (EDT), Marcelo C, Handbook of Telemedicine, IOS press, 3rd printing, 2002.
2. Ling Guan, Multimedia image and video processing, CRC Press, 2nd edition, 2017.

REFERENCES

1. Thorsten M Buzug, Heinz Handels, Dietrich Holz, Telemedicine: Medicine and communication, Springer Verlag , 1st edition, 2001.
2. Douglas V Goldstein, E Healthcare: Harness the power of internet, e – commerce and e – care, Jones and barlett Publishers. 2000.
3. A. C Norris, Essentials of Telemedicine and Telecare, John Wiley & Sons, 2010.

CO-PO Mapping:

Mapping of course objectives with PO's and PSO's
(1/2/3 indicates strength of correlation) 3-Strong, 2-Medium, 1-Weak

COs	Programme Outcomes (Pos)													
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO 2
CO1	2	3	3	2	3	2			2				2	2
CO2	2	2	2		3					2			2	2
CO3			2	2	1		2			3			2	3
CO4	3	2	3		3	2				2			3	3
CO5	2		3		2		2			3			3	3

BM16252 **BIOMEDICAL LASER INSTRUMENTS** **3 0 0 3**

COURSE OBJECTIVES

To enable the students to

- describe the laser radiation characteristics and interaction of lasers with tissues
- explain the types, construction and operation of different laser systems
- associate the role of different types of laser systems used for biomedical applications
- understand the applications of laser in ophthalmology, dermatology, urology, gynecology and neurology
- attain the knowledge on applications of laser in orthopedic surgery, dentistry and precautionary method in laser safety

UNIT I LASER TISSUE INTERACTION **9**

Principle and fundamentals of laser-Laser radiation and its characteristics-Biological tissue composition-Light penetration and reflectance-Laser medicine domains-Laser light scattering in tissues-Alterations of bio tissue properties during hyperthermal and ablation reactions, photodynamic therapy.

UNIT II TYPES OF LASER USED IN MEDICINE **9**

Types of laser,CO2, Nd-YAG, He-Ne and semiconductor laser, construction and working principle of solid state laser-Atomic laser-Molecular laser-Liquid dye laser-Diode laser- dye laser, fiber, Gas laser.

UNIT III LASER APPLICATIONS-I **9**

Applications of laser radiation in ophthalmology-Laser treatment for eye tissues and diseases-Lasers in dermatology- handling of pain-Dermatological Disorders-Lasers in cardiovascular diagnostics-Lasers in cardiovascular therapy

UNIT IV LASER APPLICATIONS- II **9**

Lasers in urology- laser stone disintegration-Lasers in gynecology- laser application for the lower genital tract-Lasers in laparoscopy-Lasers in laryngeal surgery-Lasers in otology-Lasers in neurology

UNIT V LASER IN ORTHOPAEDIC SURGERY, DENTISTRY AND LASER SAFETY **9**

Mechanism of bone and cartilage reparation-Lasers in orthopedic surgery-Laser techniques used in spinal surgery-Lasers in dentistry- lasers in endodontic procedures-Caries detection and treatment by laser radiation-Laser Bleaching-Types of laser hazards, laser safety, laser use risk management,

TOTAL PERIODS **45**

COURSE OUTCOMES

Upon the completion of the course, the students will be able to

- classify the basic principles of Lasers
- acquire knowledge about the different types of lasers available in medicine.
- recall their principle of working and construction and their applications in the field of biomedical engineering.

- summarize the applications of lasers in urology, gynecology and neurology
- outline the applications in surgery, and laser safety techniques.

TEXT BOOKS

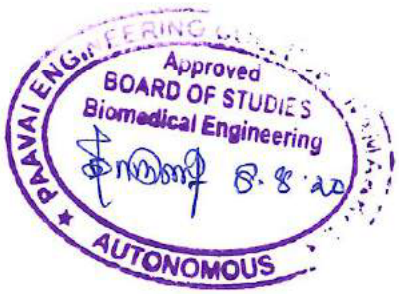
1. Helena Jelinkova, "Lasers for medical applications: Diagnostics, Therapy and Surgery", WoodheadPublishing, 1st edition, 2013.

REFERENCES

1. MarkolfH.Neimz, "Laser tissue interactions-Fundamentals and applications", Springer, 3rd edition,2014.
2. OrazioSvelto and David C. Hanna, "Principles of lasers", Springer, 5th edition, 2016.
3. William T. Silfvast, "Laser fundamentals", Cambridge University Press, 2nd edition, 2012.

CO-PO Mapping:

Mapping of course objectives with PO's and PSO's (1/2/3 indicates strength of correlation) 3-Strong, 2-Medium, 1-Weak														
COs	**Programme Outcomes (Pos)**													
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO 2**
CO1	3	2	3	3	2					3		2	2	2
CO2	3	2	3	2	2	2					2		2	2
CO3	3	3	3	2	2	2	3				2		2	2
CO4	3	3	3	2	2	2	3				2		2	2
CO5	3	3	3	2	2	2	3				2		2	2



BM16253 **PATTERN RECOGNITION AND NEURAL NETWORKS** **3 0 0 3**

COURSE OBJECTIVES

To enable the students to

- apply the fundamentals of pattern recognition and its application.
- develop algorithms suitable for pattern classification.
- have a knowledge on neural network
- create back propagation network and associative memory
- develop applications of pattern recognition and classification in image processing and computer vision.

UNIT I SUPERVISED LEARNING 9

Overview of Pattern recognition, Types of Pattern recognition, Parametric and Nonparametric approach, Bayesian classifier, Discriminant function, non-parametric density estimation, histograms, kernels, window estimators, k- nearest neighbor classifier, estimation of error rates.

UNIT II UNSUPERVISED LEARNING AND CLUSTERING ANALYSIS 9

Unsupervised learning- Hierarchical clustering- Single-linkage Algorithm, Complete – linkage Algorithm, Average - Linkage Algorithm and Ward's method. Partitional clustering- Forgy's Algorithm and k-means algorithm. Case studies.

UNIT III INTRODUCTION TO NEURAL NETWORK 9

Elementary neurophysiology and biological neural network –Artificial neural network – Architecture, biases and thresholds, Hebb net, Perceptron, Adaline and Madaline.

UNIT IV BACK PROPAGATION NETWORK AND ASSOCIATIVE MEMORY 9

Back propagation network, generalized delta rule, Bidirectional Associative memory, Hopfield Network

UNIT V NEURAL NETWORKS BASED ON COMPETITION 9

Kohonen Self organizing map, Learning Vector Quantization, Counter Propagation network, Case studies.

TOTAL PERIODS 45

COURSE OUTCOMES

Upon the completion of the course, the students will be able to

- classify patterns using statistical pattern classifier
- perform unsupervised classification using clustering techniques.
- explain the fundamentals of neural networks.
- design back propagation and hopfield network.
- perform classification using competitive neural networks.

TEXT BOOKS

1. Duda R.O, Hart P.G, "Pattern Classification and scene analysis'', Wiley Edition, 2000.
2. Freeman J. A., and Skapura B.M, "Neural networks, algorithms, applications and programming techniques", Addison- Wesley,2011.

REFERENCES

1. Hagan, Demuth and Beale, "Neural Network Design'', Vikas Publishing House Pvt Ltd., New Delhi, 2nd edition, 2016.
2. Robert Schalkoff, "Pattern recognition, Statistical, Structural and neural approaches", John Wiley and Sons (Asia) Pvt Ltd., Singapore, 2005.
3. LaureneFausett, "Fundamentals of Neural Networks- Architectures, Algorithms and Application", Prentice Hall, 2008.

CO-PO Mapping:

Mapping of course objectives with PO's and PSO's (1/2/3 indicates strength of correlation) 3-Strong, 2-Medium, 1-Weak													
COs	**Programme Outcomes (Pos)**												
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO 2**
CO1	3	3	3		3							3	2	2
CO2	3	3	3		3							3	2	2
CO3	3	3	3		3							3	2	3
CO4	3	3	3		3							3	2	3
CO5	3	3	3		3							3	2	3

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BM16254 **ADVANCED BIOANALYTICAL AND THERAPEUTIC TECHNIQUES** **3 0 0 3**

COURSE OBJECTIVES

To enable the students to

- understand the basic preparation of standards
- study common analytical techniques.
- enumerate the effects of radioactive radiation on human body.
- learn the appropriate technique for a given size & type of sample.
- illustrate the scientific foundation concerning characterization, testing and approval of nanoscale drugs in diagnostics, imaging agents, and therapeutics

UNIT I ANALYTICAL TECHNIQUES **9**

Principle, instrumentation and application of electrophoresis- SDS, native gel. UV and IR spectroscopy and its application. Spectrophotometry, fluorimetry. NMR – principle, instrumentation and application in medical sciences.

UNIT II ENZYMES AS A DIAGNOSTIC TOOL **9**

Isoenzymes and their screening techniques, enzyme pattern in health and diseased condition: lipase, amylase, ALP, ACP, SGOT, SGPT, LDH & CPK. Biosensors- enzyme based, antibody based, DNA based and optical biosensor. Blotting techniques. Automation in clinical laboratory.

UNIT III RADIOISOTOPIC TECHNIQUES **9**

Types of radioisotopes, units of measurements, methods in measuring radioactivity –G.M liquid scintillation counter application in diagnosis (RIA & ELISA) , autoradiography, biological hazards, safety measures in handling isotopes, disposal of labeled compounds and dosimetry.

UNIT IV GENE THERAPY **9**

Human genome project, central concept of gene therapy, prerequisite of human gene therapy, biological basis of gene therapy strategies, vehicles for gene transfer, gene transfer methods, clinical gene therapy case studies for hereditary disease, cancer and HIV. Ethical issues in human gene therapy.

UNIT V NANOTHERAPEUTICS **9**

Introduction to nanoparticles – their types, nanocarriers in drug delivery, synthesis and physiochemical properties of particles at nanoscale. Transport across biological barriers, Nanotechnology in Cancer therapy, bone treatment, oral vaccination and skin disease. Fate of nanoparticle and its toxicity.

TOTAL PERIODS **45**

COURSE OUTCOMES

Upon the completion of the course, the students will be able to

- report and discuss on chemical analytical aspects relevant for the selection of proper analytical techniques.
- implement bio analytical aspects in medical sciences.

- discuss on preventive measures of radioactive pollution and regulations regarding safety measures for radiation exposure.
- analyze the underlying etiology of the disease that might be treated by gene therapy.
- describe the basic science behind the properties of materials at nanoscale and the principles behind advanced experimental and computational techniques for studying nanomaterials.

TEXT BOOKS

1. Douglas A, "Principles of Instrumental Analysis", Skoog Brooks Cole publisher, 7th Edition 2018.
2. Keith Wilson & John Walker, "Practical Biochemistry – Principles and Techniques", Oxford University Press, 7th Edition, 2010.

REFERENCES

1. Trevor Palmer, "Understanding Enzymes", Published by Ellis Horwood LTD, 4th Edition, 1995.
2. Harvey Lodish W. H, "Molecular Cell Biology", Freeman publisher 8th Edition, 2016.
3. G. Louis Hornyak, John J. Moore, Harry F. Tibbals and JoydeepDutta, "Fundamentals of Nanotechnology", CRC press, 1st Edition, 2009.
4. Gabor L. Hornyak, JoydeepDutta, H.F. Tibbals, Anil Rao, "Introduction to NanoScience", CRC Press, 2008.

CO-PO Mapping:

Mapping of course objectives with PO's and PSO's (1/2/3 indicates strength of correlation) 3-Strong, 2-Medium, 1-Weak														
COs	Programme Outcomes (Pos)													
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO 2
CO1	3	3	3									3	2	3
CO2				3	3	3	3	3			3	3	2	2
CO3					3	3	3	3				3	3	3
CO4				3	3	3	3	3				3	3	2
CO5				3	3	3	3	3			3	3	3	2