Dr.M.G.R. EDUCATIONAL AND RESEARCH INSTITUTE UNIVERSITY
(Declared U/S 3 of the UGC Act 1956)

DEPARTMENT OF BIOMEDICAL INSTRUMENTATION

CURRICULUM AND SYLLABUS

2017 REGULATION

Semester: 3

Theory:

Course Code	Course Title	C	L	T/SLr	P/R	Ty / Lb/ ETL
BMA17006	Mathematics III for Electrical Engineers	4	3	1/0	0/0	Ty
BEI17001	Circuit Theory	4	3	1/0	0/0	Ty
BBI17001	Electric Field and Machines	4	3	1/0	0/0	Ty
BBI17002	Human Anatomy	3	3	0/0	0/0	Ty
BEC17I06	Analog and Digital IC's	3	3	0/0	0/0	Ty

Practical:

BBI17ET1	Advancement In Electronics *	3	1	0/2	1/1	ETL
BBI17L01	Human Anatomy Laboratory	1	0	0/0	3/0	Lb
BBI17L02	Electric Circuits Laboratory	1	0	0/0	3/0	Lb
BEC17IL4	Analog and Digital IC's Laboratory	1	0	0/0	3/0	Lb

Credits Sub Total: 24

Semester: 4

Theory:

Course Code	Course Title	C	L	T/SLr	P/R	Ty / Lb/ ETL
BMA17011	Numerical Methods For Electrical Engineers	4	3	1/0	0/0	Ty
BEI17007	Transducer Engineering	4	3	1/0	0/0	Ty
BBI17003	Human Physiology	4	3	1/0	0/0	Ty
BBI17004	Medical Physics	3	3	0/0	0/0	Ty
BBT17I02	Bio-Chemistry	3	3	0/0	0/0	Ty

C : Credits L : Lecture T : Tutorial S.Lr : Supervised Learning P : Problem / Practical R : Research
Ty/Lb/ETL : Theory/Lab/Embedded Theory and Lab
* Internal evaluation (Departmental level Refer Annexure for evaluation methodology)

Practical:

BSK17ET1	Soft Skill 1	2	1	0/1	1/0	ETL
BBI17ET2	Bio-Mechanics*	3	1	0/2	1/1	ETL
BBI17L03	Human physiology Laboratory	1	0	0/0	3/0	Lb
BEI17L03	Transducer Laboratory	1	0	0/0	3/0	Lb
BBT17IL2	Bio- Chemistry Laboratory	1	0	0/0	3/0	Lb
BBI17TSX	Technical Skill 1 (Evaluation)	1	0	0/0	2/0	Lb

Credits Sub Total: 27

Semester: 5
Theory:

Course Code	Course Title	C	L	T/SLr	P/R	Ty / Lb/ ETL
BBI17005	Bio-Control Systems	4	3	1/0	0/0	Ty
BBI17006	Bio-Medical Signal processing	4	3	1/0	0/0	Ty
BBI17007	Bio-Medical Instrumentation	3	3	0/0	0/0	Ty
BBI17008	Bio-Materials and Artificial Organs	3	3	0/0	0/0	Ty
BEE17I02	Microprocessor, Microcontroller and its Applications	3	3	0/0	0/0	Ty

Practical:

BBI17ET3	Measurement and Instrumentation*	3	1	0/2	1/1	ETL
BBI17L04	Electrical and Electronics Measurements Laboratory	1	0	0/0	3/0	Lb
BBI17L05	Bio- Signal Acquisition Laboratory	1	0	0/0	3/0	Lb
BEE17IL3	Microprocessor, Microcontroller and its Applications Laboratory	1	0	0/0	3/0	Lb
BBI17TSX	Technical Skill 2 (Evaluation)	1	0	0/0	3/0	Lb
BBI17L06	Inplant Training (Evaluation)	1	0	0/0	2/0	Lb

Credits Sub Total: 25

C: Credits L: Lecture T: Tutorial S.Lr : Supervised Learning P : Problem / Practical R : Research
Ty/Lb/ETL: Theory/Lab/Embedded Theory and Lab

* Internal evaluation (Departmental level Refer Annexure for evaluation methodology)

Semester: 6
Theory:

Course Code	Course Title	C	L	T/SLr	P/R	Ty / Lb/ ETL
BBI17009	Pathology and Microbiology	4	3	1/0	0/0	Ty
BBI17010	Medical Image Processing	3	3	0/0	0/0	Ty
BBI17EXX	Elective 1	3	3	0/0	0/0	Ty
BEC17I07	Communication System and IOT	3	3	0/0	0/0	Ty
BBI17OEX	Open Elective (Interdisciplinary)	3	3	0/0	0/0	Ty

Practical:

BSK17ET2	Soft Skill 2	2	1	0/1	1/0	ETL
BBI17L07	Bio-Medical Signal and Image Processing Laboratory	1	0	0/0	3/0	Lb
BBI17L08	Bio-Medical Instrumentation Laboratory - I	1	0	0/0	3/0	Lb
BBI17L09	Pathology and Microbiology Laboratory	1	0	0/0	3/0	Lb
BBI17L10	Mini Project (Evaluation)	1	0	0/0	0/2	Lb
BBI17TSX	Technical Skill 3 (Evaluation)	1	0	0/0	2/0	Lb

Credits Sub Total: 23

Semester: 7
Theory:

Course Code	Course Title	C	L	T/SLr	P/R	Ty / Lb/ ETL
BBI17011	Bio-Medical Equipments	4	3	1/0	0/0	Ty
BBI17012	Virtual Instrumentation for Medical Application	4	3	1/0	0/0	Ty
BBI17EXX	Elective 2	3	3	3	0/0	0
BBI17EXX	Elective 3	3	3	3	0/0	0
BMG17003	Total Quality Management	3	3	3	0/0	0

Credits L : Lecture T : Tutorial S.Lr : Supervised Learning P : Problem / Practical R : Research
Ty/Lb/ETL : Theory/Lab/Embedded Theory and Lab

Practical:

BBI17ESX	Elective (Special - Based on Current Technology) *	3	1	0/2	1/1	ETL
BBI17L11	Bio-Medical Instrumentation Laboratory - II	1	0	0/0	3/0	Lb
BBI17L12	Virtual Instrumentation Laboratory for Medical Application	1	0	0/0	3/0	Lb
BBI17L13	Project Phase – 1	2	0	0/0	0/2	Lb
BFL17001	Foreign Language (Evaluation)	2	1	1	0/0	

Credits Sub Total: 26

Semester: 8
Theory:

Course Code	Course Title	C	L	T/SLr	P/R	Ty / Lb/ ETL
BBI17EXX	Elective 4	3	3	0/0	0/0	Ty
BBI17EXX	Elective 5	3	3	0/0	0/0	Ty
BMG17005	Entrepreneurship Development	3	3	0/0	0/0	Ty

Practical:

BBI17L14	Project (Phase – II)	10	0/0	0/0	10	Lb

Credits Sub Total: 19

C : Credits L : Lecture T : Tutorial S.Lr : Supervised Learning P : Problem / Practical R : Research
Ty/Lb/ETL : Theory/Lab/Embedded Theory and Lab
* Internal evaluation (Departmental level Refer Annexure for evaluation methodology)
4 Credit papers should compulsorily have either P/R component.

Credit Summary

Semester : 1 : 18
Semester : 2 : 23
Semester : 3 : 24
Semester : 4 : 27
Semester : 5 : 25
Semester : 6 : 23
Semester : 7 : 26
Semester : 8 : 19

Total Credits : 185

Elective 1

Course Code	Course Title	C	L	T/S Lr	P/R	Ty / Lb/ ETL
BBI17E01	Troubleshooting of Bio-Medical Equipments	3	3	0/0	0/0	Ty
BBI17E02	Rehabilitation Engineering	3	3	0/0	0/0	Ty
BBI17E03	Human Assist Devices	3	3	0/0	0/0	Ty

Elective 2

Course Code	Course Title	C	L	T/S Lr	P/R	Ty / Lb/ ETL
BBI17E04	Laser and Ultrasonic Application in Medicine	3	3	0/0	0/0	Ty
BBI17E05	Computer based Medical Instrumentation	3	3	0/0	0/0	Ty
BBI17E06	Biomedical MEMS and Nano Technology	3	3	0/0	0/0	Ty

Elective 3

Course Code	Course Title	C	L	T/S Lr	P/R	Ty / Lb/ ETL
BBI17E07	Radiological Equipments	3	3	0/0	0/0	Ty
BBI17E08	Biological Effects of Radiation	3	3	0/0	0/0	Ty
BBI17E09	Computer in Medicine	3	3	0/0	0/0	Ty

Elective 4

Course Code	Course Title	C	L	T/S Lr	P/R	Ty / Lb/ ETL
BBI17E10	Medical Informatics	3	3	0/0	0/0	Ty
BBI17E11	Fibre Optic and Laser Instruments	3	3	0/0	0/0	Ty
BBI17E12	Diagnostic and Therapeutic Equipments I	3	3	0/0	0/0	Ty

Elective 5

Course Code	Course Title	C	L	T/S Lr	P/R	Ty / Lb/ ETL
BBI17E13	Recent Advances Applied to Hospital Engineering	3	3	0/0	0/0	Ty
BBI17E14	Diagnostic and Therapeutic Equipments II	3	3	0/0	0/0	Ty
BBI17E15	System Theory Applied to Biomedical Engineering	3	3	0/0	0/0	Ty

Subject Code:	Subject Name : MATHEMATICS III FOR ELECTRICAL ENGINEERS	T / L/ ETL	L	T / S.Lr	P/ R	C
BMA17006	Prerequisite:	T	3	1/0	0/0	4

L : Lecture T : Tutorial SLr : Supervised Learning P : Project R : Research C: Credits
T/L/ETL : Theory/Lab/Embedded Theory and Lab

OBJECTIVE :

- To understand the basic concepts in Transformer

COURSE OUTCOMES (COs) : (3- 5)

CO1	To understand the Basic concepts in Laplace Transforms
CO2	To understand the Applications of Laplace Transforms
CO3	To understand the Basic concepts in Fourier series
CO4	To understand the Basic concepts in Fourier Transforms
CO5	To understand the Basic concepts in Z Transforms

Mapping of Course Outcomes with Program Outcomes (POs)

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	L	H	L	L	L	L	L	L	M	L	L	M
CO2	L	H	L	L	L	L	L	L	M	L	L	M
CO3	L	H	L	L	L	L	L	L	M	L	L	M
CO4	L	H	L	L	L	L	L	L	M	L	L	M
CO5	L	H	L	L	L	L	L	L	M	L	L	M

COs / PSOs	PSO1	PSO2	PSO3	PSO4	PSO5			
CO1	M	M	L	L	L			
CO2	M	M	L	L	L			
CO3	M	M	L	L	L			
CO4	M	M	L	L	L			
CO5	M	M	L	L	L			

H/M/L indicates Strength of Correlation H- High, M- Medium, L-Low

Category	Basic Sciences	Engineering Sciences	Humanities and Social Sciences	Program Core	Program Electives	Open Electives	Practical / Project	Internships / Technical Skill	Soft Skills			
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Approval	

MATHEMATICS III FOR ELECTRICAL ENGINEERS

UNIT I LAPLACE TRANSFORMS **12 Hrs**

Transforms of simple functions – Properties of Transforms – Inverse Transforms – Transforms of Derivatives and Integrals

UNIT II APPLICATIONS OF LAPLACE TRANSFORMS **12 Hrs**

Periodic functions – Initial and final value theorems – Convolution theorem – Applications of Laplace transforms for solving linear ordinary differential equations up to second order with constant coefficients and Linear simultaneous differential equations of first order with constant coefficients

UNIT III FOURIER SERIES **12 Hrs**

Dirichlet's conditions – General Fourier series – Half range Sine and Cosine series – Complex form of Fourier series – Parseval's identity – Harmonic Analysis

UNIT IV FOURIER TRANSFORMS **12 Hrs**

Statement of Fourier integral theorem – Fourier transform pairs – Fourier Sine and Cosine transforms – Properties – Transforms of simple functions – Convolution theorem – Parseval's theorem.

UNIT V Z TRANSFORMS AND DIFFERENCE EQUATION **12 Hrs**

Z-transforms – Elementary properties – Inverse Z transforms – Partial fraction – Residue method – Convolution theorem – Solution of difference equation using Z transform (simple problems).

Total Number of Hours: 60 Hrs

Text Books:

1. Veerarajan T., Engineering Mathematics (for first year), Tata McGraw Hill Publishing Co., (2008)
2. Veerarajan T., Engineering Mathematics (for semester III), Tata McGraw Hill Publishing Co., (2005)
3. Grewal B.S., Higher Engineering Mathematics, Khanna Publishers, (2012)

Reference Books:

1. Kreyszig E., Advanced Engineering Mathematics (9 th ed.), John Wiley & Sons, (2011)
2. Singaravelu, Transforms and Partial Differential Equations, Meenakshi Agency, (2017)

Subject Code: BEI17001	**Subject Name : CIRCUIT THEORY**	**T / L/ ETL**	**L**	**T / S.Lr**	**P/ R**	**C**
	Prerequisite:	T	3	1/0	0/0	4

L : Lecture T : Tutorial SLr : Supervised Learning P : Project R : Research C: Credits
T/L/ETL : Theory/Lab/Embedded Theory and Lab

OBJECTIVE :

- Enabling the students to acquire knowledge about the basic of circuit analysis, network theorems, ac circuits and transient analysis.
- The graduate will learn the analysis of complex circuits using mesh current and nodal voltage methods.
- Students to analyze complex circuits using network theorems.
- To get an insight into solution of RLC circuits.
- Understanding the concept of complex frequency and free and forced response of RL, RC and RLC circuits.

COURSE OUTCOMES (COs) : (3- 5)

CO1	Understands basics of circuit analysis, network theorems, ac circuits and transient analysis.
CO2	The graduate will be able to analysis complex circuits using mesh current and nodal voltage methods.
CO3	Ability to analyze complex circuits using network theorems
CO4	Capable to analyze RLC circuits
CO5	Understands the concept of complex frequency and free and forced response of RL, RC and RLC circuits.

Mapping of Course Outcomes with Program Outcomes (POs)

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	H	M	H	M	L	H	M	H	M	L	M	H
CO2	M	H	M	L	H	M	H	M	H	M	H	H
CO3	L	H	H	H	M	L	H	M	H	L	M	H
CO4	M	H	L	M	H	M	L	M	H	M	L	M
CO5	L	M	H	M	H	M	L	M	H	M	M	L

COs / PSOs	PSO1	PSO2	PSO3	PSO4	PSO5			
CO1	H	H	M	M	L			
CO2	M	H	M	L	M			
CO3	H	M	H	L	L			
CO4	M	M	H	L	H			
CO5	M	M	L	L	H			

H/M/L indicates Strength of Correlation H- High, M- Medium, L-Low

Category	Basic Sciences	Engineering Sciences	Humanities and Social Sciences	Program Core	Program Electives	Open Electives	Practical / Project	Internships / Technical Skill	Soft Skills			
				✓								
Approval												

CIRCUIT THEORY

UNIT I BASICS OF CIRCUIT ANALYSIS **12 Hrs**

Kirchhoff's Laws, DC and AC excitation, series and parallel circuits, sinusoidal steady state analysis, Mesh current and Node Voltage method of Analysis, Matrix method of Analysis.

UNIT II NETWORK THEOREMS AND RESONANCE CIRCUITS **12 Hrs**

Thevenin's and Norton's theorems, Superposition theorem, Compensation theorem, Reciprocity theorem, Maximum power transfer theorem, series and parallel resonance, Quality factor and Bandwidth

UNIT III ANALYSIS OF NETWORKS IN 'S' DOMAIN **12 Hrs**

Network elements, Transient response of RL, RC and RLC Circuits to DC excitation, Natural and forced oscillations, Two-port Networks, Parameters and transfer function, Interconnection of two-ports

UNIT IV ELEMENTS OF NETWORK SYNTHESIS **12 Hrs**

Network reliability, Hurwitz polynomials, Positive real functions, Properties of RL, RC and LC Networks, Foster and Causer forms of Realization, Transmission Zeroes, synthesis of transfer functions

UNIT V FILTER DESIGN **12 Hrs**

Butterworth and Chebyshev approximation, Normalized specifications, Low pass filter design, Frequency transformations, Frequency and Impedance denormalisation, Types of frequency selective filters, Linear phase filters, Active filter design concepts.

Total Number of Hours: 60 Hrs

Text Books:

1. A. Sudhakar, Shyammohan S. Palli, "Circuits and Networks Analysis and Synthesis", Second Edition, Tata McGraw-Hill, 2002
2. Vasudev. K, "Network Theory and Filter Design", Wiley – Eastern Ltd, Second Edition, 1993

Reference Books:

1. William H. Hayt and Jack E. Kermmerly, "Engineering Circuit Analysis", McGraw-Hill International Edition, 1993.
2. Joseph Edminister and Mahmood Nahri, "Electric Circuits", Third Edition, Tata McGraw-Hill, New Delhi, 1999.
3. Umesh Sinha, "Network Analysis", Satya Prakasan, New Delhi, 1986.
4. Franklin. F. Kuo, "Network Analysis and Synthesis", John Wiley, 1996.
5. Vanval Kenburg, "Network Analysis", Prentice Hall of India Pvt. Ltd, New Delhi, 1994.

Subject Code: BBI17001	**Subject Name : ELECTRIC FIELD AND MACHINES**	**T / L/ ETL**	**L**	**T / S.Lr**	**P/ R**	**C**
	Prerequisite:	T	3	1/0	0/0	4

L : Lecture T : Tutorial SLr : Supervised Learning P : Project R : Research C: Credits
T/L/ETL : Theory/Lab/Embedded Theory and Lab

OBJECTIVE :

- To gain Knowledge on vector concepts
- To study about static electric field
- To learn about steady magnetic field
- To gain knowledge on time varying electric and magnetic fields
- To learn about electrical machines

COURSE OUTCOMES (COs) : (3- 5)

CO1	Capable to analyze Vector concepts
CO2	Understands static electric field
CO3	Acquire the knowledge about steady magnetic field
CO4	Ability to analyze time varying electric and magnetic fields
CO5	Capable to analyze electrical machines

Mapping of Course Outcomes with Program Outcomes (POs)

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	H	M	L	H	M	H	H	H	L	L	M	H
CO2	M	M	M	M	H	H	H	H	M	L	L	M
CO3	H	H	H	M	L	L	M	H	L	M	H	L
CO4	M	H	L	M	M	H	L	M	M	L	H	L
CO5	H	M	H	M	L	H	L	M	H	L	M	L

COs / PSOs	PSO1	PSO2	PSO3	PSO4	PSO5			
CO1	H	M	L	M	H			
CO2	M	M	L	L	H			
CO3	M	H	H	M	L			
CO4	H	H	M	M	L			
CO5	M	M	H	M	H			

H/M/L indicates Strength of Correlation H- High, M- Medium, L-Low

Category	Basic Sciences	Engineering Sciences	Humanities and Social Sciences	Program Core	Program Electives	Open Electives	Practical / Project	Internships / Technical Skill	Soft Skills			
				✓								
Approval												

ELECTRIC FIELD AND MACHINES

UNIT I INTRODUCTION **12 Hrs**

Brief introduction to Vector Analysis, Coordinate systems (rectangular, cylindrical, spherical) and field theory

UNIT II STATIC ELECTRIC FIELD **12 Hrs**

Coulomb's law - electric field intensity, Gauss's law – potential and its applications, Dielectrics, Permittivity, Polarization, Boundary relation, capacitance, Dielectric strength, Energy and energy density. Electric current, current density ohm's law continuity relations for current, problems - Poisson's and Laplace equations

UNIT III STEADY MAGNETIC FIELD **12 Hrs**

The Biot Savart's law for magnetic fields and magnetic field intensity, ampere's law, magnetic materials, Ferro magnetism, hysteresis, magnetic dipoles, loops and solenoids, Magnetization, inductance, energy in an inductor and energy density, boundary relations, reluctance and permeance, problems

UNIT IV TIME VARYING ELECTRIC AND MAGNETIC FIELDS **12 Hrs**

Faraday's law, Transformer and motional induction, Maxwell's equation from Faraday's law Self and Mutual Inductance, Displacement, Current, Maxwell's Equation from Ampere's law and it's in consistency, Boundary relation, Brief introduction to waves and Pointing Vector, Comparison of field and circuit theory, Circuit application of Pointing Vector.

UNIT V ELECTRICAL MACHINES **12 Hrs**

Principles of operation and characteristics of Transformers (Single-phase and Three-phase), DC machines, Synchronous Machines, 3 phase and Single phase Induction motors

Total Number of Hours: 60 Hrs

Text Books:

1. John D.Krauss, "Electro Magnetism", McGraw Hill, 1999

Reference Books:

1. Hayt W.H, "Engineering Electromagnetics", McGraw Hill, 1995.

Subject Code: BBI17002	**Subject Name : HUMAN ANATOMY**	**T / L/ ETL**	**L**	**T / S.Lr**	**P/ R**	**C**
	Prerequisite:	T	3	0/0	0/0	3

L : Lecture T : Tutorial SLr : Supervised Learning P : Project R : Research C: Credits
T/L/ETL : Theory/Lab/Embedded Theory and Lab

OBJECTIVE :

- To learn basics of human body, cell and blood
- To study about the positioning and functioning of the cardiovascular
- To study about the positioning and functioning of the respiratory systems
- To study about the positioning and functioning of the nervous system
- To study about the positioning and functioning of the musculoskeletal system

COURSE OUTCOMES (COs) : (3- 5)

CO1	Understands the basics of human body, cell, and blood
CO2	Capable to analyze the positioning and functioning of the cardiovascular
CO3	Acquires knowledge on the positioning and functioning of the respiratory systems
CO4	Understands the positioning and functioning of the nervous system
CO5	Acquires the positioning and functioning of the musculoskeletal system

Mapping of Course Outcomes with Program Outcomes (POs)

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	M	M	M	H	H	H	H	M	L	M	H	M
CO2	H	H	H	M	L	H	M	L	H	M	L	M
CO3	M	M	H	L	M	H	M	L	H	M	L	M
CO4	H	H	M	H	M	H	M	H	H	M	H	M
CO5	H	M	L	H	M	H	L	H	M	M	H	M

COs / PSOs	PSO1	PSO2	PSO3	PSO4	PSO5			
CO1	M	H	M	H	M			
CO2	H	H	M	H	M			
CO3	L	M	L	H	H			
CO4	M	H	M	H	L			
CO5	H	M	L	M	H			

H/M/L indicates Strength of Correlation H- High, M- Medium, L-Low

Category	Basic Sciences	Engineering Sciences	Humanities and Social Sciences	Program Core	Program Electives	Open Electives	Practical / Project	Internships / Technical Skill	Soft Skills			
		✓										
Approval												

HUMAN ANATOMY

UNIT I INTRODUCTION **9 Hrs**

Cell structure and Organelles Description- Circulatory System- Heart, Pericardium, Chambers, Major Blood Vessels, Blood supply

UNIT II DIGESTIVE SYSTEM **9 Hrs**

Digestive System- GI Tract, parts, stomach, Intestine, Liver and Pancreas, Respiratory System- Trachea and Lungs.

UNIT III EXCRETORY AND UROGENITA SYSTEM **9 Hrs**

Parts, Reproductive System – Male and Female Reproductive Organs - Nervous System – Functions of Neurons, Synapse, Reflexes and Receptors, Brain, Brainstem, Ventricles and Spinal cord. Peripheral Automatic Nervous System

UNIT IV MUSCULAR SYSTEM **9 Hrs**

Musculo - Skeletal System – Muscle Tissue, Structure of Skeletal Muscle, Types of Muscle, Types of Joints, Major Muscles of Limbs and their actions

UNIT V ENT **9 Hrs**

Eye, Ear, Endocrine Glands

Total Number of Hours: 45 Hrs

Text Books:

1. Ranganathan, T.S. “Text Book of Human Anatomy”, S.Chand and Co. Ltd., Delhi, 1996

Reference Books:

1. Tobin, C.E., “Basic Human Anatomy”, McGraw Hill Publishing Co. Ltd., Delhi, 1997
2. J.Gibson, “Modern Physiology and Anatomy for Nurses”, Blackwell SC Publishing 1981

Subject Code: BEC17I06	**Subject Name : ANALOG AND DIGITAL IC'S**	**T / L/ ETL**	**L**	**T / S.Lr**	**P/ R**	**C**
	Prerequisite:	T	3	0/0	0/0	3

L : Lecture T : Tutorial SLr : Supervised Learning P : Project R : Research C: Credits
T/L/ETL : Theory/Lab/Embedded Theory and Lab

OBJECTIVE :

- To learn about operational amplifiers and applications
- To study about phase locked loop and applications D/A A/D converters
- To gain knowledge on number systems
- To learn about MSI combinational circuits
- To study about sequential circuits

COURSE OUTCOMES (COs) : (3- 5)

CO1	The graduate understands operational amplifiers and applications
CO2	Acquire the knowledge about phase locked loop and applications D/A A/D converters
CO3	Understands the analysis of on number systems
CO4	The graduate understands MSI combinational circuits
CO5	Acquire the knowledge about sequential circuits

Mapping of Course Outcomes with Program Outcomes (POs)

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	M	H	M	H	M	L	L	L	M	H	M	H
CO2	M	H	M	L	M	H	M	L	M	H	L	M
CO3	H	M	H	L	M	H	M	H	L	L	M	M
CO4	M	H	M	L	L	H	M	L	M	H	M	L
CO5	H	M	L	L	L	M	H	L	M	H	M	L

COs / PSOs	PSO1	PSO2	PSO3	PSO4	PSO5			
CO1	M	H	H	M	L			
CO2	H	M	M	H	M			
CO3	H	M	L	M	H			
CO4	M	M	H	H	L			
CO5	H	H	M	M	L			

H/M/L indicates Strength of Correlation H- High, M- Medium, L-Low

Category	Basic Sciences	Engineering Sciences	Humanities and Social Sciences	Program Core	Program Electives	Open Electives	Practical / Project	Internships / Technical Skill	Soft Skills			
				✓								

Approval	

ANALOG AND DIGITAL IC'S

UNIT I OPERATIONAL AMPLIFIERS AND APPLICATIONS 9 Hrs

Characteristics of ideal op amp, virtual short, differential amplifier, offset current and voltages, slew rate, 741IC specifications inverting and non inverting amplifiers adder/subtractor, instrumentation amplifier, voltage to current and current to voltage converter, DC voltage follower, differential DC amplifier, bridge amplifier, integrator, differentiator, active low pass, high pass and band pass active filters, precision diode and clamp, half wave rectifier, average detector, peak detectors, log-antilog amplifiers, stable, mono stable and triangular wave generators, Schmitt trigger, analog multiplier

UNIT II PHASELOCKEDLOOP AND APPLICATIONS D/A A/D CONVERTERS 9 Hrs

Basic principles, phase comparator, voltage controlled oscillators, lock range, capture range PLL IC 565, functional block schematic of PLL, PLL applications - frequency multiplications, frequency translation, AM, FM detection, D/A converters successive approximation, parallel ADC, V to F ADC, counter ramp ADC.

UNIT III NUMBER SYSTEMS 9 Hrs

Number systems - Binary, octal, hexa decimal, BCD, Grey and excess3 representations r's and (r-1)'s complements, subtraction using 1's and 2's complement binary to grey, grey to binary conversions alpha numeric codes, Boolean theorems min terms and max terms representation, SOP and POS forms Karnaugh maps tabulation methods logic gates –truth table realization of Boolean functions using gates, universal gates

UNIT IV MSI COMBINATIONAL CIRCUITS 9 Hrs

Half and full adders parallel binary adder BCD adder, half and full sub tractors magnitude comparator decoder, encoder, multiplier, ROM, PLA, Boolean expression implementation using these IC's

UNIT V SEQUENCIAL CIRCUITS 9 Hrs

Flip flops-SR, JK, T, D characteristic equations, excitation tables design of counters using excitation tables, synchronous and asynchronous counters , 7490, 74161 counters IC specifications , ring and Johnson counters shift registers, 74194 shift IC specifications.

Total Number of Hours: 45 Hrs

Text Books:

1. Millman.J. Halkias., "Integrated Electronics", McGraw hill 1972

Reference Books:

1. Ramakant. A. Gayakwad, "Op-amp and Linear IC's", Prentice Hall 1994
2. Moris Mano.M "Digital Logic and Computer Design", Prentice Hall 2001

Subject Code: BBI17ET1	Subject Name: ADVANCEMENT IN ELECTRONICS*	T / L/ ETL	L	T / S.Lr	P/ R	C
	Prerequisite:	ETL	1	0/2	1/1	3

L : Lecture T : Tutorial SLr : Supervised Learning P : Project R : Research C: Credits
T/L/ETL : Theory/Lab/Embedded Theory and Lab

OBJECTIVE :

- Familiarity on the basics of Electronic devices.
- To gain knowledge about the fundamental devices of different circuits, its characteristics and configurations
- Familiarity on the basics of Feedback Circuits
- To impart knowledge on the fundamental concepts of Nanotechnology
- To develop students to gain knowledge on Nanomaterials

COURSE OUTCOMES (COs) : (3- 5)

CO1	Gain Knowledge on Electronics devices and design different circuits
CO2	Develop knowledge to incorporate the devices and circuits for different applications
CO3	Capable to design Oscillators and Amplifiers depending upon the applications.
CO4	Students capable to gain knowledge on the latest technology
CO5	Students capable to gain knowledge in fabricating Electronic devices and other materials

Mapping of Course Outcomes with Program Outcomes (POs)

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	H	M	M	L	H	M	H	M	L	H	M	H
CO2	M	M	M	M	H	H	H	H	L	M	L	M
CO3	H	M	H	M	M	M	L	L	L	L	M	H
CO4	H	M	M	H	H	H	M	H	M	M	H	M
CO5	H	H	H	M	M	M	M	L	L	L	M	H

COs / PSOs	PSO1	PSO2	PSO3	PSO4	PSO5			
CO1	H	M	L	M	L			
CO2	H	M	M	L	H			
CO3	L	H	M	M	L			
CO4	M	M	L	H	M			
CO5	M	H	M	L	M			

H/M/L indicates Strength of Correlation H- High, M- Medium, L-Low

Category	Basic Sciences	Engineering Sciences	Humanities and Social Sciences	Program Core	Program Electives	Open Electives	Practical / Project	Internships / Technical Skill	Soft Skills			
				✓								

Approval	

ADVANCEMENT IN ELECTRONICS*

UNIT I SEMICONDUCTOR DIODE **9 Hrs**

Theory of p-n junction – p-n junction as diode – p-n diode currents – Volt-ampere characteristics – Diode resistance – Temperature effect of p-n junction – Zener Diode- VI Characteristic- Zener diode Voltage Regulator- Characteristics of SCR, TRIAC, DIAC and LDR

UNIT II TRANSISTORS **9 Hrs**

Transistor construction – Input and output characteristics of CE, CB and CC configurations – Junction field effect transistor – Pinch off voltage – JFET volt-ampere characteristics – JFET small signal model – MOSFETS and their characteristics—Uni-junction transistor

UNIT III FEEDBACK CIRCUITS **9 Hrs**

Introduction-Principle of Feedback Amplifiers-Negative Feedback Circuits –Types of Negative feedback Circuits-Positive Feedback Circuits: Condition for Oscillations, Barkhausen criterion-Types of Oscillators: RC phase shift, Wein Bridge, Crystal, Collpitts, Hartley

UNIT IV FUNDAMENTALS and OVERVIEW OF NANO SCIENCE **9 Hrs**

Fundamental concepts- Basic Structure of Nanoparticles -Nanomaterials- scaling -.Approaches-Tools and Techniques

UNIT V NANO MATERIALS **9 Hrs**

Nanomaterials-properties- Nanostructures: Kinetics in Nanostructured Materials- Zero dimensional, size and shape of nanoparticles; one-dimensional and two dimensional nanostructures- clusters of metals and semiconductors, bio nano-particles-Carbon Nanotubes, Fullerenes, Nanowires, Quantum Dots-Applications of nanostructures.

Total Number of Hours: 45 Hrs

Text Books:

1. Jacob Millman, Christos, C. Halkias, (2010) Electronic Devices and Circuits, 3rd Edn, Tata McGraw Hill Publishing Limited
2. David, A. Bell (2003) Electronic Devices and Circuit, Prentice Hall of India Private Limited
3. Chattopadhyay, P.K, , Banerjee, A.N.(2009) Introduction to Nanoscience and Nanotechnology, Prentice Hall India Learning Private Limited

Reference Books:

1. Theodre, F. Boghert, (2003) Electronic Devices and Circuits.6th Ed. Pearson Education.
2. Ben G. Streetman, Sanjay Banerjee, (2002) Solid State Electronic Devices. Pearson Education.PHI.
3. Allen Mottershead(2003) Electronic Devices and Circuits – An Introduction. New Delhi: Prentice Hall of India Private Limited
4. Manasi Karkare(2008)Nanotechnology: Fundamentals and Applications
5. Fuleka, M H(2010)Nanotechnology: Importance and Applications, I K International Publishing House Pvt. Ltd

Subject Code: BBI17L01	**Subject Name : HUMAN ANATOMY LABORATORY**	**T / L/ ETL**	**L**	**T / S.Lr**	**P/ R**	**C**
	Prerequisite:	L	0	0/0	3/0	1

L : Lecture T : Tutorial SLr : Supervised Learning P : Project R : Research C: Credits
T/L/ETL : Theory/Lab/Embedded Theory and Lab

OBJECTIVE :

- To understand the standard operating procedures of various anatomy instruments.
- To analyze the different bio molecules present in the biological system using the analytical techniques

COURSE OUTCOMES (COs) : (3- 5)

CO1	Understands the standard operating procedures of various anatomy instruments.
CO2	Capable to analyze the different bio molecules present in the biological system using the analytical techniques

Mapping of Course Outcomes with Program Outcomes (POs)

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	H	M	H	M	L	H	M	L	M	H	L	L
CO2	M	H	M	H	L	, M	L	L	M	M	H	H

COs / PSOs	PSO1	PSO2	PSO3	PSO4	PSO5			
CO1	H	M	L	H	M			
CO2	M	M	H	M	H			

H/M/L indicates Strength of Correlation H- High, M- Medium, L-Low

Category	Basic Sciences	Engineering Sciences	Humanities and Social Sciences	Program Core	Program Electives	Open Electives	Practical / Project	Internships / Technical Skill	Soft Skills			
							✓					
Approval												

HUMAN ANATOMY LABORATORY

LIST OF EXPERIMENTS

1. To study the human respiratory system
2. To study the human skeleton system
3. To study the human muscular system
4. To study the human reproductive system
5. To study the human urinary system
6. To study the human nervous system
7. To study the human joint system
8. To study the human sense organ system

Total Number of Hours: 45 Hrs

Subject Code: BBI17L02	**Subject Name: ELECTRIC CIRCUITS LABORATORY**	**T / L/ ETL**	**L**	**T / S.Lr**	**P/ R**	**C**
	Prerequisite:	L	0	0/0	3/0	1

L : Lecture T : Tutorial SLr : Supervised Learning P : Project R : Research C: Credits
T/L/ETL : Theory/Lab/Embedded Theory and Lab

OBJECTIVE :

- Students will learn various network theorems
- Students will demonstrate the ability to Design and apply Hardware Implementation of what they have learnt theoretically in the field of Electronics, Electric circuits and network analysis using both analog techniques.
- Students will demonstrate the ability to Design and apply Hardware Implementation of what they have learnt theoretically in the field of Electronics, Electric circuits and network analysis using both digital techniques.
- To Design and implement the hardware of a voltage Regulator for AC inputs in hardware and Design a filter circuit for Active and passive components.

COURSE OUTCOMES (COs) : (3- 5)

CO1	Students Understands various network theorems
CO2	The graduate gets the ability to design and apply Hardware Implementation of what they have learnt theoretically in the field of Electronics, Electric circuits and network analysis using both analog techniques.
CO3	The graduate gets the ability to design and apply Hardware Implementation of what they have learnt theoretically in the field of Electronics, Electric circuits and network analysis using both digital techniques.
CO4	Students will be able to Design and implement the hardware of a voltage Regulator for AC inputs in hardware
CO5	Students will be able to Design a filter circuit for Active and passive components.

Mapping of Course Outcomes with Program Outcomes (POs)

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	H	L	M	H	M	L	M	M	M	L	L	M
CO2	H	H	H	M	M	L	L	L	M	H	M	H
CO3	M	M	L	H	M	L	M	H	M	L	H	M
CO4	L	H	M	H	L	H	L	L	M	H	L	H
CO5	L	M	L	H	L	H	M	L	H	M	L	H

COs / PSOs	PSO1	PSO2	PSO3	PSO4	PSO5			
CO1	M	L	H	H	M			
CO2	M	H	L	M	H			
CO3	H	H	M	L	H			
CO4	M	M	L	H	H			
CO5	H	M	L	L	M			

H/M/L indicates Strength of Correlation H- High, M- Medium, L-Low

Category	Basic Sciences	Engineering Sciences	Humanities and Social Sciences	Program Core	Program Electives	Open Electives	Practical / Project	Internships / Technical Skill	Soft Skills			
							✓					
Approval												

ELECTRIC CIRCUITS LABORATORY

LIST OF EXPERIMENTS

1. Experimental verification of Kirchhoff's voltage and current laws
2. Experimental verification of Current and Voltage Division and Source Transformation
3. Experimental verification of network theorems (Thevenin, Norton, Superposition and maximum power transfer Theorem).
4. Determination of average value, RMS value, form factor, peak factor of sinusoidal wave, square wave using hard ware and digital simulation.
5. Verification of Nodal and Mesh Analysis
6. Study of CRO and measurement of sinusoidal voltage, frequency and power factor
7. Experimental determination of time constant of series R-C electric circuits
8. Experimental determination of frequency response of RLC circuits.
9. Design and Simulation of series resonance circuit.
10. Design and Simulation of parallel resonant circuits
11. Design and Simulation of Half wave and Full wave Rectifiers
12. Simulation of three phase balanced and unbalanced star, delta networks circuits
13. Experimental determination of power in three phase circuits by two-watt meter method
14. Calibration of single phase energy meter
15. Determination of two port network parameters
16. Design and Simulation of low pass and high pass passive filters
17. Design and Verification of Attenuators
18. Determination of self, mutual inductance and coefficient of coupling.

.

Total Number of Hours: 45 Hrs

Subject Code: BEC17IL4	**Subject Name : ANALOG AND DIGITAL IC'S LABORATORY**	**T / L/ ETL**	**L**	**T / S.Lr**	**P/ R**	**C**
	Prerequisite:	L	0	0/0	3/0	1

L : Lecture T : Tutorial SLr : Supervised Learning P : Project R : Research C: Credits
T/L/ETL : Theory/Lab/Embedded Theory and Lab

OBJECTIVE :

- To understand various Digital and Linear Integrated Circuits used in Simple System Configuration.
- To be able to understand the various types of combinational circuits.
- To Understand the Operational amplifier characteristics and applications
- To learn about Designing and verifying waveform generator circuits and filter circuits

COURSE OUTCOMES (COs) : (3- 5)

CO1	Graduates can understand various Digital and Linear Integrated Circuits used in Simple System Configuration**.**
CO2	The students will be able to understand the various types of combinational circuits.
CO3	Understands the Operational amplifier characteristics and applications
CO4	Will be capable of Designing and verifying waveform generator circuits and filter circuits

Mapping of Course Outcomes with Program Outcomes (POs)

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	M	H	M	L	H	H	M	L	L	M	H	H
CO2	L	H	M	L	M	H	M	L	H	M	H	M
CO3	H	H	M	L	L	H	M	L	M	H	M	L
CO4	M	L	H	L	H	M	L	H	M	L	M	H

COs / PSOs	PSO1	PSO2	PSO3	PSO4	PSO5			
CO1	M	H	M	L	M			
CO2	H	M	L	M	H			
CO3	M	H	M	L	M			
CO4	L	H	M	L	L			

H/M/L indicates Strength of Correlation H- High, M- Medium, L-Low

Category	Basic Sciences	Engineering Sciences	Humanities and Social Sciences	Program Core	Program Electives	Open Electives	Practical / Project	Internships / Technical Skill	Soft Skills			
							✓					

Approval	

ANALOG AND DIGITAL IC'S LAB

LIST OF EXPERIMENTS

1. Integrator and Differentiator
2. Multivibrators using IC 555 Timer
3. Schmitt Trigger
4. Instrumentation Amplifier
5. Phase Shift Oscillator and Wien Bridge Oscillator
6. Half Adder and Full Adder
7. Encoder and Decoder
8. Multiplexer
9. Shift Register
10. Decade Counter

Total Number of Hours: 45 Hrs

Subject Code: BMA17011	**Subject Name : NUMERICAL METHODS FOR ELECTRICAL ENGINEERS**	**T / L/ ETL**	**L**	**T / S.Lr**	**P/ R**	**C**
	Prerequisite:	T	3	1/0	0/0	4

L : Lecture T : Tutorial SLr : Supervised Learning P : Project R : Research C: Credits
T/L/ETL : Theory/Lab/Embedded Theory and Lab

OBJECTIVE :

- To develop the ability in Numerical Skills

COURSE OUTCOMES (COs) : (3- 5)

CO1	To understand the Basic concepts in Numerical Analysis
CO2	To understand the Basic concepts in System of Linear Equations
CO3	To understand the Basic concepts in Non Linear Equations
CO4	To understand the Basic concepts in Interpolation
CO5	To understand the Basic concepts in Numerical Differentiation and Integration

Mapping of Course Outcomes with Program Outcomes (POs)

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	L	H	L	L	L	L	L	L	M	L	L	M
CO2	L	H	L	L	L	L	L	L	M	L	L	M
CO3	L	H	L	L	L	L	L	L	M	L	L	M
CO4	L	H	L	L	L	L	L	L	M	L	L	M
CO5	L	H	L	L	L	L	L	L	M	L	L	M

COs / PSOs	PSO1	PSO2	PSO3	PSO4	PSO5			
CO1	M	M	L	L	L			
CO2	M	M	L	L	L			
CO3	M	M	L	L	L			
CO4	M	M	L	L	L			
CO5	M	M	L	L	L			

H/M/L indicates Strength of Correlation H- High, M- Medium, L-Low

Category	Basic Sciences	Engineering Sciences	Humanities and Social Sciences	Program Core	Program Electives	Open Electives	Practical / Project	Internships / Technical Skill	Soft Skills			
				✓								
Approval												

NUMERICAL METHODS FOR ELECTRICAL ENGINEERS

UNIT I BASICS OF NUMERICAL METHODS **12 Hrs**

Curve fitting-Method of group averages-Principle of least square-Method of moments-Finite differences-Operators (Forward, Backward and Shifting) -Relationship between the operators.

UNIT II SYSTEM OF LINEAR EQUATIONS **12 Hrs**

Gauss Elimination method – Gauss-Jordan method – Iterative methods – Gauss-Jacobi method – Gauss-Seidel method – Matrix Inversion by Gauss-Jordan method- Eigen value problem-Power method

UNIT III NON LINEAR EQUATIONS **12 Hrs**

Solution of Algebraic and Transcendental equations – Method of false position -Fixed point iteration method (single and multi variables) - Newton-Raphson method (single and multi variables)

UNIT IV INTERPOLATION **12 Hrs**

Newton forward and backward differences – Central differences – Sterling's and Bessel's formulae – Interpolation with Newton's divided differences – Lagrange's method.

UNIT V NUMERICAL DIFFERENTIATION AND INTEGRATION **12 Hrs**

Numerical differentiation with interpolation polynomials – Numerical integration by Trapezoidal and Simpson's (both $1/3^{rd}$ and $3/8^{th}$) rules – Two and three point Gaussian Quadrature formulae – Double integrals using Trapezoidal and Simpson's rules.

Total Number of Hours: 60 Hrs

Text Books:

1. Veerarajan T., Numerical Methods, Tata McGraw Hill Publishing Co., (2007)
2. Sastry S.S., Introductory Methods of Numerical Analysis, Prentice Hall of India, (2012)

Reference Books:

1. Grewal B.S., Higher Engineering Mathematics, Khanna Publishers, (2012)
2. Kandasamy P., Thilagavathy, Gunavathy K., Numerical Methods (Vol.IV), S.Chand & Co., (2008)

Subject Code: BEI17007	**Subject Name : TRANSDUCER ENGINEERING**	**T / L/ ETL**	**L**	**T / S.Lr**	**P/ R**	**C**
	Prerequisite:	T	3	0/0	0/0	3

L : Lecture T : Tutorial SLr : Supervised Learning P : Project R : Research C: Credits
T/L/ETL : Theory/Lab/Embedded Theory and Lab

OBJECTIVE :

- The student will understand the dynamics of the transducer
- The student will learn to select a suitable transducer for a given application.
- The student will learn to design a transducer as per the requirement
- Developing the knowledge in inductance and capacitance transducers.
- Studying the operation, characteristics, applications, advantages and disadvantages of various types of transducers.

COURSE OUTCOMES (COs) : (3- 5)

CO1	The graduate understand the dynamics of the transducer
CO2	The graduate is capable to select a suitable transducer for a given application
CO3	The graduate is capable to design a transducer as per the requirement
CO4	Develops the knowledge in inductance and capacitance transducers
CO5	Capable to operate various types of transducers.

Mapping of Course Outcomes with Program Outcomes (POs)

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	H	M	M	L	L	H	M	M	L	H	M	H
CO2	M	M	H	M	L	M	H	M	M	L	M	H
CO3	H	H	M	H	M	L	M	H	M	H	L	M
CO4	L	M	L	H	M	H	L	M	H	L	M	H
CO5	M	H	M	H	M	L	L	H	M	L	H	M

COs / PSOs	PSO1	PSO2	PSO3	PSO4	PSO5			
CO1	H	M	L	H	M			
CO2	M	H	M	H	M			
CO3	L	L	M	H	M			
CO4	H	M	L	H	M			
CO5	M	M	H	M	H			

H/M/L indicates Strength of Correlation H- High, M- Medium, L-Low

Category	Basic Sciences	Engineering Sciences	Humanities and Social Sciences	Program Core	Program Electives	Open Electives	Practical / Project	Internships / Technical Skill	Soft Skills			
				✓								
Approval												

TRANSDUCER ENGINEERING

UNIT I SCIENCE OF MEASUREMENT **12 Hrs**

Units and standards – calibration methods – static calibration – classification of errors – error analysis – statistical methods – odds and uncertainty

UNIT II CHARACTERISTICS OF TRANSDUCERS **12 Hrs**

Static characteristics – accuracy, precision, sensitivity, and linearity – mathematical model of transducers – zero, first-order and second-order transducers – response to impulse, step, ramp and sinusoidal inputs

UNIT III VARIABLE RESISTANCE TRANSDUCERS **12 Hrs**

Principle of operation, construction details, characteristics and applications of resistance potentiometers, strain gauges, resistance thermometers, thermistors, hot-wire anemometer, piezo resistive sensors and humidity sensors.

UNIT IV VARIABLE INDUCTANCE AND VARIABLE CAPACITANCE TRANSDUCERS **12 Hrs**

Induction potentiometer – variable reluctance transducers – EI pick up – LVDT – capacitive transducers – variable air gap type – variable area type – variable permittivity type – capacitor microphone

UNIT V OTHER TRANSDUCERS **12 Hrs**

Piezoelectric transducer – magnetostrictive transducer – IC sensor – digital transducers – smart sensor – fiber optic transducers

Total Number of Hours: 60 Hrs

Text Books:

1. Neubert, H.K.P. Instrument Transducers, Clarenden Press, Oxford, 1988.
2. Patranabis, D, Sensors and Transducers, Wheeler Publishing Co., Ltd. New Delhi, 1997

Reference Books:

1. Doebelin, E.O., Measurement Systems, McGraw-Hill Book Co., 1998.
2. Neubert, H.K.P. Instrument Transducers, Clarenden Press, Oxford, 1988.
3. Patranabis, D, Sensors and Transducers, Wheeler Publishing Co., Ltd. New Delhi, 1997.
4. Murthy, D.V.s., Transducers and Instrumentation, Prentice Hall of India Pvt. Ltd., New Delhi, 1995.
5. Renganathan, S., Transducer Engineering, Allied Publishers, Chennai, 1999.

Subject Code: BBI17003	**Subject Name : HUMAN PHYSIOLOGY**	**T / L/ ETL**	**L**	**T / S.Lr**	**P/ R**	**C**
	Prerequisite:	T	3	0/0	0/0	3

L : Lecture T : Tutorial SLr : Supervised Learning P : Project R : Research C: Credits
T/L/ETL : Theory/Lab/Embedded Theory and Lab

OBJECTIVE :

- To study about the positioning and functioning of the digestive organs
- To study about the positioning and functioning of the excretory system
- To study about the positioning and functioning of the special organs
- To study about the positioning and functioning of the endocrine glands
- To study about the positioning and functioning of the reproductive organs

COURSE OUTCOMES (COs) : (3- 5)

CO1	Understands the positioning and functioning of the digestive organs
CO2	Capable to know the positioning and functioning of the excretory system
CO3	Understands the positioning and functioning of the special organs
CO4	Capable to know the positioning and functioning of the endocrine glands
CO5	Understands the positioning and functioning of the reproductive organs

Mapping of Course Outcomes with Program Outcomes (POs)

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	H	M	H	M	L	L	M	H	M	L	M	H
CO2	M	H	M	L	M	H	L	M	H	M	L	M
CO3	M	M	H	M	L	M	L	M	H	M	H	M
CO4	H	M	L	M	L	H	M	L	L	M	H	M
CO5	M	H	M	L	M	L	M	L	M	H	M	L

COs / PSOs	PSO1	PSO2	PSO3	PSO4	PSO5			
CO1	M	H	M	H	M			
CO2	M	H	M	H	M			
CO3	L	L	M	H	M			
CO4	H	L	H	L	M			
CO5	M	M	L	M	H			

H/M/L indicates Strength of Correlation H- High, M- Medium, L-Low

Category	Basic Sciences	Engineering Sciences	Humanities and Social Sciences	Program Core	Program Electives	Open Electives	Practical / Project	Internships / Technical Skill	Soft Skills			
				✓								
Approval												

HUMAN PHYSIOLOGY

UNIT I CELL **12 Hrs**

Structure of Cell – Function of each components of the cell – Membrane Potential – Action Potential – Generation and Conduction – Electrical Stimulation - Blood Cell – Composition – Origin of RBC – Blood groups – Estimation of RBC, WBC and platelet.

UNIT II CARDIAC AND NERVOUS SYSTEM **12 Hrs**

Cardiac Cycle – ECGT – Blood Pressure – Feedback Control for Blood Pressure – Nervous control of Heart - Cardiac output – Coronary and Peripheral Circulation – Structure and function of Nervous tissue – Reflex action – Velocity of Conduction of Nerve Impulses - Electro Encephalograph – Autonomic Nervous System

UNIT III RESPIRATORY SYSTEM **12 Hrs**

Physiological aspects of respiration - Exchange of gases – Regulation of Respiration - Disturbance of respirating function. Pulmonary function test

UNIT IV DIGESTIVE AND EXCRETORY SYSTEM **12 Hrs**

Organization of GI system, Digestion and absorption – Movement of GI tract – Structure of Nephron – mechanism of Urine formation – Urine Reflex – Skin and Sweat Gland – Temperature regulation.

UNIT V SPECIAL SENSES **12 Hrs**

Optics of Eye – Retina – Photochemistry of Vision – Accommodation Neurophysiology of vision – EOG. Physiology of Internal Ear – Mechanism of Hearing – Auditory pathway, Hearing Tests

Total Number of Hours: 60 Hrs

Text Books:

1. Sarada Subramanyam, K. Madhavan Kutty and H.D. Singh – Text book of 'Human Physiology' – S.Chand and Company, 1996
2. Sujit K. Chaudhuri – Concise Medical Physilogy – New Central Book agency, 1997

Reference Books:

1. Arthur.C.Guyton – Textbook of Medical Physiology – Prism Book (p) Ltd. 1996
2. Cyril A. Keele Eric Neil Norman Joels Samson Wrights' Applied Physiology – Oxford University Press – 1983

Subject Code: BBI17004	**Subject Name : MEDICAL PHYSICS**	**T / L/ ETL**	**L**	**T / S.Lr**	**P/ R**	**C**
	Prerequisite:	T	3	0/0	0/0	3

L : Lecture T : Tutorial SLr : Supervised Learning P : Project R : Research C: Credits
T/L/ETL : Theory/Lab/Embedded Theory and Lab

OBJECTIVE :

- Introduction to Atomic Physics
- To understand the concept of Interaction With Living Cells
- To provide the knowledge about the Effects of Radiation

COURSE OUTCOMES (COs) : (3- 5)

CO1	Understands the concept of Atomic Physics
CO2	Capable to understand the concept of Interaction with Living Cells
CO3	The graduates attains knowledge about the Effects of Radiation

Mapping of Course Outcomes with Program Outcomes (POs)

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	M	H	M	H	L	H	M	L	M	H	M	L
CO2	H	M	L	M	H	M	L	M	H	L	M	H
CO3	L	M	H	L	M	H	L	M	H	L	M	H

COs / PSOs	PSO1	PSO2	PSO3	PSO4	PSO5			
CO1	L	M	H	M	H			
CO2	M	H	M	L	H			
CO3	M	H	M	M	L			

H/M/L indicates Strength of Correlation H- High, M- Medium, L-Low

Category	Basic Sciences	Engineering Sciences	Humanities and Social Sciences	Program Core	Program Electives	Open Electives	Practical / Project	Internships / Technical Skill	Soft Skills			
				✓								
Approval												

MEDICAL PHYSICS

UNIT I ATOMIC PHYSICS **9 Hrs**

Traditional definition of atom, periodic system of elements, mechanical properties of atom, emission of light and its frequencies - Electromagnetic spectra - Principles of Nuclear Physics – Natural radioactivity, Decay series, type of radiation and their applications, artificially produced isotopes and its application, accelerator principles; Radio nuclides used in Medicine and technology.

UNIT II INTERACTION WITH LIVING CELLS **9 Hrs**

Target theory, single hit and multi target theory, cellular effects of radiation, DNA damage, depression of Macro molecular synthesis, Chromosomal damage.

UNIT III SOMATIC EFFECT OF RADIATION **9 Hrs**

Radio sensitivity protocol of different tissues in human, LD 50/30 effect of radiation on skin, blood forming organs, lenses of eye, embryo and Endocrinal glands.

UNIT IV GENETIC EFFECT OF RADIATION **9 Hrs**

Threshold of linear dose effect, relationship, factors affecting frequency of radiation induced mutation, Gene controlled hereditary diseases, biological effect of microwave and RF wave. Variation in dielectric constant and specific conductivity of tissues - Penetration and propagation of signals effects in various vital organs, Protection standards

UNIT V PHOTO MEDICINE **9 Hrs**

Synthesis of Vitamin D in early and late cutaneous effects, Phototherapy, Photo chemotherapy, exposure level, hazards and maximum permissible exposures - Laser physics – Characteristics of Laser radiation, Laser speckle, biological effects, laser safety management

Total Number of Hours: 45 Hrs

Text Books:

1. Moselly, “Non ionizing Radiation”, Adam Hilgar Brustol 1988

Reference Books:

1. Branski.S and Cherski.P ‘Biological effects of Microwave’ Hutchinson and ROSS Inc. Strondsburg 1980.
2. Glasser.O.Medical Physics Vol.1, 2, 3 years Book Publisher Inc Chicago, 1980

Subject Code: BBT17I02	**Subject Name : BIO CHEMISTRY**	**T / L/ ETL**	**L**	**T / S.Lr**	**P/ R**	**C**
	Prerequisite:	T	3	0/0	0/0	3

L : Lecture T : Tutorial SLr : Supervised Learning P : Project R : Research C: Credits
T/L/ETL : Theory/Lab/Embedded Theory and Lab

OBJECTIVE :

- To study structural and functional properties of carbohydrates
- To study structural and functional properties of proteins
- To study structural and functional properties of lipids
- To study structural and functional properties of nucleic acids
- To emphasize the role of these bio molecules by providing basic information on specific metabolic diseases and disorders of these bio molecules

COURSE OUTCOMES (COs) : (3- 5)

CO1	Understands structural and functional properties of carbohydrate
CO2	Capable to analyze structural and functional properties of proteins
CO3	Understands structural and functional properties of lipids
CO4	Capable to structural and functional properties of nucleic acids
CO5	Understands the emphasize the role of these bio molecules by providing basic information on specific metabolic diseases and disorders of these bio molecules

Mapping of Course Outcomes with Program Outcomes (POs)

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	M	H	M	L	L	L	H	M	L	M	H	M
CO2	H	H	M	L	H	M	H	L	M	H	M	L
CO3	M	H	M	L	M	H	L	M	H	L	M	H
CO4	M	H	M	H	L	M	M	H	M	L	H	M
CO5	H	M	L	L	M	H	L	M	H	L	M	H

COs / PSOs	PSO1	PSO2	PSO3	PSO4	PSO5			
CO1	M	H	M	L	M			
CO2	H	M	M	H	L			
CO3	H	M	L	M	H			
CO4	M	L	H	M	H			
CO5	L	M	H	M	L			

H/M/L indicates Strength of Correlation H- High, M- Medium, L-Low

Category	Basic Sciences	Engineering Sciences	Humanities and Social Sciences	Program Core	Program Electives	Open Electives	Practical / Project	Internships / Technical Skill	Soft Skills			
				✓								
Approval												

BIO CHEMISTRY

UNIT I BIOCHEMISTRY OF LIVING CELL **9 Hrs**

Biochemistry of living cell, sub cellular fractionation using the differential centrifugation method - Function of each organelle Redox Potential, Oxidative Phosphorylation, Transport of substances a cross biological membrane - NUCLEAR ACID: Composition and Function, Genes, Outline of DNA structure, Re-Combinant DNA and its applications.

UNIT II ENZYMES **9 Hrs**

Chemical Nature, General Properties, Spectrophotometric measurement of enzymes, Isolation techniques, Diagnostic enzymes - Enzyme biotechnology - Hormones: Chemical Nature, Properties of hormones, Hormonal Assay and their significance.

UNIT III CARBOHYDRATE and LIPIDS **9 Hrs**

Carbohydrate – Classification, Metabolism of carbohydrate, and its dysfunction, uses of Carbohydrates. Lipids: Classification, Metabolism of lipids, Cholesterol, bile acids, Transport of lipids, Lipids metabolism dysfunction. Protein: Classification, Amino acids, Chromatography, electrophoresis and architecture of protein molecules

UNIT IV BIO CHEMISTRY OF BLOOD AND BODY FLUIDS **9 Hrs**

Liver Function tests, Renal Function Tests, Blood gas Analysis, Measurement of Electrolytes - their abnormal and Normal values and conditions - Biochemistry of Urine and Stools testing

UNIT V DIAGNOSTIC TOOL **9 Hrs**

Principles and Application of Photometry, Spectrophotometry, Flurometry, Photometry, Densitometry, calorimetry, Automation in clinical Laboratory - Use of Isotopes in Biochemistry

Total Number of Hours: 45 Hrs

Text Books:

1. Dr. Amniga Shanmugam, “Fundamentals of Bio hemistry for Medical Students”, Karthic Printers, Madras 1997

Reference Books:

1. Jain J, Jain L, Nitin Sunjay Jain, “Fundamentals of Biochemistry,” Chand. S, Group, ISBN: 8121924537.
2. Satyanarayana U, and Chakrapani U, “Biochemistry”, Books and Allied (p) Ltd., ISBN: 8187134801.

Subject Code: BSK17ET1	**Subject Name :SOFT SKILLS – I CAREER and CONFIDENCE BUILDING**	**T / L/ ETL**	**L**	**T / S.Lr**	**P/ R**	**C**
	Prerequisite: None	Ty	1	0/1	1/0	2

L : Lecture T : Tutorial SLr : Supervised Learning P : Project R : Research C: Credits
T/L/ETL : Theory/Lab/Embedded Theory and Lab

OBJECTIVE :

- To create awareness in students, various top companies helping them improve their skill set matrix, leading to develop a positive frame of mind.
- To help students be aware of various techniques of candidate recruitment and help them prepare CV's and resume.
- To help student how to face various types of interview, preparing for HR, technical interviews.
- To help students improve their verbal reading, narration and presentation skills by performs various mock sessions.

COURSE OUTCOMES (COs) : (3- 5)

Students will be able to

CO1	Be aware of various top companies leading to improvement in skills amongst them.
CO2	Be aware of various candidate recruitment techniques like group discussion, interviews and be able to prepare CV's and resumes.
CO3	Prepare for different types of interviews and be prepared for HR and technical interviews.
CO4	Improve their verbal, written and other skills by performing mock sessions.

Mapping of Course Outcomes with Program Outcomes (POs)

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	L	L	L	L	L	M	M	H	M	H	M	H
CO2	L	L	L	L	L	M	M	H	M	H	M	H
CO3	L	L	L	L	L	M	M	H	M	H	M	H
CO4	L	L	L	L	L	M	M	H	M	H	M	H

COs / PSOs	PSO1	PSO2	PSO3	PSO4	PSO5			
CO1	L	L	H	L	L			
CO2	L	L	H	L	L			
CO3	L	L	H	L	L			
CO4	L	L	H	L	L			

H/M/L indicates Strength of Correlation H- High, M- Medium, L-Low

Category	Basic Sciences	Engineering Sciences	Humanities and Social Sciences	Program Core	Program Electives	Open Electives	Practical / Project	Internships / Technical Skill	Soft Skills			
			✓						✓			
Approval												

SOFT SKILLS – I CAREER AND CONFIDENCE BUILDING

UNIT I **6 Hrs**

Creation of awareness of top companies / improving skill set matrix / Development of positive frame of mind / Creation of self-awareness

UNIT II **6 Hrs**

Group discussions / Do's and don'ts – handling group discussions / what evaluators look for interpersonal relationships / Preparation of Curriculum Vitae / Resume

UNIT III **6 Hrs**

Interview – awareness of facing questions – Do's and don'ts of personal interview / group interview, enabling students to prepare for different proce3dures such as HR interviews and Technical Interviews / self-introductions

UNIT IV **6 Hrs**

Verbal aptitude, Reading comprehension / narration / presentation / Mock Interviews

UNIT V **6 Hrs**

Practical session on Group Discussion and written tests on vocabulary and reading comprehension

Total Number of Hours: 30 Hrs

Subject Code: BBI17ET2	**Subject Name : BIO MECHANICS***	**T / L/ ETL**	**L**	**T / S.Lr**	**P/ R**	**C**
	Prerequisite:	ETL	1	0/2	1/1	3

L : Lecture T : Tutorial SLr : Supervised Learning P : Project R : Research C: Credits
T/L/ETL : Theory/Lab/Embedded Theory and Lab

OBJECTIVE :

- To study about Biofluid mechanics
- To learn about Cardiac mechanics
- The student will analyze Respiratory mechanics
- To learn about Soft tissue mechanics
- Student will learn about Orthopaedic mechanics

COURSE OUTCOMES (COs) : (3- 5)

CO1	Understands the Biofluid mechanics
CO2	Capable to analyze Cardiac mechanics
CO3	Capable to analyze Respiratory mechanics
CO4	Understands the Soft tissue mechanics
CO5	Student can analyze Orthopedic mechanics

Mapping of Course Outcomes with Program Outcomes (POs)

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	M	M	H	M	H	M	L	L	M	H	M	L
CO2	M	H	M	L	M	L	H	M	L	H	M	L
CO3	H	M	L	H	M	L	M	H	L	M	H	M
CO4	L	L	M	H	L	M	H	L	M	H	L	H
CO5	H	M	L	H	M	H	M	L	H	M	L	M

COs / PSOs	PSO1	PSO2	PSO3	PSO4	PSO5			
CO1	M	H	M	L	H			
CO2	M	M	M	L	M			
CO3	H	M	L	H	M			
CO4	M	H	L	M	H			
CO5	H	M	L	H	H			

H/M/L indicates Strength of Correlation H- High, M- Medium, L-Low

Category	Basic Sciences	Engineering Sciences	Humanities and Social Sciences	Program Core	Program Electives	Open Electives	Practical / Project	Internships / Technical Skill	Soft Skills			
				✓								
Approval												

BIO MECHANICS

UNIT I BIOFLUID MECHANICS **9 Hrs**

Newton's laws, stress, strain elasticity, Hooke's-law, viscosity, Newtonian fluid, Non-Newtonian fluid, Viscoelastic fluids, vascular tree. Relationship between diameter, velocity and pressure of blood flow, resistance against flow

UNIT II CARDIAC MECHANICS **9 Hrs**

Cardio vascular system, Mechanical properties of blood vessels – arteries, arterioles, capillaries, veins, blood flow: laminar and turbulent, physics of cardio vascular diseases, prosthetic heart valves and replacement.

UNIT III RESPIRATORY MECHANICS **9 Hrs**

Alveoli mechanics, interaction of blood and lung, P-V curve of lung, breathing mechanism, airway resistance, physics of lung diseases

UNIT IV SOFT TISSUE MECHANICS **9 Hrs**

Pseudo elasticity, nonlinear stress-strain relationship, viscoelasticity, structure, function and mechanical properties of skin, ligaments and tendons

UNIT V ORTHOPAEDIC MECHANICS **9 Hrs**

Mechanical properties of cartilage, diffusion properties of articular cartilage, mechanical properties of bone, kinetics and kinematics of joints, lubrication of joints analysis of force in orthopaedic implants

Total Number of Hours: 45 Hrs

Text Books:

1. Y.C.Fung, "Biomechanics: Mechanical properties of living tissues", Springer, New York, 1981.

Reference Books:

1. D.Dawson and Right, "Introduction to bio-mechanics of joints and joint replacement", Mechanical Engineering Publication Ltd, 1989.

Subject Code: BBI17L03	**Subject Name : HUMAN PHYSIOLOGY LABORATORY**	**T / L/ ETL**	**L**	**T / S.Lr**	**P/ R**	**C**
	Prerequisite:	L	0	0/0	3/0	1

L : Lecture T : Tutorial SLr : Supervised Learning P : Project R : Research C: Credits
T/L/ETL : Theory/Lab/Embedded Theory and Lab

OBJECTIVE :

- To understand the basics of the physiology
- To study about the of ionic changes
- To perform the electrical activity of the muscles physiology
- To understand the presence of Sugar, Protein
- To study about the peripheral nervous system

COURSE OUTCOMES (COs) : (3- 5)

CO1	Understands the basics of the physiology
CO2	Capable to analyze ionic changes
CO3	Capable to perform the electrical activity of the muscles physiology
CO4	Understands the presence of Sugar, Protein
CO5	Capable to understand the peripheral nervous system

Mapping of Course Outcomes with Program Outcomes (POs)

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	M	H	M	H	M	L	H	M	H	M	L	H
CO2	H	M	M	L	M	H	L	M	H	M	L	H
CO3	H	M	L	H	M	L	H	H	M	L	M	H
CO4	M	L	H	L	M	H	M	L	L	M	H	L
CO5	L	M	H	M	L	H	M	L	H	M	L	H

COs / PSOs	PSO1	PSO2	PSO3	PSO4	PSO5			
CO1	M	H	M	L	M			
CO2	H	H	M	L	H			
CO3	M	H	L	M	L			
CO4	M	H	L	M	H			
CO5	H	M	L	H	M			

H/M/L indicates Strength of Correlation H- High, M- Medium, L-Low

Category	Basic Sciences	Engineering Sciences	Humanities and Social Sciences	Program Core	Program Electives	Open Electives	Practical / Project	Internships / Technical Skill	Soft Skills			
							✓					
Approval												

HUMAN PHYSIOLOGY LABORATORY

LIST OF EXPERIMENTS

1. Recording of Muscle to Induced Electrical Stimulation
2. Study of rate of Conduction of Nerve Impulses.
3. Isolated Frog Heart Perfusion and Effect of ionic changes.
4. Testing of Hearing using Tuning Fork.
5. Testing of various parameters of Vision and Errors of Refraction.
6. Testing for Detection of Glucose, Fructose and Starch.
7. General Test for Proteins.
8. Testing of Urine for presence of Sugar, Protein
9. Estimation using Spectrophotometer.

Total Number of Hours:45 Hrs

Subject Code: BEI17L03	**Subject Name : TRANSDUCER LABORATORY**	**T / L/ ETL**	**L**	**T / S.Lr**	**P/ R**	**C**
	Prerequisite:	L	0	0/0	3/0	1

L : Lecture T : Tutorial SLr : Supervised Learning P : Project R : Research C: Credits
T/L/ETL : Theory/Lab/Embedded Theory and Lab

OBJECTIVE :

- To learn practically about transducers and about the types of Transducers
- To study various transducers used for the measurement of various physical Quantities
- To identify suitable instruments to meet the requirements of industrial applications
- To measure Resistive, Capacitive and Inductive transducers
- To calibrate various transducers

COURSE OUTCOMES (COs) : (3- 5)

CO1	Enables the students to practically know about transducers and about the types of Transducers
CO2	Various transducers used for the measurement of various physical Quantities
CO3	The student can identify suitable instruments to meet the requirements of industrial applications
CO4	The graduate can measure Resistive, Capacitive and Inductive transducers
CO5	Graduate can calibrate various transducers

Mapping of Course Outcomes with Program Outcomes (POs)

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	H	L	M	H	H	M	M	L	H	M	H	M
CO2	H	H	H	H	M	M	L	L	M	H	M	L
CO3	H	M	M	M	M	L	M	M	H	H	M	L
CO4	M	H	H	M	H	M	H	H	H	M	L	M
CO5	H	H	H	M	L	M	L	M	H	H	M	L

COs / PSOs	PSO1	PSO2	PSO3	PSO4	PSO5			
CO1	M	M	H	H	L			
CO2	H	H	H	M	M			
CO3	M	H	H	M	L			
CO4	H	H	M	H	L			
CO5	M	M	H	L	H			

H/M/L indicates Strength of Correlation H- High, M- Medium, L-Low

Category	Basic Sciences	Engineering Sciences	Humanities and Social Sciences	Program Core	Program Electives	Open Electives	Practical / Project	Internships / Technical Skill	Soft Skills			
							✓					
Approval												

TRANSDUCER LABORATORY

LIST OF EXPERIMENTS

1. Displacement versus output voltage characteristics of a Potentiometric transducer.
2. Strain gauge characteristics.
3. Load cell characteristics.
4. Photoelectric tachometer.
5. Hall Effect transducer.
6. Characteristics of LVDT.
7. Characteristic of LDR, Thermistor and thermocouple.
8. Ramp response characteristic of filled in system thermometer.
9. Step response characteristic of RTD and thermocouple.
10. Flapper nozzle system.
11. P/I and I/P converters.
12. Study of smart transducers

Total Number of Hours: 45 Hrs

Subject Code: BBT17IL2	**Subject Name: BIO-CHEMISTRY LABORATORY**	**T / L/ ETL**	**L**	**T / S.Lr**	**P/ R**	**C**
	Prerequisite:	L	0	0/0	3/0	1

L : Lecture T : Tutorial SLr : Supervised Learning P : Project R : Research C: Credits
T/L/ETL : Theory/Lab/Embedded Theory and Lab

OBJECTIVE :

- General biochemical reactions for the identification of bio molecules
- To quantitatively estimate the primary and secondary metabolites present in plants

COURSE OUTCOMES (COs) : (3- 5)

CO1	Understands General biochemical reactions for the identification of bio molecules
CO2	Capable to quantitatively estimate the primary and secondary metabolites present in plants

Mapping of Course Outcomes with Program Outcomes (POs)

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	H	M	L	M	H	M	L	L	H	M	L	M
CO2	M	H	M	L	H	M	L	H	M	L	M	H

COs / PSOs	PSO1	PSO2	PSO3	PSO4	PSO5			
CO1	M	H	M	L	H			
CO2	H	M	M	L	H			

H/M/L indicates Strength of Correlation H- High, M- Medium, L-Low

Category	Basic Sciences	Engineering Sciences	Humanities and Social Sciences	Program Core	Program Electives	Open Electives	Practical / Project	Internships / Technical Skill	Soft Skills			
							✓					
Approval												

BIO-CHEMISTRY LABORATORY

LIST OF EXPERIMENTS

1. Laboratory Safety and Hygiene: Standard Operating Procedures, Units and Measurements, basic statistical concepts for biochemical analysis.
2. Use of Instruments, pH and Buffers
3. Qualitative analysis of Carbohydrates
4. Qualitative analysis of Proteins and Amino acids
5. Qualitative analysis of carbohydrates, lipids and steroids
6. Determination of pK and pI value of amino acid
7. Estimation of amino acids by ninhydrin method.
8. Measurement of enzyme activity: alpha-amylase, catalase
9. Biological Preparations: Isolation of caesin, lecithin and starch

Total Number of Hours: 45 Hrs

Subject Code: BEI17TSX	Subject Name : TECHNICAL SKILL I	T / L/ ETL	L	T / S.Lr	P/ R	C
		0	0	0	1	1

L : Lecture T : Tutorial SLr : Supervised Learning P : Project R : Research C: Credits

T/L/ETL : Theory/Lab/Embedded Theory and Lab

OBJECTIVE : The objective is to develop the technical skill of the students.

COURSE OUTCOMES (COs) : (3- 5)

CO1	Develop the technical skills required in the field of study
CO2	Bridge the gap between the skill requirements of the employer or industry and the competency of the students.
CO3	Enhance the employability of the students.

Mapping of Course Outcomes with Program Outcomes (POs)

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	H	H	H	H	H	H	M	M	H	M	H	M
CO2	H	H	M	H	H	H	M	M	H	H	H	H
CO3	H	H	H	H	H	H	M	M	H	H	H	H

COs / PSOs	PSO1	PSO2	PSO3	PSO4	PSO5			
CO1	H	H	H	H	H			
CO2	H	H	H	H	H			
CO3	H	H	H	H	H			

H/M/L indicates Strength of Correlation H- High, M- Medium, L-Low

Category	Basic Sciences	Engineering Sciences	Humanities and Social Sciences	Program Core	Program Electives	Open Electives	Practical / Project	Internships / Technical Skill	Soft Skills			
								✓				

Approval	

Subject Code: BBI17005	**Subject Name : BIO CONTROL SYSTEMS**	**T / L/ ETL**	**L**	**T / S.Lr**	**P/ R**	**C**
	Prerequisite:	T	3	1/0	0/0	4

L : Lecture T : Tutorial SLr : Supervised Learning P : Project R : Research C: Credits
T/L/ETL : Theory/Lab/Embedded Theory and Lab

OBJECTIVE :

- To provide strong foundation in basic science and mathematics necessary to formulate, solve and analyze control and instrumentation problems
- To solve control and instrumentation problems
- To analyze control and instrumentation problems
- To understand and apply differential equation, integrals, matrix theory, probability theory etc
- To provide good knowledge of instrumentation systems and their applications

COURSE OUTCOMES (COs) : (3- 5)

CO1	Understands strong foundation in basic science and mathematics necessary to formulate, solve and analyze control and instrumentation problems
CO2	Capable to solve control and instrumentation problems
CO3	Capable to analyze control and instrumentation problems
CO4	Understands and applies differential equation, integrals, matrix theory, probability theory etc
CO5	Familiarized with good knowledge of instrumentation systems and their applications

Mapping of Course Outcomes with Program Outcomes (POs)

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	M	H	M	H	M	L	L	M	H	L	H	M
CO2	M	H	L	M	H	L	M	H	L	M	H	M
CO3	H	M	L	H	M	L	H	M	L	H	M	L
CO4	M	H	M	L	M	H	L	M	H	L	M	H
CO5	M	H	L	M	H	L	M	H	L	M	H	L

COs / PSOs	PSO1	PSO2	PSO3	PSO4	PSO5			
CO1	M	H	L	M	H			
CO2	H	M	L	H	M			
CO3	M	H	M	H	L			
CO4	H	M	L	M	M			
CO5	H	M	L	M	H			

H/M/L indicates Strength of Correlation H- High, M- Medium, L-Low

Category	Basic Sciences	Engineering Sciences	Humanities and Social Sciences	Program Core	Program Electives	Open Electives	Practical / Project	Internships / Technical Skill	Soft Skills			
				✓								

Approval	

BIO CONTROL SYSTEMS

UNIT I CONTROL SYSTEM MODELING **12 Hrs**

System concept, Differential Equations, Transfer functions, modeling of electrical systems, Translational and rotational mechanical systems, Electro-mechanical systems, physiological systems, block diagram modeling, signal flow graphs.

UNIT II TIME RESPONSE ANALYSIS **12 Hrs**

Time domain specifications, step and Impulse response analysis of first order and second order systems, steady state errors, stability, Routh-Hurwitz criteria, Root locus techniques, construction of root locus, stability, dominant poles, applications of Root locus diagram

UNIT III FREQUENCY RESPONSE ANALYSIS **12 Hrs**

Frequency response, Bode plot-Nyquist plots, Nyquist stability criterion, Relative stability, Gain margin, phase margin, bandwidth magnitude plots, constant circles, Nichol's chart

UNIT IV PHYSIOLOGICAL CONTROL SYSTEMS **12 Hrs**

Introduction to physiological control systems, modeling of human movements, parameter estimation, linearizing

UNIT V STUDY OF BIOLOGICAL SYSTEMS **12 Hrs**

Human Thermal system, Neuro muscular system, Respiratory system, occulomotor system

Total Number of Hours: 60 Hrs

Text Books:

1. M.Gopal, “Control Systems”, Principles and Design, Tata McGraw-Hill, 1997.
2. Benjamin. C.Kuo, “Automatic Control Systems”, Prentice Hall of India, 1995

Reference Books:

1. Manfreclyner and John H.Milsum, Bio Medical engineering system, McGraw-Hill and Co., New York, 1970.

Subject Code: BBI17006	**Subject Name : BIOMEDICAL SIGNAL PROCESSING**	**T / L/ ETL**	**L**	**T / S.Lr**	**P/ R**	**C**
	Prerequisite:	T	3	1/0	0/0	4

L : Lecture T : Tutorial SLr : Supervised Learning P : Project R : Research C: Credits
T/L/ETL : Theory/Lab/Embedded Theory and Lab

OBJECTIVE :

- Introduction to periodic and pulse signals, various systems
- To be able to time domain analysis.
- To understand the properties of Z-transform
- To be able solve the Fourier series.
- To study Overview of FFT and problems in the fast Fourier transforms.

COURSE OUTCOMES (COs) : (3- 5)

CO1	Understands periodic and pulse signals, various systems
CO2	Capable of analysis of time domain specification.
CO3	Understands the properties of Z-transform
CO4	Capable tosolve the Fourier series.
CO5	Understands Overview of FFT and problems in the fast Fourier transform.

Mapping of Course Outcomes with Program Outcomes (POs)

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	M	H	M	L	M	H	M	H	M	L	H	M
CO2	H	M	L	M	H	M	L	H	M	L	M	H
CO3	H	M	L	H	M	H	M	L	M	H	M	L
CO4	H	M	M	H	M	L	H	M	H	M	L	H
CO5	L	M	H	M	L	M	H	L	M	H	H	M

COs / PSOs	PSO1	PSO2	PSO3	PSO4	PSO5			
CO1	L	M	H	M	L			
CO2	H	M	L	M	H			
CO3	M	M	L	H	H			
CO4	H	M	L	M	H			
CO5	M	H	M	M	H			

H/M/L indicates Strength of Correlation H- High, M- Medium, L-Low

Category	Basic Sciences	Engineering Sciences	Humanities and Social Sciences	Program Core	Program Electives	Open Electives	Practical / Project	Internships / Technical Skill	Soft Skills			
				✓								
Approval												

BIOMEDICAL SIGNAL PROCESSING

UNIT I DISCRETE – TIME SIGNALS AND SYSTEMS **12 Hrs**

Characterization, classification and time domain representation of discrete-time signals - Typical sequences and their representation - Classification of sequences - Basic operations on sequences - Discrete-time systems

UNIT II TRANSFORM **12 Hrs**

Discrete Time Fourier transform (DTFT): Discrete Fourier Transform (DFT) computation of DFT, Z-transform: Mathematical derivation of the unilateral-transform properties of the Z-transform - The Inverse Z-Transform

UNIT III NEUROLOGICAL SIGNAL PROCESSING **12 Hrs**

Brain and its potentials.EEG analysis - Linear prediction theory – Autoregressive method adaptive segmentation - Transient detection - Overall performance - Data acquisition and classification of sleep stages

UNIT IV CARDIOLOGICAL SIGNAL PROCESSING **12 Hrs**

ECG data acquistion - ECG lead system ECG parameters and their estimaton - Multiscale analysis for parameters estimation of ECG waveforms - Arrhythmia analysis monitoring - Continuous ECG recording -

UNIT V ECG DATA REDUCTION TECHNIQUES **12 Hrs**

Discrete data compression techniques - Direct ECG data compression techniques - Transformation compression techniques - Other data compression techniques - Compression clinical application of prony's method

Total Number of Hours: 60 Hrs

Text Books:

1. DC Reddy, Biomedical signal processing TMH 2005

Reference Books:

1. Akav M.Biomedial signal processing Academic press 1994.
2. Kok FL, Biomedical signal processing, PHI 1999.
3. Mitra SK, Digital signal processing, TMH 2001.

Subject Code: BBI17007	**Subject Name : BIOMEDICAL INSTRUMENTATION**	**T / L/ ETL**	**L**	**T / S.Lr**	**P/ R**	**C**
	Prerequisite:	T	3	0/0	0/0	3

L : Lecture T : Tutorial SLr : Supervised Learning P : Project R : Research C: Credits
T/L/ETL : Theory/Lab/Embedded Theory and Lab

OBJECTIVE :

- The student will study about communication mechanics in a biomedical system with few examples
- The students tries to understand the basic principles in imaging techniques
- The student will acquire basic knowledge in life assisting and therapeutic devices

COURSE OUTCOMES (COs) : (3- 5)

CO1	The graduate will be able to study about communication mechanics in a biomedical system with few examples
CO2	Understands the basic principles in imaging techniques
CO3	Acquires basic knowledge in life assisting and therapeutic devices

Mapping of Course Outcomes with Program Outcomes (POs)

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	M	H	L	M	H	M	L	M	H	M	L	M
CO2	M	H	M	L	M	M	H	L	M	H	M	L
CO3	L	M	H	L	M	H	L	M	H	M	L	M

COs / PSOs	PSO1	PSO2	PSO3	PSO4	PSO5			
CO1	M	L	M	H	M			
CO2	H	M	H	M	H			
CO3	L	M	H	M	L			

H/M/L indicates Strength of Correlation H- High, M- Medium, L-Low

Category	Basic Sciences	Engineering Sciences	Humanities and Social Sciences	Program Core	Program Electives	Open Electives	Practical / Project	Internships / Technical Skill	Soft Skills			
				✓								

Approval	

BIOMEDICAL INSTRUMENTATION

UNIT I BIO-POTENTIAL ELECTRODES **9 Hrs**

Electrode electrolyte interface, half-cell potential, polarization and non- polarizable electrode, calomel electrode, needle and wire electrode, microelectrode-metal micropipette

UNIT II RECORDING SYSTEM **9 Hrs**

Low-Noise preamplifier, main amplifier and driver amplifier, inkjet recorder, thermal array recorder, photographic recorder, magnetic tape recorder, X-Y recorder, medical oscilloscope

UNIT III BIO-CHEMICAL MEASUREMENT **9 Hrs**

pH, pO2, pCO2, pHCO3, Electrophoresis, colorimeter, spectro photometer, flame photometer, auto analyzer

UNIT IV NON-ELECTRICAL PARAMETER MEASUREMENTS **9 Hrs**

Respiration, heart rate, temperature, pulse blood pressure, cardiac output, O2, CO2 measurements

UNIT V BLOOD FLOW AND BLOOD CELL COUNTING **9 Hrs**

Electromagnetic and ultrasonic blood flowmeter, indicator dilution method, thermo dilution method, manual and automatic counting of RBC, WBC and platelets

Total Number of Hours: 45 Hrs

Text Books:

1. John G. Webster, "Medical Instrumentation Application and Design", John Wiley and sons, New York, 1998.
2. Leslie Cromwell, "Biomedical Instrumentation and measurement", Prentice hall of India, New Delhi, 1997

Reference Books:

1. Khandpur R.S, "Handbook of Biomedical Instrumentation", Tata McGraw-Hill, New Delhi, 1997
2. Joseph J.carr and John M. Brown, "introduction to Biomedical equipment technology", John wiley and sons, New York, 1997

Subject Code: BBI17008	**Subject Name : BIOMATERIALS and ARTIFICIAL ORGANS**	**T / L/ ETL**	**L**	**T / S.Lr**	**P/ R**	**C**
	Prerequisite:	T	3	0/0	0/0	3

L : Lecture T : Tutorial SLr : Supervised Learning P : Project R : Research C: Credits
T/L/ETL : Theory/Lab/Embedded Theory and Lab

OBJECTIVE :

- To know about the different classes of materials used in medicine
- To gain knowledge about the application of biomaterials in medicine
- To understand the concept of biocompatibility and the methods of biomaterial testing
- To know about the technologies of biomaterial processing, clinical trials, ethical issues and regulatory standards.
- To gain knowledge in some of the existing designs of artificial organs.

COURSE OUTCOMES (COs) : (3- 5)

CO1	The graduate understands about the different classes of materials used in medicine
CO2	Familiar with the application of biomaterials in medicine
CO3	Graduate understands the concept of biocompatibility and the methods of biomaterial testing
CO4	The graduate will be able to use technologies of biomaterial processing, clinical trials, ethical issues and regulatory standards.
CO5	Acquires knowledge in some of the existing designs of artificial organs.

Mapping of Course Outcomes with Program Outcomes (POs)

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	M	M	H	L	M	H	L	M	H	M	L	M
CO2	H	M	H	M	L	M	H	L	H	M	H	M
CO3	H	L	M	M	L	H	M	L	H	M	L	M
CO4	H	M	L	H	M	L	H	M	L	M	H	L
CO5												

COs / PSOs	PSO1	PSO2	PSO3	PSO4	PSO5			
CO1	M	H	M	L	M			
CO2	H	M	L	M	H			
CO3	H	M	M	H	M			
CO4	M	L	H	M	L			
CO5	M	H	L	M	H			

H/M/L indicates Strength of Correlation H- High, M- Medium, L-Low

Category	Basic Sciences	Engineering Sciences	Humanities and Social Sciences	Program Core	Program Electives	Open Electives	Practical / Project	Internships / Technical Skill	Soft Skills			
				✓								

Approval	

BIOMATERIALS AND ARTIFICIAL ORGANS

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

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

UNIT II IMPLANT MATERIALS 9 Hrs

Metallic implant materials, stainless steels, co-based alloys, Ti-based alloys, ceramic implant materials, aluminum oxides, hydroxyapatite glass ceramics carbons, medical applications.

UNIT III POLYMERIC IMPLANT MATERIALS 9 Hrs

Polymerization, polyolefin, polyamicles, Acryrilic, polymers, rubbers, high strength thermoplastics, medical applications

UNIT IV TISSUE REPLACEMENT IMPLANTS 9 Hrs

Soft-tissue replacements, sutures, surgical tapes, adhesive, percutaneous and skin implants, maxillofacial augmentation, blood interfacing implants, hard tissue replacement implants, internal fracture fixation devices, joint replacements.

UNIT V ARTIFICIAL ORGANS 9 Hrs

Artificial Heart, Prosthetic Cardiac Valves, Limb prosthesis, Externally Powered limb Prosthesis, Dental Implants

Total Number of Hours: 45 Hrs

Text Books:

1. PARK J.B., "Biomaterials Science and Engineering", Plenum Press, 1984.

Reference Books:

1. Chua, Chena.J.Y, Wanga.L.P, N.Huang, "Plasma-surface modification of biomaterials", Materials Science and Engineering: R: Reports, Volume 36, Number 5, 29 March 2002, pp. 143-206 (64)

Subject Code: BEE17I02	Subject Name: MICROPROCESSOR, MICROCONTROLLER AND ITS APPLICATIONS	T / L/ ETL	L	T / S.Lr	P/ R	C
	Prerequisite:	T	3	0/0	0/0	3

L : Lecture T : Tutorial SLr: Supervised Learning P : Project R : Research C: Credits
T/L/ETL : Theory/Lab/Embedded Theory and Lab

OBJECTIVE :

- To develop an in-depth understanding of the operation of microprocessor and microcontroller, machine language programming and interfacing techniques.
- The graduate will learn some the internal organization of some popular microprocessor and microcontroller.
- To learn hardware and software interaction and integration.
- The graduate will learn the design of microprocessor and microcontroller based system.
- Understand the application of microcontroller.

COURSE OUTCOMES (COs) : (3- 5)

CO1	Familiarize with operation of microprocessor and microcontroller, machine language programming and interfacing techniques
CO2	Acquire the knowledge on internal organization of some popular microprocessor and microcontroller
CO3	Capable of understanding the hardware and software interaction and integration
CO4	Understand the design of microprocessor and microcontroller based system
CO5	Understand the applications of microcontroller

Mapping of Course Outcomes with Program Outcomes (POs)

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	H	H	H	H	H	H	H	L	H	M	H	M
CO2	H	H	H	H	H	H	M	M	H	M	H	M
C03	H	H	H	M	M	L	L	L	M	L	M	L
CO4	H	H	H	H	H	M	M	M	H	M	H	M
CO5	H	H	H	H	H	M	M	M	H	M	H	M

COs / PSOs	PSO1	PSO2	PSO3	PSO4	PSO5			
CO1	M	H	H	M	M			
CO2	M	H	H	H	M			
CO3	L	H	H	M	L			
C04	L	M	M	M	L			
CO5	M	H	H	M	M			

H/M/L indicates Strength of Correlation H- High, M- Medium, L-Low

Category	Basic Sciences	Engineering Sciences	Humanities and Social Sciences	Program Core	Program Electives	Open Electives	Practical / Project	Internships / Technical Skill	Soft Skills			
				✓								
Approval												

MICROPROCESSOR, MICROCONTROLLER AND ITS APPLICATIONS

UNIT I ARCHITECTURE **9 Hrs**

General 8-bit microprocessor and its architecture – 8085 functional block diagram – architecture functions of different sections – architecture of 8086 CPU.

UNIT II INSTRUCTION SETS **9 Hrs**

Instruction format-addressing addressing modes – instruction set of 8085 CPU – instruction cycle – timing diagrams – different machine cycles – fetch and execute operations – estimation of execution time.

UNIT III ASSEMBLY LANGUAGE PROGRAMMING **9 Hrs**

Assembly format of 8085 – assembly directions – multiple precision arithmetic operations – binary to BCD and BCD to binary code conversion – ALU programming using look up table – stack and subroutines

UNIT IV DATA TRANSFER AND INTERFACING **9 Hrs**

Data transfer schemes – program I/O û interrupt structure of 8085 – interrupt driven I/O – DMA serial I/O – input/output ports – latches and buffers – peripheral interface IC's – 8212, 8255, 8251, 8279, 8259 – interfacing of A/D and D/A converters – RAM and ROM – memory devices – display devices – applications.

UNIT V MICROCONTROLLERS **9 Hrs**

Architecture of 8-bit micro controller (8051) – bus configuration – reset circuitry – power down considerations – instruction sets - programming exercises and micro controllers software design - development and troubleshooting tools – applications.

Total Number of Hours: 45 Hrs

Text Books:

1. Gaonkarr.s., Microprocessor Architecture Programming and Application, Wiley Eastern Ltd., New Delhi, 1995.
2. Kenneth hint, Danieltabak, Microcontrollers, Architecture, Implementation and Programming, Mcgraw hill international, USA, 1992.

Reference Books:

1. Mathur A.P., Introduction of Microprocessors, Tata McGraw-Hill Publishing Co.Ltd., New Delhi, 1989.
2. John B.Peatman, Design with Microcontrollers, McGraw Hill International, USA, 1988.

Subject Code: BBI17ET3	**Subject Name : MEASUREMENTS AND INSTRUMENTS ***	**T / L/ ETL**	**L**	**T / S.Lr**	**P/ R**	**C**
	Prerequisite:	ETL	3	0/2	1/1	3

L : Lecture T : Tutorial SLr : Supervised Learning P : Project R : Research C: Credits
T/L/ETL : Theory/Lab/Embedded Theory and Lab

OBJECTIVE :

- To learn Developing adequate knowledge of the instruments, relevant circuits and their working
- To study about Introduction to electrical instruments and measurements techniques.
- To learn the analog and digital techniques used to measure voltage, current, power etc

COURSE OUTCOMES (COs) : (3- 5)

CO1	Developing adequate knowledge of the instruments, relevant circuits and their working
CO2	Introduction to electrical instruments and measurements techniques.
CO3	To Emphasis Knowledge on analog and digital techniques used to measure voltage, current, power etc.

Mapping of Course Outcomes with Program Outcomes (POs)

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	H	M	L	M	H	L	H	M	L	M	H	M
CO2	M	H	L	M	H	L	M	H	M	L	M	H
CO3	L	M	H	M	L	M	H	L	M	H	L	M

COs / PSOs	PSO1	PSO2	PSO3	PSO4	PSO5			
CO1	M	H	L	M	M			
CO2	H	M	H	M	H			
CO3	M	L	H	M	L			

H/M/L indicates Strength of Correlation H- High, M- Medium, L-Low

Category	Basic Sciences	Engineering Sciences	Humanities and Social Sciences	Program Core	Program Electives	Open Electives	Practical / Project	Internships / Technical Skill	Soft Skills			
				✓								
Approval												

MEASUREMENTS AND INSTRUMENTS

UNIT I INTRODUCTION **9 Hrs**

Units, Dimensions and standards-measurement errors PMMC, moving iron instruments – Galvanometer – construction -Principle of operation- Types of Ammeter and voltmeter- Rectifier type voltmeter and ammeter.

UNIT II RESISTANCE, INDUCTANCE and CAPACITANCE MEASUREMENTS **9 Hrs**

Resistance measurement – wheat stone bridge and Kelvin double bridge measurement of inductance and capacitance– Maxwell bridge and Hay's bridge measurement of capacitance – Schering bridge, student type potentiometer- precision potentiometer – AC potentiometer, polar and co-ordinate type – application

UNIT III WATT METER AND ENERGY METER CALIBRATION **9 Hrs**

Electro dynamic Instruments, wattmeter – theory and its error – methods of correction – LPF wattmeter – induction type wattmeter – theory and adjustment – calibration of wattmeter and energy meter, Instrument transformer – construction and theory of current Transformer and potential Transformer.

UNIT IV ANALOG and DIGITAL INSTRUMENTS **9 Hrs**

CRO – operation – measurement of voltage, frequency and phase-Analog storage oscilloscope, sampling oscilloscope -DSO – operation, signal and function generation – Digital voltmeter and multimeter - Q-meter

UNIT V DIGITAL DISPLAY AND RECORDING DEVICES **9 Hrs**

Bar graph display – seven segment and dot matrix display – signal recorders – XY recorders – magnetic tape recorders – digital recording and data loggers.

Total Number of Hours: 45 Hrs

Text Books:

1. Cooper, "Electronic Instrumentation and Measurement Techniques", Prentice Hall of India, 1988.
2. A. K. Shawney "Electronics and Electrical Instrumentation" Tata McGraw Hill, 1975.
3. David A. Bell, Electronic Instrumentation and Measurements, Prentice Hall of India New Delhi 2005

Reference Books:

1.Bouwels A.J., "Digital Instrumentation", McGraw Hill, 1986.
2.Barney .C, "Intelligent Instrumentation ", Prentice Hall of India, 1985.
3.Oliver and Cage, "Electronic Measurements and Instruments and Instrumentation", McGraw Hill, 1975.
4.Deobelin, "Measurements Systems", McGraw Hill, 1990.

Subject Code: BBI17L04	**Subject Name : ELECTRICAL AND ELECTRONIC MEASUREMENTS LABORATORY**	**T / L/ ETL**	**L**	**T / S.Lr**	**P/ R**	**C**
	Prerequisite:	L	0	0/0	3/0	1

L : Lecture T : Tutorial SLr : Supervised Learning P : Project R : Research C: Credits
T/L/ETL : Theory/Lab/Embedded Theory and Lab

OBJECTIVE :

- Developing adequate knowledge of the compensating circuits
- Introduction to synchronous motor
- Introduction to measurements techniques.
- To Emphasis Knowledge on control system
- To Emphasis Knowledge on digital techniques used to measure voltage, current, power etc

COURSE OUTCOMES (COs) : (3- 5)

CO1	The graduate will get adequate knowledge of the compensating circuits
CO2	Capable of describing synchronous motor
CO3	Capable of describing various measurements techniques.
CO4	Knowledge on control system
CO5	Knowledge on digital techniques used to measure voltage, current, power etc. gets enhanced

Mapping of Course Outcomes with Program Outcomes (POs)

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	H	M	M	H	L	H	H	M	M	L	L	M
CO2	M	H	H	M	L	M	H	H	H	L	M	M
CO3	M	H	H	H	H	L	M	L	M	L	H	H
CO4	H	H	H	M	M	M	H	M	H	L	H	M
CO5	M	H	H	L	L	M	H	H	H	M	M	H

COs / PSOs	PSO1	PSO2	PSO3	PSO4	PSO5			
CO1	H	M	L	H	M			
CO2	H	H	M	L	H			
CO3	H	M	H	L	L			
CO4	L	H	H	L	M			
CO5	M	M	H	L	H			

H/M/L indicates Strength of Correlation H- High, M- Medium, L-Low

Category	Basic Sciences	Engineering Sciences	Humanities and Social Sciences	Program Core	Program Electives	Open Electives	Practical / Project	Internships / Technical Skill	Soft Skills			
							✓					

Approval	

ELECTRICAL AND ELECTRONIC MEASUREMENTS LABORATORY

LIST OF EXPERIMENTS

1. Use of Wheat Stone Bridge as resistance to voltage converter and to determine its sensitivity for various ratios
2. Kelvin double bridge
3. Determination of critical damping resistance of a D'Arsonval Galvanometer
4. Tests on a single-phase energy meter
5. Calibration of wattmeter at different power factors
6. Testing of current transformers
7. Calibration of ammeter, voltmeter and wattmeter using student type potentiometer
8. Design, construction and calibration of series and shunt type ohmmeters
9. Operational amplifier applications
10. Regulated power supply using fixed voltage IC regulators and LM 723
11. Frequency response characteristics of CE and CB amplifiers
12. Study of feedback in amplifiers
13. RC phase shift and Wien bridge oscillator.

Total Number of Hours: 45 Hrs

Subject Code: BBI17L05	**Subject Name : BIO-SIGNAL ACQUISITION LABORATORY**	**T / L/ ETL**	**L**	**T / S.Lr**	**P/ R**	**C**
	Prerequisite:	L	0	0/0	3/0	1

L : Lecture T : Tutorial SLr : Supervised Learning P : Project R : Research C: Credits
T/L/ETL : Theory/Lab/Embedded Theory and Lab

OBJECTIVE :

- To represent the basic discrete time signals and analyze it
- To design the IIR and FIR filter
- To acquire various types of bio signals and study its characteristics

COURSE OUTCOMES (COs) : (3- 5)

CO1	The graduate is capable of representing the basic discrete time signals and analyze it
CO2	Capable to design the IIR and FIR filter
CO3	Capable to acquire various types of bio signals and study its characteristics

Mapping of Course Outcomes with Program Outcomes (POs)

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	H	M	L	H	M	L	M	H	L	M	H	M
CO2	H	M	L	M	H	L	M	H	L	M	H	L
CO3	M	L	H	M	L	M	L	H	M	L	M	H

COs / PSOs	PSO1	PSO2	PSO3	PSO4	PSO5			
CO1	H	M	L	M	H			
CO2	L	M	L	M	H			
CO3	M	L	H	H	M			

H/M/L indicates Strength of Correlation H- High, M- Medium, L-Low

Category	Basic Sciences	Engineering Sciences	Humanities and Social Sciences	Program Core	Program Electives	Open Electives	Practical / Project	Internships / Technical Skill	Soft Skills			
							✓					
Approval												

BIO-SIGNAL ACQUISITION LABORATORY

LIST OF EXPERIMENTS

1. Representation of basic discrete time signals
2. Computation of convolution –linear convolution
3. Response of a difference equation to initial conditions; stability
4. DFT and FFT computation
5. FIR filter design using windowing techniques
6. IIR filters design-digital Butterworth filter and Chebyshev filter
7. Simulation of signals.
8. Simulation of ECG signals.
9. Simulation of EEG signals
10. Simulation of EMG signals

Total Number of Hours: 45 Hrs

Subject Code: BEE17IL3	Subject Name: MICROPROCESSOR, MICROCONTROLLER AND ITS APPLICATIONS LABORATORY	T / L/ ETL	L	T / S.Lr	P/ R	C
	Prerequisite:	L	0	0/0	3/0	1

L : Lecture T : Tutorial SLr : Supervised Learning P : Project R : Research C: Credits

T/L/ETL : Theory/Lab/Embedded Theory and Lab

OBJECTIVE :

- The students understand to do basic programming in microprocessors and Interfacing.
- Basic concept to understand code conversion.
- Logical calculations to carry out basic arithmetic.
- Graduates to understand the programming concepts of microprocessor.
- To understand the programming concepts of microcontroller.

COURSE OUTCOMES (COs) : (3- 5)

CO1	Capable of programming in microprocessors and Interfacing.
CO2	Familiar with code conversion.
CO3	Capable of performing Logical calculations to carry out basic arithmetic
CO4	Capable of understand the programming concepts of microprocessor.
CO5	Understand the programming concepts of microcontroller.

Mapping of Course Outcomes with Program Outcomes (POs)

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	H	H	H	H	H	H	H	L	H	M	H	M
CO2	H	H	H	M	M	L	L	L	M	L	M	L
CO3	H	H	H	H	H	H	M	M	H	M	H	M
CO4	H	H	H	H	H	M	M	M	H	M	H	M
CO5	H	H	H	H	H	M	M	M	H	M	H	M

COs / PSOs	PSO1	PSO2	PSO3	PSO4	PSO5			
CO1	L	M	M	L	M			
CO2	M	M	M	M	H			
CO3	M	M	M	M	H			
CO4	M	M	M	L	H			
CO5	L	M	M	M	M			

H/M/L indicates Strength of Correlation H- High, M- Medium, L-Low

Category	Basic Sciences	Engineering Sciences	Humanities and Social Sciences	Program Core	Program Electives	Open Electives	Practical / Project	Internships / Technical Skill	Soft Skills			
				✓								
Approval												

MICROPROCESSOR, MICROCONTROLLER AND ITS APPLICATIONS LABORATORY

LIST OF EXPERIMENTS

1. Familiarisation of 8085 Microprocessor kit
2. Familiarisation of 8051 Microcontroller kit
3. 8085 and 8051 assembly language programming exercises
4. Interfacing of switches and display devices
5. Interfacing of D/A and A/D Converters
6. Interface of key board and display using programmable controllers
7. Interface of programmable Timer
8. Stepper motor control using microprocessor
9. Simple 8086 assembly language programming exercises
10. Study of MASM and DEBUG utilities

Total Number of Hours: 45 Hrs

Subject Code: BEI17TSX	Subject Name : TECHNICAL SKILL II	T / L/ ETL	L	T / S.Lr	P/ R	C
		0	0	0	1	1

L : Lecture T : Tutorial SLr : Supervised Learning P : Project R : Research C: Credits

T/L/ETL : Theory/Lab/Embedded Theory and Lab

OBJECTIVE : The objective is to develop the technical skill of the students.

COURSE OUTCOMES (COs) : (3- 5)

CO1	Develop the technical skills required in the field of study
CO2	Bridge the gap between the skill requirements of the employer or industry and the competency of the students.
CO3	Enhance the employability of the students.

Mapping of Course Outcomes with Program Outcomes (POs)

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	H	H	H	H	H	H	M	M	H	M	H	M
CO2	H	H	M	H	H	H	M	M	H	H	H	H
CO3	H	H	H	H	H	H	M	M	H	H	H	H

COs / PSOs	PSO1	PSO2	PSO3	PSO4	PSO5			
CO1	H	H	H	H	H			
CO2	H	H	H	H	H			
CO3	H	H	H	H	H			

H/M/L indicates Strength of Correlation H- High, M- Medium, L-Low

Category	Basic Sciences	Engineering Sciences	Humanities and Social Sciences	Program Core	Program Electives	Open Electives	Practical / Project	Internships / Technical Skill	Soft Skills			
								✓				

Approval	

Subject Code: BBI17L06	**Subject Name : INPLANT TRAINING**	**T / L/ ETL**	**L**	**T / S.Lr**	**P/ R**	**C**
		L	0	0/0	2/0	1

L : Lecture T : Tutorial SLr : Supervised Learning P : Project R : Research C: Credits
T/L/ETL : Theory/Lab/Embedded Theory and Lab

OBJECTIVE : The main objective of the Inplant training is to provide a short-term work experience in an Industry/ Company/ Organization

COURSE OUTCOMES (COs) : (3- 5)

CO1	To get an insight of an industry / organization/company pertaining to the domain of study.
CO2	To acquire skills and knowledge for a smooth transition into the career.
CO3	To gain field experience and get linked with the professional network.

Mapping of Course Outcomes with Program Outcomes (POs)

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	M	L	L	L	L	H	H	H	H	H	H	H
CO2	H	M	H	H	M	H	H	H	H	H	H	M
CO3	H	H	H	H	M	H	H	H	H	H	H	M
COs / PSOs	PSO1		PSO2		PSO3		PSO4		PSO5			
CO1												
CO2												

H/M/L indicates Strength of Correlation H- High, M- Medium, L-Low

Category	Basic Sciences	Engineering Sciences	Humanities and Social Sciences	Program Core	Program Electives	Open Electives	Practical / Project	Internships / Technical Skill	Soft Skills			
								✓				
Approval												

Subject Code: BBI17009	**Subject Name : PATHOLOGY AND MICRO BIOLOGY**	**T / L/ ETL**	**L**	**T / S.Lr**	**P/ R**	**C**
	Prerequisite:	T	3	1/0	0/0	4

L : Lecture T : Tutorial SLr : Supervised Learning P : Project R : Research C: Credits
T/L/ETL : Theory/Lab/Embedded Theory and Lab

OBJECTIVE :

- To learn about Normal cell structure
- To gain knowledge on Fluid and heamodynamic derangement
- To study about Genetic disorders
- To acquire knowledge on General structural organization
- To be able to do Identification of disease producing organism

COURSE OUTCOMES (COs) : (3- 5)

CO1	Understands Normal cell structure
CO2	Gets knowledge on Fluid and heamodynamic derangement
CO3	Famailiar about Genetic disorders
CO4	Acquires knowledge on General structural organization
CO5	Performs Identification of disease producing organism

Mapping of Course Outcomes with Program Outcomes (POs)

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	H	M	H	L	M	H	L	M	H	L	M	H
CO2	M	L	H	M	L	L	M	H	L	M	H	L
CO3	M	H	L	M	H	L	M	H	L	M	H	L
CO4	H	M	M	L	M	H	L	M	H	L	M	H
CO5	L	L	L	M	H	L	M	H	L	M	H	L

COs / PSOs	PSO1	PSO2	PSO3	PSO4	PSO5			
CO1	H	M	H	M	L			
CO2	M	L	M	H	M			
CO3	L	M	H	M	L			
CO4	H	M	L	M	H			
CO5	M	L	H	M	L			

H/M/L indicates Strength of Correlation H- High, M- Medium, L-Low

Category	Basic Sciences	Engineering Sciences	Humanities and Social Sciences	Program Core	Program Electives	Open Electives	Practical / Project	Internships / Technical Skill	Soft Skills			
				✓								
Approval												

PATHOLOGY AND MICRO BIOLOGY

UNIT I NORMAL CELL STRUCTURE **12 Hrs**

Cell Degeneration and regeneration – Inflammations, apoptosis. Classification, Difference between benign and malignant tumors – Etiology of tumors – Spread of Tumors.

UNIT II FLUID AND HEAMODYNAMIC DERANGEMENT **12 Hrs**

Edema, Shock, Hemorrhage – Thrombus – Embolism 0- Disseminated intra vascular Coagulation – Hematological disorders. Bleeding Disorders – Leukemia – lymphoma.

UNIT III GENETIC DISORDERS **12 Hrs**

Genetic disorders, infection and immunity, Autosomal and sex linked disorders – Storage disorders – types of hypersensitivity reactions – Immune deficiency syndrome – Primary – HIV – Viral disease, Chlamydial – Bacterial – mycoplasma – Rickettsial disease – Fungal protozolal. – helminthic disease.

UNIT IV GENERAL STRUCTURAL ORGANIZATION **12 Hrs**

General structural organization of Bacterial, Viral Cell – Growth and Identification of Bacteria, Observation pf culture. Microscopy: Light Microscopy – Dark field Microscopy – Phase Contrast microscopy – electron microscopy.

UNIT V IDENTIFICATION PF DISEASE PRODUCING ORGANISM **12 Hrs**

Identification pf disease producing organism, simple stain, Gram stain, AFB Stain, Fluorescent techniques, Antigen – Antibody Techniques.

Total Number of Hours: 60 Hrs

Text Books:

1. Robbins S.L. and Ramzi S. C. “Pathologic Basis of Diseases”, W.B. Saunders Co. 1999

Reference Books:

1. Anatha Narayanan .R. and Jayaram C.R., ‘Text Book of Microbiology, Orient Laongman’ 1998.

Subject Code: BBI17010	**Subject Name : MEDICAL IMAGE PROCESSING**	**T / L/ ETL**	**L**	**T / S.Lr**	**P/ R**	**C**
	Prerequisite:	T	3	0/0	0/0	3

L : Lecture T : Tutorial SLr : Supervised Learning P : Project R : Research C: Credits
T/L/ETL : Theory/Lab/Embedded Theory and Lab

OBJECTIVE :

- To learn the different methods and modalities used for medical imaging
- To learn the preferred medical imaging methods for routine clinical applications
- To understand the engineering models used to describe and analyze medical images

COURSE OUTCOMES (COs) : (3- 5)

CO1	The graduate understands the different methods and modalities used for medical imaging
CO2	The graduate is capable of understanding the preferred medical imaging methods for routine clinical applications
CO3	Graduate is capable to explain the engineering models and analyze medical images

Mapping of Course Outcomes with Program Outcomes (POs)

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	M	M	H	L	M	H	M	L	M	H	M	H
CO2	H	M	L	M	H	L	M	H	L	M	H	M
CO3	L	M	H	L	M	H	L	M	H	L	M	H

COs / PSOs	PSO1	PSO2	PSO3	PSO4	PSO5			
CO1	M	H	M	H	M			
CO2	L	M	H	M	L			
CO3	H	M	L	M	H			

H/M/L indicates Strength of Correlation H- High, M- Medium, L-Low

Category	Basic Sciences	Engineering Sciences	Humanities and Social Sciences	Program Core	Program Electives	Open Electives	Practical / Project	Internships / Technical Skill	Soft Skills			
				✓								
Approval												

MEDICAL IMAGE PROCESSING

UNIT I IMAGE FUNDAMENTALS **9 Hrs**

Image perception, MTF of the visual system, image fidelity criteria, image model, image sampling and quantization – two dimensional sampling theory, image quantization, optimum mean square quantizer, image transforms –2D-DFT and other transforms.

UNIT II IMAGE PREPROCESSING **9 Hrs**

Image enhancement–point operation, histogram modeling, spatial operations, transforms operations. Image restoration-image degradation model, inverse and Wiener filtering.

UNIT III IMAGE ANALYSIS AND CLASSIFICATION **9 Hrs**

Image analysis – spatial feature extraction, edge detection, image segmentation classification techniques – statistical methods, neural network approaches.

UNIT IV RECONSTRUCTION OF CT AND MRI IMAGES **9 Hrs**

Image reconstruction from projections – Radon transforms, filter back projection algorithm, algebraic methods, 3D tomography, imaging methods in CT images, imaging methods in magnetic resonance imagers, Fourier reconstruction of magnetic resonance images.

UNIT V TRANSMISSION OF MEDICAL **9 Hrs**

Medical image data compression and transmission – transform coding pixel coding, predictive coding, interframe coding - Application of image processing techniques in thermography, SPECT, PET, DSA, AI techniques in medical imaging - Biomagnetic diagnosis in connection with medical imaging of CT or MRI - Software implementation of image processing algorithms on medical images, Design consideration for RF cage

Total Number of Hours: 45 Hrs

Text Books:

1. Albert Macouskl, Medical Imaging Systems, Prentice Hall New Jersery, 1983.
2. Gonzalez .R and Wintz .P, Digital Image Processing Addision Wesley Publishing Co. USA, 1987.

Reference Books:

1. Eric Krestel Imaging Systems for Medical diagnosis, Siemens Aktlengesellschaft, FRG, 199.
2. Alfred Horowitz MRI Physics for Radiologists – A Visual Approach, Springer Verlag, New York, II Edition, 1991.
3. Anil K. Jain, Fundamental of Digital Image Processing, Prentice Hall of India Pvt Ltd., New Delhi, 1995.

Subject Code: BEC17I07	**Subject Name: COMMUNICATION SYSTEMS and IOT**	**T / L/ ETL**	**L**	**T / S.Lr**	**P/ R**	**C**
	Prerequisite:	L	3	0/0	0/0	3

L : Lecture T : Tutorial SLr : Supervised Learning P : Project R : Research C: Credits
T/L/ETL : Theory/Lab/Embedded Theory and Lab

OBJECTIVE :

- To understand the Analog and Digital Communication.
- To study about the methods to convert Analog to Digital communication using code theory.
- To study about different modulation techniques
- To introduce various media for digital communication
- To apply the concept of Internet of Things in the real world scenario

COURSE OUTCOMES (COs) : (3- 5)

CO1	Capable of understanding the concepts of Analog and Digital communication circuits
CO2	Gain knowledge about the Communication conversion methods
CO3	Gain knowledge about the different concepts of modulation techniques
CO4	Develop knowledge about the various digital communication media
CO5	Ability to understand and incorporate the concepts of IOT in different fields.

Mapping of Course Outcomes with Program Outcomes (POs)

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	H	M	M	M	L	L	L	H	H	H	H	M
CO2	L	L	M	L	L	H	H	H	M	L	M	M
CO3	M	M	M	L	H	L	H	M	L	M	H	M
CO4	H	H	M	M	M	L	H	M	L	M	H	M
CO5	H	M	L	M	H	L	H	M	L	M	H	L

COs / PSOs	PSO1	PSO2	PSO3	PSO4	PSO5			
CO1	H	M	L	H	H			
CO2	M	M	H	L	L			
CO3	H	M	M	H	M			
CO4	M	L	L	M	H			
CO5	L	M	L	H	M			

H/M/L indicates Strength of Correlation H- High, M- Medium, L-Low

Category	Basic Sciences	Engineering Sciences	Humanities and Social Sciences	Program Core	Program Electives	Open Electives	Practical / Project	Internships / Technical Skill	Soft Skills			
				✓								

Approval	

COMMUNICATION SYSTEMS AND IOT

UNIT I SIGNALS and NOISE **9 Hrs**

Periodic and Aperiodic Signals – Noise - External Noise – Thermal Agitation – Shot Noise – Noise Figure – Signal to Noise ratio – Equivalent Noise resistance.

UNIT II INTRODUCTION TO COMMUNICATION **9 Hrs**

Basic Communication systems – Need for Modulation in communication systems – Amplitude Modulation – Double Side Band amplitude Modulation – Single sideband and VSB modulation – modulators. AM Transmitter and Receiver, FM transmitter and Receiver.

UNIT III MODULATION TECHNIQUES AND PULSE MODULATION **9 Hrs**

Phase modulation – Noise triangle – Pre-emphasis and de-emphasis – Stereophonic FM multiplex system – comparison of wideband and narrow band FM – AFC – Sampling theorem –Quantization, Quantization Error, PAM, PWM, PPM, PCM.

UNIT IV DIGITAL MODULATION and INFORMATION THEORY **9 Hrs**

ASK, FSK, PSK, Transmitter and Receiver. Introduction-Information and Entropy, Source Coding Theory, Discrete Memory less Channel, Mutual Information Channel Capacity, Channel Coding Theory

UNIT V INTERNET OF THINGS **9 Hrs**

Introduction – Block diagram of IoT- IoT Architecture – Communication Technologies in IoT – Cloud Storage in IoT-Data Storage in IoT – Applications of IoT – Smart Home, Smart City, Smart Agriculture, Health Monitoring System.

Total Number of Hours: 45 Hrs

Text Books:

1. Roy Blake, (2002) Electronic Communication systems. 2nd Ed. Thomson Learning.
2. George Kennedy, (1992) Electronic communication systems. Tata McGraw Hill publications.
3. Simon Haykins, (2001) Principles of Communications. Prentice Hall of India.

Reference Books:

1. Michael Miller, (2015) The Internet of Things. Que Publishing
2. Bruce Carlson, A. Taub and Schilling, (1986) Principles of Communication Systems. Tata McGraw Hill.
3. Arshdeep Bahga, Vijay Madisetti, "Internet of Things – A hands-on approach", Universities Press, 2015

Subject Code:	Subject Name : SOFT SKILLS – II	T / L/ ETL	L	T / S.Lr	P/ R	C
	Prerequisite: Soft Skills - I					1

L : Lecture T : Tutorial SLr : Supervised Learning P : Project R : Research C: Credits

T/L/ETL : Theory/Lab/Embedded Theory and Lab

OBJECTIVE : The main objective is to strengthen the logical and arithmetic reasoning skills of the students.

COURSE OUTCOMES (COs) : (3- 5)

CO1	Recognize and apply arithmetic knowledge in a variety of contexts.
CO2	Ability to identify and critically evaluate philosophical arguments and defend them from criticism.
CO3	Define data and interpret information from graphs.

Mapping of Course Outcomes with Program Outcomes (POs)

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	H	H	H	H	H	H	L	L	H	M	H	H
CO2	M	M	M	H	L	H	L	H	H	H	H	L
CO3	H	H	H	H	H	H	M	M	H	H	H	H

COs / PSOs	PSO1	PSO2	PSO3	PSO4	PSO5			
CO1								
CO2								

H/M/L indicates Strength of Correlation H- High, M- Medium, L-Low

Category	Basic Sciences	Engineering Sciences	Humanities and Social Sciences	Program Core	Program Electives	Open Electives	Practical / Project	Internships / Technical Skill	Soft Skills			
									✓			

Approval	

SOFT SKILL 2

UNIT I LOGICAL REASONING I

Logical Statements – Arguments – Assumptions – Courses of Action

UNIT II LOGICAL REASONING II

Logical conclusions – Deriving conclusions from passages – Theme detection

UNIT III ARITHMETICAL REASONING I

Number system – H.C.F and L.C.M – Problem on ages – Percentage – Profit and Loss – Ratio and Proportion – Partnership

UNIT IV ARITHMETICAL REASONING II

Time and Work – Time and Distance – Clocks – Permutations and Combinations – Heights and Distances – Odd man out and Series

UNIT V DATA INTERPRETATION

Tabulation – Bar graphs – Pie graphs – Line graphs

Reference Books:

1. R.S.Agarwal, A modern approach to Logical Reasoning, S.Chand and Co., (2017).
2. R.S.Agarwal, A modern approach to Verbal and Non verbal Reasoning, S.Chand and Co., (2017).
3. R.S.Agarwal, Quantitative Aptitude for Competitive Examinations, S.Chand and Co., (2017).
4. A.K.Gupta, Logical and Analytical Reasoning, Ramesh Publishing House, (2014).
5. B.S.Sijwali, Indu sijwali, A new approach to Reasoning (Verbal and Non verbal), Arihant Publishers, (2014).

Subject Code: BBI17L07	**Subject Name : BIO-MEDICAL SIGNAL and IMAGE PROCESSING LABORATORY**	**T / L/ ETL**	**L**	**T / S.Lr**	**P/ R**	**C**
	Prerequisite:	L	0	0/0	3/0	1

L : Lecture T : Tutorial SLr : Supervised Learning P : Project R : Research C: Credits
T/L/ETL : Theory/Lab/Embedded Theory and Lab

OBJECTIVE :

- To analyze various types of bio signals and study its characteristics

COURSE OUTCOMES (COs) : (3- 5)

CO1	Capable to analyze various types of bio signals and study its characteristics

Mapping of Course Outcomes with Program Outcomes (POs)

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	H	M	L	M	H	M	L	H	M	M	L	H

COs / PSOs	PSO1	PSO2	PSO3	PSO4	PSO5			
CO1	M	H	L	M	H			

H/M/L indicates Strength of Correlation H- High, M- Medium, L-Low

Category	Basic Sciences	Engineering Sciences	Humanities and Social Sciences	Program Core	Program Electives	Open Electives	Practical / Project	Internships / Technical Skill	Soft Skills			
							✓					

Approval	

BIO-MEDICAL SIGNAL AND IMAGE PROCESSING LABORATORY

LIST OF EXPERIMENTS

1. Analysis of Bio-signals.
2. Analysis of ECG signals.
3. Analysis of EEG signals
4. Analysis of EMG signals
5. To obtain the response of I order low pass filter
6. To obtain the response of II order band pass filter
7. To analysis the ECG waveform using MATLAB
8. To analyze IIR digital filter for ECG using MATLAB
9. To perform Frequency domain analysis of the ECG using MATLAB
10. To perform EEG signal averaging using MATLAB

Total Number of Hours:45 Hrs

Subject Code: BBI17L08	**Subject Name : BIO-MEDICAL INSTRUMENTATION LABORATORY -I**	**T / L/ ETL**	**L**	**T / S.Lr**	**P/ R**	**C**
	Prerequisite:	L	0	0/0	3/0	1

L : Lecture T : Tutorial SLr : Supervised Learning P : Project R : Research C: Credits
T/L/ETL : Theory/Lab/Embedded Theory and Lab

OBJECTIVE :

- Study of Biological Preamplifiers.
- To learn Recording of ECG signal and Analysis.
- To learn Recording of Audiogram.
- To study Recording of EMG

COURSE OUTCOMES (COs) : (3- 5)

CO1	Understands Biological Preamplifiers.
CO2	Capable of Recording of ECG signal and Analysis.
CO3	Capable of Recording of Audiogram.
CO4	Capable of Recording of EMG

Mapping of Course Outcomes with Program Outcomes (POs)

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	H	M	M	H	M	L	M	M	L	H	M	L
CO2	H	M	L	M	H	L	M	H	L	M	H	L
CO3	M	M	M	L	H	M	L	H	M	L	M	H
CO4	L	M	H	M	L	M	H	L	M	H	H	M

COs / PSOs	PSO1	PSO2	PSO3	PSO4	PSO5			
CO1	M	H	L	M	H			
CO2	M	H	L	M	H			
CO3	M	H	L	M	H			
CO4	M	L	M	H	L			

H/M/L indicates Strength of Correlation H- High, M- Medium, L-Low

Category	Basic Sciences	Engineering Sciences	Humanities and Social Sciences	Program Core	Program Electives	Open Electives	Practical / Project	Internships / Technical Skill	Soft Skills			
							✓					
Approval												

BIO-MEDICAL INSTRUMENTATION LABORATORY -I

LIST OF EXPERIMENTS

1. Study of Biological Preamplifiers.
2. Recording of ECG signal and Analysis.
3. Recording of Audiogram.
4. Recording of EMG.
5. Recording of EEG.
6. Re cording of various physiological parameters using patient monitoring system and telemetry units.
7. Measurement of pH, pO2 and conductivity.
8. Study and analysis of functioning and safety aspects of surgical diathermy.

Total Number of Hours:45 Hrs

Subject Code: BBI17L09	**Subject Name : PATHOLOGY AND MICROBIOLOGY LABORATORY**	**T / L/ ETL**	**L**	**T / S.Lr**	**P/ R**	**C**
	Prerequisite:	L	0	0/0	3/0	1

L : Lecture T : Tutorial SLr : Supervised Learning P : Project R : Research C: Credits
T/L/ETL : Theory/Lab/Embedded Theory and Lab

OBJECTIVE :

- The study of microorganisms, which are unicellular or cell-cluster microscopic organisms.
- Fungi and, protists and prokaryotes. Viruses, though not strictly classed as living organisms, are also studied

COURSE OUTCOMES (COs) : (3- 5)

CO1	Capable to understand the study of microorganisms, which are unicellular or cell-cluster microscopic organisms.
CO2	The graduate can analyze Fungi and, protists and prokaryotes. Viruses, though not strictly classed as living organisms, are also studied

Mapping of Course Outcomes with Program Outcomes (POs)

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	M	M	H	L	M	H	L	M	H	L	M	H
CO2	H	M	L	M	H	L	M	H	L	M	H	L

COs / PSOs	PSO1	PSO2	PSO3	PSO4	PSO5			
CO1	M	H	L	M	H			
CO2	M	H	L	M	H			

H/M/L indicates Strength of Correlation H- High, M- Medium, L-Low

Category	Basic Sciences	Engineering Sciences	Humanities and Social Sciences	Program Core	Program Electives	Open Electives	Practical / Project	Internships / Technical Skill	Soft Skills			
							✓					
Approval												

PATHOLOGY AND MICROBIOLOGY LABORATORY

LIST OF EXPERIMENTS

1. To measure Gram positive and Gram negative, based on the differences of the chemical and physical properties of the cell wall.
2. To measure Rapid qualitative isolation method for obtaining discrete colonies from a mixed population.
3. To introduce and demonstrate the principle and experimental set up for determining the motility of microbes
4. To introduce and demonstrate the principle and experimental set up for determining the microbe's ability to detoxify hydrogen peroxide and /or to cause blood coagulation.
5. To introduce the preparation and use of different selective and differential media
6. To introduce and demonstrate the principle and experimental set up for determining the ability of microorganism to produce "Lecithinase" enzyme.
7. To study the different phases of growth of a bacterium by plotting a curve with time of growth on the X-axis and optical density on the Y-axis.
8. To study the different carbohydrate utilization of bacteria using phenol red carbohydrate fermentation broth.
9. To study the staining of bacteria with special stains that help to reveal their morphology thereby enhancing the contrast using a bright field microscope.
10. To determine the susceptibility of a microbial species against different antibiotic agents.
11. To Check the quality of the given milk sample

Total Number of Hours: 45 Hrs

Subject Code: BBI17L10	**Subject Name : MINI PROJECT**	**T / L/ ETL**	**L**	**T / S.Lr**	**P/ R**	**C**
	Prerequisite: NIL	L	1	0/0	2/0	1

L : Lecture T : Tutorial SLr : Supervised Learning P : Project R : Research C: Credits
T/L/ETL : Theory/Lab/Embedded Theory and Lab

OBJECTIVE : To acquire hands-on experience in converting a novel idea / technique into a working model / prototype involving multi-disciplinary skills and / or knowledge and working in at team.

COURSE OUTCOMES (COs) : (3- 5)

CO1	To conceptualize a novel idea / technique into a product
CO2	To develop a multi-disciplinary thinking and enable teamwork
CO3	Ideate and develop a prototype

Mapping of Course Outcomes with Program Outcomes (POs)

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	H	H	H	M	M	H	H	H	M	L	H	M
CO2	H	H	H	M	H	M	M	M	H	H	H	H
CO3	H	H	H	H	H	H	M	H	H	M	H	H

COs / PSOs	PSO1	PSO2	PSO3	PSO4	PSO5			
CO1								
CO2								

H/M/L indicates Strength of Correlation H- High, M- Medium, L-Low

Category	Basic Sciences	Engineering Sciences	Humanities and Social Sciences	Program Core	Program Electives	Open Electives	Practical / Project	Internships / Technical Skill	Soft Skills			
							✓					
Approval												

Subject Code: BEI17TSX	Subject Name : TECHNICAL SKILL III	T / L/ ETL	L	T / S.Lr	P/ R	C
		L	0	0/0	2/0	1

L : Lecture T : Tutorial SLr : Supervised Learning P : Project R : Research C: Credits

T/L/ETL : Theory/Lab/Embedded Theory and Lab

OBJECTIVE : The objective is to develop the technical skill of the students.

COURSE OUTCOMES (COs) : (3- 5)

CO1	Develop the technical skills required in the field of study
CO2	Bridge the gap between the skill requirements of the employer or industry and the competency of the students.
CO3	Enhance the employability of the students.

Mapping of Course Outcomes with Program Outcomes (POs)

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	H	H	H	H	H	H	M	M	H	M	H	M
CO2	H	H	M	H	H	H	M	M	H	H	H	H
CO3	H	H	H	H	H	H	M	M	H	H	H	H

COs / PSOs	PSO1	PSO2	PSO3	PSO4	PSO5			
CO1	H	H	H	H	H			
CO2	H	H	H	H	H			
CO3	H	H	H	H	H			

H/M/L indicates Strength of Correlation H- High, M- Medium, L-Low

Category	Basic Sciences	Engineering Sciences	Humanities and Social Sciences	Program Core	Program Electives	Open Electives	Practical / Project	Internships / Technical Skill	Soft Skills			
								✓				

Approval	

Subject Code: BBI17011	**Subject Name : BIO-MEDICAL EQUIPMENTS**	**T / L/ ETL**	**L**	**T / S.Lr**	**P/ R**	**C**
	Prerequisite:	T	3	1/0	0/0	4

L : Lecture T : Tutorial SLr : Supervised Learning P : Project R : Research C: Credits
T/L/ETL : Theory/Lab/Embedded Theory and Lab

OBJECTIVE :

- To study the Cardiac care units
- To learn about Neurological equipments
- To gain knowledge on Diathermy and stimulator
- To learn about Bio-telemetry
- To gain knowledge on Recent trends and electrical safety

COURSE OUTCOMES (COs) : (3- 5)

CO1	Acquires knowledge on the Cardiac care units
CO2	Capable to understand Neurological equipments
CO3	Capable of analyzing Diathermy and stimulator
CO4	Acquires knowledge of Bio-telemetry
CO5	Graduate knows the Recent trends and electrical safety

Mapping of Course Outcomes with Program Outcomes (POs)

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	M	H	M	L	M	H	L	M	H	L	M	H
CO2	H	H	H	M	L	M	H	L	M	H	L	M
CO3	L	M	H	L	M	H	L	M	H	L	M	H
CO4	M	H	M	L	M	H	L	M	H	L	M	H
CO5	L	M	H	L	M	L	M	H	L	M	H	L

COs / PSOs	PSO1	PSO2	PSO3	PSO4	PSO5			
CO1	M	H	L	M	H			
CO2	L	M	L	M	H			
CO3	H	M	L	M	H			
CO4	M	L	M	H	L			
CO5	M	H	L	M	H			

H/M/L indicates Strength of Correlation H- High, M- Medium, L-Low

Category	Basic Sciences	Engineering Sciences	Humanities and Social Sciences	Program Core	Program Electives	Open Electives	Practical / Project	Internships / Technical Skill	Soft Skills			
				✓								
Approval												

BIO-MEDICAL EQUIPMENTS

UNIT I CARDIAC CARE UNITS **12 Hrs**

Pace makers – different types, batteries for pace makers, AC defibrillators, asynchronous and synchronous DC defibrillators, patient monitoring system

UNIT II NEUROLOGICAL EQUIPMENTS **12 Hrs**

Stereo toxic unit, depth recording system, dot scanners, transcutaneous nerve stimulator, anesthesia Monitor, EEG controlled Anesthesia, Bio Feedback Equipments, Spinal Reflex Measurements, Front end devices for all Biomedical Equipments

UNIT III DIATHERMY AND STIMULATOR **12 Hrs**

Depth of penetration and physiological effects of H.F. radiation, short wave, Ultrasonics, and Micro Wave Diathermy, Surgical Diathermy, Physiological effects of stimulation, Galvanic, Farradical Surged types, Interfrantial Therapy

UNIT IV BIO-TELEMETRY **12 Hrs**

Principal, frequency selection for Telemetry, radio pills, multiplexing and tracking techniques, Telestimulation

UNIT V RECENT TRENDS AND ELECTRICAL SAFETY **12Hrs**

Principles of Thermography, detecting circuits, its application in medicine, principles of Cryogenic Techniques, its application in medicine, Principles of Fiber optic cable, Endoscopy, Laproscopy, Opthaimic Equipments. Micro and macro shock, sources of shock, monitoring and interrupting circuit from leakage current, Earthing scheme

Total Number of Hours: 60 Hrs

Text Books:

1. Albert M. Cook and Webster J.G., Therapeutic Medical Devices, Prentice Hall Inc., New Jersery, 1982.
2. Feinberg B.N. Applied Clinical Engineering, Prentice Hall Inc., Engiewood Cliffs, New Jersery, 1986

Reference Books:

1. Khandpur R.S. Handbook of Biomedical Instrumentation. Tata McGraw Hill Publishing company, New Delhi 1999.
2. Jacobson B. and Webster. J.G. Medicine and Clinical engineering, Prentice Hall of India, New Delhi, 1999
3. Leslie Cromwell, etal., Biomedical Instrumentation and measurements, Prentice Hall India, New Delhi, 2000

Subject Code: BBI17012	**Subject Name : VIRTUAL INSTRUMENTATION DESIGN FOR MEDICAL APPLICATIONS**	**T / L/ ETL**	**L**	**T / S.Lr**	**P/ R**	**C**
	Prerequisite:	T	3	1/0	0/0	4

L : Lecture T : Tutorial SLr : Supervised Learning P : Project R : Research C: Credits
T/L/ETL : Theory/Lab/Embedded Theory and Lab

OBJECTIVE :

- To educate about the Basic concepts of VI
- To make them understand the programming concepts of VI.
- To provide an insight to various Common Instrument Interface.
- To enable them to implement VI in medical systems
- To impart knowledge on various analysis tools

COURSE OUTCOMES (COs) : (3- 5)

CO1	Understands the Basic concepts of VI
CO2	Understands the programming concepts of VI.
CO3	Capable to analyze various Common Instrument Interface
CO4	Capable to implement VI in medical systems
CO5	Understands various analysis tools

Mapping of Course Outcomes with Program Outcomes (POs)

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	H	M	L	M	M	L	M	H	L	M	H	M
CO2	M	M	M	L	M	H	L	M	H	L	M	H
CO3	M	H	L	M	L	M	L	M	L	H	M	L
CO4	H	M	L	M	H	M	L	M	H	L	M	H
CO5	L	M	H	M	L	M	H	L	M	H	M	L

COs / PSOs	PSO1	PSO2	PSO3	PSO4	PSO5			
CO1	M	H	L	M	H			
CO2	M	L	H	M	L			
CO3	H	H	M	L	H			
CO4	M	H	L	M	H			
CO5	M	H	L	M	H			

H/M/L indicates Strength of Correlation H- High, M- Medium, L-Low

Category	Basic Sciences	Engineering Sciences	Humanities and Social Sciences	Program Core	Program Electives	Open Electives	Practical / Project	Internships / Technical Skill	Soft Skills			
				✓								
Approval												

VIRTUAL INSTRUMENTATION DESIGN FOR MEDICAL APPLICATIONS

UNIT I INTRODUCTION **12 Hrs**

Virtual instrumentation (VI): Evolution, Definition, Architecture- Conventional-, and Distributed- VI, Comparison of VI with traditional Instruments, Need of VI, advantages, block diagram, data flow techniques, graphical programming, Comparison between graphical programming and conventional programming, VI in engineering process.

UNIT II PROGRAMMING MODES **12 Hrs**

front panel, Block diagram, LABVIEW Environment: Startup-, Shortcut-, and Pull down menu, Palletes, Control structures: FOR loop, WHILE loop, Shift Registers, feedback nodes, Selection Structures: Case and sequence structures, Formulae nodes, Arrays, Clusters, Waveform Chart and graph, XY Graph, Strings, Tables, File I/O functions

UNIT III HARDWARE ASPECTS **12 Hrs**

Pull-up and pull down resistors, TTL to solid state Relays, Voltage dividers, data acquisition in LABVIEW, hardware installation and configuration, Data acquisition (DAQ): Components, Accessories, Hardware, and Software.

UNIT IV COMMON INSTRUMENT INTERFACE **12 Hrs**

4-20mA, 60mA, RS232, RS422, RS485, General purpose interface bus(GIPB) , Virtual Instrument Software Architecture (VISA), Universal serial port bus(USB), Peripheral computer interface (PCI), VME extensions for instrumentation (VXI), PCI extensions for Instrumentation (PXI), Personal Computer Memory Card International Association (PCMCIA), Signal conditioning extension for instrumentation (SCXI).

UNIT V ANALYSIS TOOLS AND APPLICATIONS OF VI **12 Hrs**

Fourier transform, Power spectrum, Correlation, Windowing, filtering, Oscilloscope, Waveform generator, Multi-channel data acquisition using LABVIEW, ECG acquisition for long term monitoring of heart rate using VI

Total Number of Hours: 60 Hrs

Text Books:

1. Gary Jonson, “Labview Graphical Programming”, Second Edition, McGraw Hill, New York, Fourth edition 2006

2. Lisa K wells and Jeffrey Travis, “Labview for everyone”, Prentice Hall Inc, New Jersey, First edition 1997.

Reference Books:

1. Gupta S J, Gu.pta P, “PC interfacing for Data Acquisition and Process Control”, Instrument Society of America, Second Edition, 1994.

2. Technical Manuals for DAS Modules of Advantech and National Instruments

Subject Code:	**Subject Name : TOTAL QUALITY MANAGEMENT**	**T / L/ ETL**	**L**	**T**	**P/R**	**C**
BMG17003	Prerequisite: Basic Knowledge as quality techniques and implementation	T	3	0/0	0/0	3

L : Lecture T : Tutorial P : Project C: Credits

OBJECTIVE:

- To acquaint the students with the basic concept of Total Quality (TQ) from design assurance to service assurance.
- To give understand International Quality Certification Systems – ISO 9000 and other standards.
- To apply in design manufacturing, quality control and services, and to closely interlink management of quality, reliability and maintainability for total product assurance.
- To understand concepts related to quality of services in contemporary environment.

COURSE OUTCOMES (COs) :

CO1	To maintain quality in all aspects
CO2	To understand the basic tools for quality control
CO3	To bring out zero defect products

Mapping of Course Outcomes (COs) with Program Outcomes (POs) and Program Specific Outcomes (PSOs)

COs/POs	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**
CO1	H	M	H	M	M	L	L	H	H	H	M	H
CO2	M	M	M		M	L		H			H	M
CO3	H	H	M	M	H	M	M	H	H	M	M	H

H/M/L indicates Strength of Correlation H- High, M- Medium, L-Low

Category	Basic Sciences	Engineering Sciences	Humanities and Social Sciences	Program Core	Program Electives	Open Electives	Practical / Project	Internships / Technical Skills	Soft Skills	Management Science		
										✓		

Approval	

TOTAL QUALITY MANAGEMENT

UNIT I INTRODUCTION **9 Hrs**

Evolution of quality as a strategy- Definitions of quality, Quality Philosophies of Deming, Crossby and Miller, Service Vs product Quality, Customer focus, Quality and Business performance leadership for quality management, Quality planning, Designing for Quality and Manufacturing for Quality, Vision, Mission statements and Quality policy.

UNIT II Models of TQM **9 Hrs**

Total Quality management- TQM models, human and system Components, Continuous Improvement Strategies, Deming wheel, Internal External Customer concept, Customer satisfaction Index, Customer retention, Team work and team building, Empowerment, TQM culture, Quality Circle, 5S principle, Top Management commitment

UNIT III Tools and Techniques **9 Hrs**

Quality management tools- principles and applications of quality Function deployment, Failure Mode and Effect Analysis, Taguichi Techniques, Basic tools- Statistical techniques and graphical tools and diagrams-

UNIT IV Quality Control techniques **9 Hrs**

Modern QC techniques - Japanese Production Related Techniques: Just in time (JIT) – Quality circles – Total productive maintenance (TPM) – Kaizen – Kanban – 5 S concepts – Toyota production systems – JIDOKA – ANDON etc. concepts. Concepts on quality management systems (QMS – ISO 9000 – 2000) – Environmental Management Systems (EMS – ISO – 14000)

UNIT V Concept in Manufacturing Management **9 Hrs**

Modern Trend and Concept in Manufacturing Management: Business processes reengineering (BPR) – Lean / flexible – manufacturing systems – Six sigma concepts.

Total Number of Hours: 45 Hrs

Reference Books:

1. Jill A. Swift, Joel E.Ross and Vincent K.Omachonu, *Peinciples of Total Quality*, St.Lucie Press, US, 1998.
2. Samuel K.Ho, *TQM*, An integrated approach, kogan page India Pvt Ltd, 2002
3. Dale H.N Besterfield et al, *Total Quality management*, Pearson Education Asia, 2001
4. RoseJ.E. *Total Quality Management* Kogan page India Pvt Ltd, 1993.
5. Mullar Max, ' *Essentials of MAterail Management*, Amacom, 2006

Subject Code: BBI17L11	**Subject Name : BIO-MEDICAL INSTRUMENTATION LABORATORY -II**	**T / L/ ETL**	**L**	**T / S.Lr**	**P/ R**	**C**
	Prerequisite:	L	0	0/0	3/0	1

L : Lecture T : Tutorial SLr : Supervised Learning P : Project R : Research C: Credits
T/L/ETL : Theory/Lab/Embedded Theory and Lab

OBJECTIVE :

- To get familiar with the various types of biomedical instruments
- To analyze the waveform pattern obtained biomedical instruments

COURSE OUTCOMES (COs) : (3- 5)

CO1	Graduate gets familiarized with the various types of biomedical instruments
CO2	Graduate is capable to analyze the waveform pattern obtained biomedical instruments

Mapping of Course Outcomes with Program Outcomes (POs)

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	H	M	L	L	L	M	H	M	H	L	M	L
CO2	M	H	L	M	H	L	M	H	L	M	H	L

COs / PSOs	PSO1	PSO2	PSO3	PSO4	PSO5			
CO1	M	H	M	H	M			
CO2	H	L	H	L	H			

H/M/L indicates Strength of Correlation H- High, M- Medium, L-Low

Category	Basic Sciences	Engineering Sciences	Humanities and Social Sciences	Program Core	Program Electives	Open Electives	Practical / Project	Internships / Technical Skill	Soft Skills			
							✓					
Approval												

BIO-MEDICAL INSTRUMENTATION LABORATORY -II

LIST OF EXPERIMENTS

1. Analysis of abnormal ECG wave pattern using arrhythmia Simulator
2. Real time patient monitoring system
3. Pulse oximetry
4. Acquisition of Heart sounds using PCG
5. Biotelemetry system
6. BP measuring techniques
7. Glucose sensor
8. Differentiating Arteries and veins using Doppler ultrasonography
9. Heart Lung machine model – study
10. Pacemaker, Defibrillator Models – Study
11. Respiratory system testing using Spirometer
12. Short wave Diathermy- study
13. Ultrasound Diathermy- study
14. Surgical Diathermy - study
15. Hemodialysis model –study

Total Number of Hours: 45 Hrs

Subject Code: BBI17L12	**Subject Name : VIRTUAL INSTRUMENTATION LABORATORY FOR MEDICAL APPLICATION**	**T / L/ ETL**	**L**	**T / S.Lr**	**P/ R**	**C**
	Prerequisite:	L	0	0/0	3/0	1

L : Lecture T : Tutorial SLr : Supervised Learning P : Project R : Research C: Credits
T/L/ETL : Theory/Lab/Embedded Theory and Lab

OBJECTIVE :

- To educate about the Basic concepts of VI
- To make them understand the programming concepts of VI.
- To provide an insight to various Common Instrument Interface.
- To enable them to implement VI in medical systems
- To impart knowledge on various analysis tools

COURSE OUTCOMES (COs) : (3- 5)

CO1	Understands the Basic concepts of VI
CO2	Understands the programming concepts of VI.
CO3	Capable to analyze various Common Instrument Interface
CO4	Capable to implement VI in medical systems
CO5	Understands various analysis tools

Mapping of Course Outcomes with Program Outcomes (POs)

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	M	L	M	H	L	M	H	L	L	H	M	L
CO2	H	M	H	M	L	M	H	L	M	H	H	H
CO3	M	L	H	M	L	M	H	L	M	H	L	M
CO4	H	H	H	H	L	M	H	L	M	H	L	M
CO5	M	H	M	L	H	M	H	M	L	M	H	M

COs / PSOs	PSO1	PSO2	PSO3	PSO4	PSO5			
CO1	M	H	L	M	H			
CO2	M	H	L	M	H			
CO3	H	M	H	M	L			
CO4	H	M	L	H	M			
CO5	L	L	M	L	H			

H/M/L indicates Strength of Correlation H- High, M- Medium, L-Low

Category	Basic Sciences	Engineering Sciences	Humanities and Social Sciences	Program Core	Program Electives	Open Electives	Practical / Project	Internships / Technical Skill	Soft Skills			
							✓					
Approval												

VIRTUAL INSTRUMENTATION LABORATORY FOR MEDICAL APPLICATION

LIST OF EXPERIMENTS

1. Basic arithmetic operations
2. Boolean operations
3. Factorial of a give number using for loop
4. Factorial of a give number using while loop
5. Sorting even numbers using while loop in an array
6. Array maximum and minimum
7. Bundle and unbundle cluster
8. Flat and stacked sequence
9. Application using formula node
10. Discrete cosine transform
1. 11 Convolution of two signals
11. Windowing technique
12. Acquiring an ECG signal
13. To measure BP, heart rate
14. To measure temperature, ECG
15. Acquire, analyze and present EEG instrumentation

Total Number of Hours: 45 Hrs

Subject Code:	Subject Name : PROJECT PHASE - 1	T / L/ ETL	L	T / S.Lr	P/ R	C
	Prerequisite: NIL	L	0	0/0	0/2	2

L : Lecture T : Tutorial SLr : Supervised Learning P : Project R : Research C: Credits
T/L/ETL : Theory/Lab/Embedded Theory and Lab

OBJECTIVE: The objective of the Main Project is to culminate the academic study and provide an opportunity to explore a problem or issue, address through focused and applied research under the direction of a faculty mentor. The project demonstrates the student's ability to synthesize and apply the knowledge and skills acquired to real-world issues and problems. This project affirms the students to think critically and creatively, find an optimal solution, make ethical decisions and to present effectively.

COURSE OUTCOMES (COs) : (3- 5)

CO1	Apply the knowledge and skills acquired in the course of study addressing a specific problem or issue.
CO2	To encourage students to think critically and creatively about societal issues and develop user friendly and reachable solutions
CO3	To refine research skills and demonstrate their proficiency in communication skills.
CO4	To take on the challenges of teamwork, prepare a presentation and demonstrate the innate talents.

Mapping of Course Outcomes with Program Outcomes (POs)

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	H	H	H	H	M	H	H	L	M	M	H	H
CO2	H	H	H	H	H	H	H	M	M	M	H	H
CO3	H	H	H	H	H	H	H	M	M	H	H	M
CO4	H	M	H	H	H	H	M	H	H	H	H	H

COs / PSOs	PSO1	PSO2	PSO3	PSO4	PSO5			
CO1	H	H	H	H	H			
CO2	H	H	H	H	H			
CO3	H	H	H	H	H			
CO4	H	H	H	H	H			

H/M/L indicates Strength of Correlation H- High, M- Medium, L-Low

Category	Basic Sciences	Engineering Sciences	Humanities and Social Sciences	Program Core	Program Electives	Open Electives	Practical / Project	Internships / Technical Skill	Soft Skills			
							✓					
Approval												

Subject Code: BFL17001	Subject Name : FOREIGN LANGUAGE	T / L/ ETL	L	T / S.Lr	P/ R	C
	Prerequisite: NIL		1	1	0/0	1

L : Lecture T : Tutorial SLr : Supervised Learning P : Project R : Research C: Credits

T/L/ETL : Theory/Lab/Embedded Theory and Lab

OBJECTIVE : To recognize the cultural values, practices, and heritage of the foreign country, communicate effectively in a foreign language and interact in a culturally appropriate manner with native speakers of that language.

COURSE OUTCOMES (COs) : (3- 5)

CO1	Achieve functional proficiency in listening, speaking, reading, and writing.
CO2	Develop an insight into the nature of language itself, the process of language and culture acquisition.
CO3	Decode, analyze, and interpret authentic texts of different genres.

Mapping of Course Outcomes with Program Outcomes (POs)

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	L	L	L	L	L	H	L	H	M	H	H	L
CO2	M	L	L	L	L	H	L	H	H	H	H	L
CO3	L	L	M	M	L	H	M	H	M	H	H	L

COs / PSOs	PSO1	PSO2	PSO3	PSO4	PSO5			
CO1	L	L	L	L	L			
CO2	L	L	L	L	L			
CO3	L	L	L	L	L			

H/M/L indicates Strength of Correlation H- High, M- Medium, L-Low

Category	Basic Sciences	Engineering Sciences	Humanities and Social Sciences	Program Core	Program Electives	Open Electives	Practical / Project	Internships / Technical Skill	Soft Skills			
			✓									
Approval												

Subject Code:	**Subject Name : ENTREPRENUERSHIP DEVELOPMENT**		**L**	**T**	**P**	**C**
BMG17005	Prerequisite: Basic Knowledge as Management Concepts		3	0	0	3

L : Lecture T : Tutorial P : Project C: Credits

OBJECTIVE: The student will learn:

- The course aims to acquaint the students with challenges of starting new ventures and enable then to investigate, understand and internalize the process of setting up a business

COURSE OUTCOMES (COs) :

CO1	Understand the basics of entrepreneurial development
CO2	Explain the requisites of starting a small scale industry
CO3	Propose a plan for new venture
CO4	Comprehend role of government in entrepreneurship

Mapping of Course Outcomes (COs) with Program Outcomes (POs) and Program Specific Outcomes (PSOs)

COs/POs	PO1	PO2	PO3	PO4	PO 5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	M	M	H			M	L	H	L	H	H	H
CO2		H			L			M		M	H	M
CO3	H	H	H			M		M	M	H	M	M
CO4		M		M	L		H			M	L	M

H/M/L indicates Strength of Correlation H- High, M- Medium, L-Low

Category	Basic Sciences	Engineering Sciences	Humanities and Social Sciences	Program Core	Program Electives	Open Electives	Practical / Project	Internships / Technical Skill	Soft Skills	Management Science		
										✓		
Approval												

ENTREPRENUERSHIP DEVELOPMENT

UNIT I INTRODUCTION **9 Hrs**

Nature and Development of Entrepreneurship; Entrepreneurial Decision Process; Role of entrepreneurship in economic development; Entrepreneurial process; managerial vs. entrepreneurial approach and emergence of entrepreneurship - Entrepreneurial background; Skills and characteristics of successful entrepreneurs; Motivation; Role Models and Support Systems

UNIT II BUSINESS IDEA **9 Hrs**

Generating business idea – sources of new ideas, methods of generating ideas, creative problem solving, opportunity recognition; Environmental scanning, competitor and industry analysis; Feasibility study – market feasibility, technical/operational feasibility, financial feasibility; Drawing a business plan; Using and Implementing the Business plan.

UNIT III MARKETING PLAN **9 Hrs**

Marketing plan – Marketing research for the new venture; Steps in preparing marketing plan; Contingency planning; Organizational plan – Forms of Business; Designing the organization; Building management team and Successful Organizational Culture; Role of Board of Directors; Board of Advisors; Financial plan – Operating and capital Budgets; Pro forma income statements; Pro forma cash flow; Pro forma balance sheet; Break even analysis; Pro forma Sources and Applications of Funds.

UNIT IV ASSESSMENT OF RISK **9 Hrs**

Assessment of Risk; Sources of finance – Debt or Equity Financing, Internal or External Funds; Personal Funds, Family and Friends; Commercial Banks – types of loans, Cash flow financing, Bank lending decisions; Venture Capital – Nature, overview, process, locating and approaching Venture Capitalists.

UNIT V ENTREPRENEURIAL STRATEGY FOR GENERATING AND EXPLOITING NEW ENTRIES; STRATEGIES FOR GROWING THE VENTURE **9 Hrs**

Entrepreneurial strategy for generating and exploiting new entries; Strategies for growing the venture; Growth implications on Economy, Firm and Entrepreneur. Other routes for growth – Franchising, Joint Ventures, Acquisitions and Mergers: Going Public – Advantages and Disadvantages, Alternatives to Going Public.

Total Number of Hours: 45 Hrs

Reference Books:

1. Hisrich, Robert D., Michael Peters and Dean Shephered, Entrepreneurship, Tata McGraw Hill, New Delhi., 9th Edition, 2012, ISBN-13: 978-0078029196, ISBN-10: 0078029198
2. Vasant Desai, The Dynamics of Entrepreneurial Development and Management, Himalaya Publishing House., 11th Edition, 2005, ISBN: 8178660598
3. Prasana Chandra, Projects – planning, analysis selection, Implementation and reviews, Tata McGraw-Hill Publishing Company, 7th Edition, 2009, ISBN-10: 0070077932, ISBN-13, 9780070077935
4. Charantimath, Poornima, Entrepreneurship Development and Small Business Enterprises, Pearson Education, New Delhi, 5th Edition, 2009, ISBN: 978-81-7758-260-4
5. K.Ramachandran, Essentials of Business Communication, McGraw Hill Education (India) Private Limited, 9th Edition, 2013, ISBN-13: 978-1-111-82122-7, ISBN-10: 1-111-82122-4

Subject Code:	Subject Name : PROJECT PHASE - 2	T / L/ ETL	L	T / S.Lr	P/ R	C
	Prerequisite: NIL	L	0	0/0	10	10

L : Lecture T : Tutorial SLr : Supervised Learning P : Project R : Research C: Credits
T/L/ETL : Theory/Lab/Embedded Theory and Lab

OBJECTIVE: The objective of the Main Project is to culminate the academic study and provide an opportunity to explore a problem or issue, address through focused and applied research under the direction of a faculty mentor. The project demonstrates the student's ability to synthesize and apply the knowledge and skills acquired to real-world issues and problems. This project affirms the students to think critically and creatively, find an optimal solution, make ethical decisions and to present effectively.

COURSE OUTCOMES (COs) : (3- 5)

CO1	Apply the knowledge and skills acquired in the course of study addressing a specific problem or issue.
CO2	To encourage students to think critically and creatively about societal issues and develop user friendly and reachable solutions
CO3	To refine research skills and demonstrate their proficiency in communication skills.
CO4	To take on the challenges of teamwork, prepare a presentation and demonstrate the innate talents.

Mapping of Course Outcomes with Program Outcomes (POs)

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	H	H	H	H	H	H	H	H	H	H	H	H
CO2	H	H	H	H	H	H	H	H	H	H	H	H
CO3	H	H	H	H	H	H	H	H	H	H	H	H
CO4	H	H	H	H	H	H	H	H	H	H	H	H

COs / PSOs	PSO1	PSO2	PSO3	PSO4	PSO5			
CO1	H	H	H	H	H			
CO2	H	H	H	H	H			
CO3	H	H	H	H	H			
CO4	H	H	H	H	H			

H/M/L indicates Strength of Correlation H- High, M- Medium, L-Low

Category	Basic Sciences	Engineering Sciences	Humanities and Social Sciences	Program Core	Program Electives	Open Electives	Practical / Project	Internships / Technical Skill	Soft Skills			
							✓					

Approval	

Subject Code: BBI17E01	**Subject Name : TROUBLESHOOTING OF BIO-MEDICAL EQUIPMENTS**	**T / L/ ETL**	**L**	**T / S.Lr**	**P/ R**	**C**
	Prerequisite:	T	3	0/0	0/0	3

L : Lecture T : Tutorial SLr : Supervised Learning P : Project R : Research C: Credits
T/L/ETL : Theory/Lab/Embedded Theory and Lab

OBJECTIVE :

- To provide adequate technical information on operating principles of medical instruments
- To attain mastery in fault detection and corrective measures.

COURSE OUTCOMES (COs) : (3- 5)

CO1	Understands the information on operating principles of medical instruments
CO2	Capable in finding fault detection and corrective measures.

Mapping of Course Outcomes with Program Outcomes (POs)

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	H	M	L	M	H	L	M	H	M	L	M	H
CO2	M	H	M	L	M	H	M	L	M	M	H	M

COs / PSOs	PSO1	PSO2	PSO3	PSO4	PSO5			
CO1	M	L	H	M	H			
CO2	H	M	L	M	H			

H/M/L indicates Strength of Correlation H- High, M- Medium, L-Low

Category	Basic Sciences	Engineering Sciences	Humanities and Social Sciences	Program Core	Program Electives	Open Electives	Practical / Project	Internships / Technical Skill	Soft Skills			
					✓							
Approval												

TROUBLESHOOTING OF BIO-MEDICAL EQUIPMENTS

UNIT I BASIC OF TROUBLESHOOTING PROCEDURES 9 Hrs

Troubleshooting Process and Fault finding Aids, Troubleshooting Techniques, Grounding Systems in Electronic Equipment, Temperature Sensitive Intermittent Problems, and Correction Action to repair the Equipment.

UNIT II TESTING OF DEVICES 9 Hrs

testing procedure OF resistors, capacitors and inductors, causes of failure for electronic components, testing procedure of special diodes, bipolar transistors, field effect transistor (FET), and thyristor.

UNIT III FAULT DIAGNOSIS IN CIRCUITS 9 Hrs

Fault Diagnosis in Op-Amp Circuits, Digital Troubleshooting Methods, Digital IC Troubleshooters, Circuit board Troubleshooting.

UNIT IV BIOMEDICAL EQUIPMENT I TROUBLESHOOTING 9 Hrs

Trouble shooting of ECG Machine, EEG Machine, Defibrillator Electrosurgical unit, Anaesthesia machine, Autoclaves and sterilizers, Endoscope

UNIT V BIOMEDICAL EQUIPMENT II TROUBLESHOOTING 9 Hrs

Troubleshooting of Incubators, Nebulizer, Oxygen Concentrators, Oxygen cylinders and flow meters, Pulse Oximeter, Sphygmomanometers, Suction Machine, X-Ray Machine Troubleshooting.

Total Number of Hours: 45 Hrs

Text Books:

1. Khandpur R S, “Troubleshooting Electronic Equipment- Includes Repair and Maintenance”, Tata McGraw-Hill, Second Edition 2009.
2. Dan Tomal and Neal Widmer, “Electronic Troubleshooting”, McGraw Hill, 3rd Edition 2004.

Reference Books:

1. Nicholas Cram and Selby Holder, “Basic Electronic Troubleshooting for Biomedical Technicians”, TSTC Publishing, 2nd Edition 2010
2. World Health Organisation, “Maintenance and Repair of Laboratory, Diagnostic imaging and Hospital Equipment”, Geneva, 1994.
3. Ian R, McClelland, “X-ray Equipment maintenance and repairs workbook for Radiographers and Radiological Technologists”, World Health Organisation, Geneva, 2004.
4. Ministry of Health and Family Welfare, “Medical Equipment Maintenance Manual- A first line maintenance guide for end users”, New Delhi, October 2010.
5. Joseph.J, Panichello, “X-Ray Repair: A Comprehensive Guide to the Installation and Servicing of Radiographic Equipment”, Charles C Thomas Publisher Ltd, 2nd Edition 2005.

Subject Code: BBI17E02	Subject Name : REHABILITATION ENGINEERING	T / L/ ETL	L	T / S.Lr	P/ R	C
	Prerequisite:	T	3	0/0	0/0	3

L : Lecture T : Tutorial SLr : Supervised Learning P : Project R : Research C: Credits
T/L/ETL : Theory/Lab/Embedded Theory and Lab

OBJECTIVE :

- To study basics of Rehabilitation Engineering
- To learn the design of Wheel Chairs
- To gain knowledge of the recent developments in the field of rehabilitation engineering.
- To understand various assistive technology for vision and hearing
- To study various orthotic and prosthetic devices

COURSE OUTCOMES (COs) : (3- 5)

CO1	Understands the basics of Rehabilitation Engineering
CO2	Capable to design Wheel Chairs
CO3	Understands the recent developments in the field of rehabilitation engineering
CO4	Acquires various assistive technology for vision and hearing
CO5	Analysis various orthotic and prosthetic devices

Mapping of Course Outcomes with Program Outcomes (POs)

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	M	L	M	H	L	M	H	L	M	H	H	H
CO2	H	M	H	M	L	M	H	L	M	H	L	M
CO3	H	M	H	M	L	M	H	H	M	H	L	M
CO4	L	H	M	L	H	M	H	L	L	H	M	H
CO5	M	H	L	H	M	L	H	L	M	H	L	M

COs / PSOs	PSO1	PSO2	PSO3	PSO4	PSO5			
CO1	M	H	L	M	H			
CO2	M	L	H	M	H			
CO3	H	L	M	H	L			
CO4	L	M	M	L	M			
CO5	H	M	L	H	M			

H/M/L indicates Strength of Correlation H- High, M- Medium, L-Low

Category	Basic Sciences	Engineering Sciences	Humanities and Social Sciences	Program Core	Program Electives	Open Electives	Practical / Project	Internships / Technical Skill	Soft Skills			
					✓							
Approval												

REHABILITATION ENGINEERING

UNIT I REHABILITATION TECHNOLOGY **9 Hrs**

Selection, design or manufacturing of augmentive or assistive devices appropriate for individual with disability

UNIT II REHABILITATION SCIENCE **9 Hrs**

Knowledge about the basic and clinical research about the variation in the physiological functioning and anatomical structure

UNIT III REHABILITATION ADVOCACY **9 Hrs**

Legal aspect helps the handicapped people in choosing the devices, the provisions available to them in this regard.

UNIT IV REHABILITATION MEDICINE **9 Hrs**

Physiological aspects of functional recovery, neurological and physhological aspects, rehabilitation therapies training to restore vision auditory and speech

UNIT V REHABILITATION ENGINEERING **9 Hrs**

Introduction to Rehabilitation Engineering - PHAATE model - Clinical practice of rehabilitation Engineering - Low technology tools - Service delivery – Universal design - Design based on human ability - Standards for assistive technology - Test for best design

Total Number of Hours: 45 Hrs

Text Books:

1. Reswick.J.What is Rehabilitation Engineering?, Annual Review of rehabilitation – volume 2 springer – verlag, New York, 1982.

Reference Books:

1. Robinsion.C.J, Rehabilitation Engineering Handbook of electrical engineering, CRC Press, Bocaraton, 1993.

Subject Code: BBI17E03	**Subject Name : HUMAN ASSIST DEVICES**	**T / L/ ETL**	**L**	**T / S.Lr**	**P/ R**	**C**
	Prerequisite:	T	3	0/0	0/0	3

L : Lecture T : Tutorial SLr : Supervised Learning P : Project R : Research C: Credits
T/L/ETL : Theory/Lab/Embedded Theory and Lab

OBJECTIVE :

- To Study the Heart Lung Machines and Artificial Heart
- To gain knowledge of Cardiac Assist Devices
- To learn about Artificial Kidney
- To gain knowledge of Prosthetic And Orthodic Devices
- To Study the Respiratory Aids and Hearing Aids

COURSE OUTCOMES (COs) : (3- 5)

CO1	Understands the Heart Lung Machines and Artificial Heart
CO2	Capable to analyze Cardiac Assist Devices
CO3	Understands the concept of Artificial Kidney
CO4	Understands the concept of Prosthetic And Orthodic Devices
CO5	Acquires knowledge on Respiratory Aids and Hearing Aids

Mapping of Course Outcomes with Program Outcomes (POs)

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	M	H	L	M	H	M	L	H	M	L	M	H
CO2	M	H	L	M	H	L	M	H	L	M	H	L
CO3	M	H	L	M	H	L	M	H	L	M	H	H
CO4	H	L	M	H	M	H	L	M	H	H	L	M
CO5	L	M	H	L	L	M	H	M	L	H	M	H

COs / PSOs	PSO1	PSO2	PSO3	PSO4	PSO5			
CO1	H	M	L	M	H			
CO2	M	L	M	H	L			
CO3	L	L	H	M	H			
CO4	M	H	L	M	H			
CO5	M	H	L	M	H			

H/M/L indicates Strength of Correlation H- High, M- Medium, L-Low

Category	Basic Sciences	Engineering Sciences	Humanities and Social Sciences	Program Core	Program Electives	Open Electives	Practical / Project	Internships / Technical Skill	Soft Skills			
					✓							
Approval												

HUMAN ASSIST DEVICES

UNIT I HEART LUNG MACHINES AND ARTIFICIAL HEART 9 Hrs

Condition to be satisfied by the H/L System - Different types of Oxygenerators, Pumps, Pulsatile and Continuous Types, Monitoring Process, Shunting, The Indication for cardiac Transplant, Driving Mechanism, Blood Handling System, Functioning and different types of Artificial Heart, Mock test setup for assessing its Functions

UNIT II CARDIAC ASSIST DEVICES 9 Hrs

Synchronous Counter pulsation, Assisted through Respiration Right Ventricular Bypass Pump, Left Ventricular Bypass Pump, Open Chest and closed Chest type, Intra Aortica Veno Pumping, Prosthetic Vardio Valves, Principles and problem, Biomaterials for implantable purposes, its characteristics and testing

UNIT III ARTIFICIAL KIDNEY 9 Hrs

Indication and Principles of heamodynalisis, Membrane, Dialasate, Different Types of hearmodialisers, Monitoring systems, Wearable Artificial Kidney, Implanting Type

UNIT IV PROSTHETIC AND ORTHODIC DEVICES 9 Hrs

Hand and Arm Replacement – Different Types of Models Externally Powered Limb Prosthesis Feedback in Orthodic system, Functional Electrical Stimulation, Sensory Assist Devices, Materials for Prosthetic and orthodic devices

UNIT V RESPIRATORY AIDS AND HEARING AIDS 9 Hrs

Intermittent positive pressure, Breathing Apparatus Operating Sequence, Electronic IPPB unit with monitoring for all respiratory parameters- Audiograms, Types of Deafness Conductive and Nervous, Hearing Aids, Construction and Functional Characteristics.

Total Number of Hours: 45 Hrs

Text Books:

1. Leving S.N.(Ed.), Advances in Bio Medical Engineering and Medical physics. Volumes I, II and IV, Inter University Publications, New York, 1968.
2. Kolff W.J., Artificial Organs, John Wiley and Sons, New York 1979.

Reference Books:

1. Andreas, F.Von racum, Hand book of bio material evaluation, Mc-Millan publishers, 1980.
2. Albert M. Cook and Webster J.G., Therapeutic Medical Devices, Prentice Hall Inc., New Jersery, 1982.

Subject Code: BBI17E04	**Subject Name : LASER AND ULTRASONIC APPLICATION IN MEDICINE**	**T / L/ ETL**	**L**	**T / S.Lr**	**P/ R**	**C**
	Prerequisite:	T	3	0/0	0/0	3

L : Lecture T : Tutorial SLr : Supervised Learning P : Project R : Research C: Credits
T/L/ETL : Theory/Lab/Embedded Theory and Lab

OBJECTIVE :

- To Gain Knowledge Of Laser
- To Study About Ultrasonics
- To Learn About Ultrasonic Scanners
- To Study About High Energy Ultrasonics
- To Gain Knowledge Of Holographic Application In Medcine

COURSE OUTCOMES (COs) : (3- 5)

CO1	Acquires Knowledge Of Laser
CO2	Graduate acquires knowledge on Ultrasonics
CO3	Capable to analyze Ultrasonic Scanners
CO4	Understands High Energy Ultrasonics
CO5	Acquires knowledge on Holographic Application In Medcine

Mapping of Course Outcomes with Program Outcomes (POs)

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	M	H	M	L	M	H	M	L	H	M	L	M
CO2	H	M	L	M	H	L	M	L	H	M	L	M
CO3	L	M	H	L	M	H	L	M	H	L	M	H
CO4	H	M	L	M	H	L	M	H	L	M	H	H
CO5	M	L	H	H	M	L	H	M	L	M	H	M

COs / PSOs	PSO1	PSO2	PSO3	PSO4	PSO5			
CO1	M	H	L	M	H			
CO2	M	L	H	M	L			
CO3	H	M	L	M	H			
CO4	M	H	L	M	H			
CO5	L	M	H	M	L			

H/M/L indicates Strength of Correlation H- High, M- Medium, L-Low

Category	Basic Sciences	Engineering Sciences	Humanities and Social Sciences	Program Core	Program Electives	Open Electives	Practical / Project	Internships / Technical Skill	Soft Skills			
					✓							
Approval												

LASER AND ULTRASONIC APPLICATION IN MEDICINE

UNIT I LASER **9 Hrs**

Principles of Laser action, different types and of lasers and its operation, Applications of Laser in Biology, Dentistry, Ophthalmology, Dermatology, Medicine, Surgery, Interferometer Applications, Flurorescence studies in cancer Diagnosis, Laser in Genetic Engineering, Low power applications in Medicine.

UNIT II ULTRASONICS **9 Hrs**

Different Modes of Display, A, B, C, scanning Techniques, Absorption in biological Tissues, Measurement of Ultrasonic Energy, Construction of Ultrasonic probe, Ultrasonic Imaging in Abdomen, Breast, Heart, Chest, Eye, Kidney, Skull, Pulsatile Motion, Pregnant and non-Pregnant uterus.

UNIT III ULTRASONIC SCANNERS **9 Hrs**

Real Time Echo, 2-D Scanners, Colour Doppler

UNIT IV HIGH ENERGY ULTRASONICS **9 Hrs**

Effects due to High energy ultrasonics applications in Surgery, Cell destruction, Cleaners

UNIT V HOLOGRAPHIC APPLICATION IN MEDCINE **9 Hrs**

Wave front Recording and Reconstruction, Recording Media, Image forming application, Motion Induced Constrast, correlation filtering, Holograms using Ultrasonic signals and Hologram using Lasers.

Total Number of Hours: 45 Hrs

Text Books:

1. Leon Goldman, M.D., and R. Jamies Rockwell, Jr. Lasers in medicine Gordon and breach, science publishers Inc., New York, 1971

2. Brown Y.H.V. and Dickson J.F. (Eds), Advances in Bio – Medical Engineering Volume II and V, Academic press, London, 1972

3. Georg W. Stroke, Kock W.E., Ultrasonic Imaging and Holography, plenum press, New York, 1974

Reference Books:

1. Mertellucci S. Sand Chester A.N. Laser Photo biology and photo medicine, plenum press, New York, 1989.

2. Wolbarsht M.L., Laser Application in Medicine and Biology, Plenum press, New York, 1989

Subject Code: BBI17E05	**Subject Name : COMPUTER BASED MEDICAL INSTRUMENTATION**	**T / L/ ETL**	**L**	**T / S.Lr**	**P/ R**	**C**
	Prerequisite:	T	3	0/0	0/0	3

L : Lecture T : Tutorial SLr : Supervised Learning P : Project R : Research C: Credits
T/L/ETL : Theory/Lab/Embedded Theory and Lab

OBJECTIVE :

- To Gain Knowledge On Introduction Of Computer Based Medical Instrumentation
- To Study About The Microcontrollers
- To Learn About The System Design
- To Gain Knowledge On Computers In Patient Monitoring
- To Study About Medical Equipments System

COURSE OUTCOMES (COs) : (3- 5)

CO1	Acquires Knowledge On Introduction Of Computer Based Medical Instrumentation
CO2	Capable to analyze the concept of Microcontrollers
CO3	Capable to analyze System Design
CO4	Capable to acquire Knowledge On Computers In Patient Monitoring
CO5	Acquires Knowledge on Medical Equipments System

Mapping of Course Outcomes with Program Outcomes (POs)

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	M	H	M	L	M	H	L	M	H	L	M	H
CO2	H	M	L	M	H	L	M	H	L	M	H	M
CO3	H	M	L	M	H	L	M	H	L	M	H	L
CO4	L	M	L	M	L	H	M	L	M	H	L	M
CO5	L	M	H	L	M	M	L	M	L	H	L	M

COs / PSOs	PSO1	PSO2	PSO3	PSO4	PSO5			
CO1	M	H	L	M	H			
CO2	H	M	L	M	H			
CO3	L	M	H	L	M			
CO4	M	H	L	M	H			
CO5	M	L	H	L	M			

H/M/L indicates Strength of Correlation H- High, M- Medium, L-Low

Category	Basic Sciences	Engineering Sciences	Humanities and Social Sciences	Program Core	Program Electives	Open Electives	Practical / Project	Internships / Technical Skill	Soft Skills			
					✓							
Approval												

COMPUTER BASED MEDICAL INSTRUMENTATION

UNIT I INTRODUCTION **9 Hrs**

8086 Architecture – system connections and timing – Instruction set and assembly language programming. Macro assemblers – BIOS and DOS Services – memory and I/O interfacing – Advanced Intel 32 bit processors.

UNIT II MICROCONTROLLERS **9 Hrs**

Introduction – 8051 architecture and programming, micro controller based medical systems – TMS 320 series – architecture and programming – applications in bio-signal processing – IDE51 – C Cross Assemblers.

UNIT III SYSTEM DESIGN **9 Hrs**

Multichannel computerized ECG, EMG and EEG data acquisition –storage, analysis and retrieval techniques – Medical image acquisitions through video –card – storage and retrieval techniques – Moderns and computer networking in the hospital.

UNIT IV COMPUTERS IN PATIENT MONITORING **9 Hrs**

Physiological monitoring – automated intensive care units – computerized arrhythmia monitoring – information flow in a clinical lab – computerized concepts – interfacing to HIS.

UNIT V MEDICAL EQUIPMENTS SYSTEM **9 Hrs**

Microprocessor based medical system – pulmonary instrumentation – anesthesia machine –EEG system – microprocessor based blood pressure monitor – prosthetic systems – bio- chemical measuring systems and micro processor based medical devices – Radiological Information system.

Total Number of Hours: 45 Hrs

Text Books:

1. Kenneth J. Ayala, the 8051 Micro Controller – Architecture Programming And Applications, Second Edition, Penram International, 1996.

Reference Books:

1. Douglas V. Hall, Microprocessors and Interfacing: Programming and hardware, Mcgrase Hill, Singapore, 1999.

Subject Code: BBI17E06	**Subject Name : BIOMEDICAL MEMS AND NANOTECHNOLOGY**	**T / L/ ETL**	**L**	**T / S.Lr**	**P/ R**	**C**
	Prerequisite:	T	3	0/0	0/0	3

L : Lecture T : Tutorial SLr : Supervised Learning P : Project R : Research C: Credits
T/L/ETL : Theory/Lab/Embedded Theory and Lab

OBJECTIVE :

- To understand the working principle of MEMS and Microsystems
- To understand the working of MOEMS Technology
- To understand the concepts of BioMEMS and its application in healthcare
- To give an insight to the DNA based BioMEMS
- To study about the biomedical Nanotechnology and its application in research domain

COURSE OUTCOMES (COs) : (3- 5)

CO1	understands the working principle of MEMS and Microsystems
CO2	understands the working of MOEMS Technology
CO3	understands the concepts of BioMEMS and its application in healthcare
CO4	Acquires knowledge on the DNA based BioMEMS
CO5	Acquires knowledge on the biomedical Nanotechnology and its application in research domain

Mapping of Course Outcomes with Program Outcomes (POs)

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	M	H	L	L	M	H	L	M	H	L	M	H
CO2	H	H	H	L	L	M	H	M	H	L	M	H
CO3	M	H	L	M	H	L	M	H	L	M	H	L
CO4	H	M	L	M	H	L	M	H	L	M	H	L
CO5	L	M	H	L	M	H	L	M	H	L	M	H

COs / PSOs	PSO1	PSO2	PSO3	PSO4	PSO5			
CO1	M	L	H	L	M			
CO2	M	H	L	M	H			
CO3	H	H	H	M	L			
CO4	M	H	L	M	H			
CO5	L	M	M	L	M			

H/M/L indicates Strength of Correlation H- High, M- Medium, L-Low

Category	Basic Sciences	Engineering Sciences	Humanities and Social Sciences	Program Core	Program Electives	Open Electives	Practical / Project	Internships / Technical Skill	Soft Skills			
					✓							
Approval												

BIOMEDICAL MEMS AND NANOTECHNOLOGY

UNIT I MEMS **9 Hrs**

Introduction - Typical MEMS Products - Application of Micro-system in Healthcare Industry – Working Principles of Microsystems Micro-sensors – Micro-actuation - MEMS with actuation– Micro-accelerators and Micro-fluidics - Materials for MEMS and Microsystems

UNIT II MEMS and Microfluidics **9 Hrs**

Fundamental principle - Light Modulators, Beam splitter – Micro-lens, Micro-mirrors - Digital Micro-mirror Device, Light detectors - Important Consideration on Micro-scale fluid, Properties of fluid - Fluid Actuation Methods – Micro-pumps - Typical Micro-fluidic Channel, Micro-fluid Dispenser.

UNIT III BIOMEMS **9 Hrs**

Introduction -Principle of Biosensor, Ampero-metric Biosensor - Micro-dialysis - BioMEMS for Clinical Monitoring - Monitoring of Glucose and Lactate with a micro-dialysis probe – Ammonia Monitoring - Electronic Nose, DNA Sensors,

UNIT IV BIOMEMS AND DNA **9 Hrs**

Unique features of Nucleic Acids, Lab on the Chip, Electrophoresis, Polymerase Chain Reaction (PCR), Biochemical reaction chains for integration: Biosensors and the "lab biochip", Typical Microarray experiment, Manufacturing of Microarrays, Synthesis on the chip, Spotting Techniques, PCR on the chip, Microchamber Chips, Micro-fluidics Chips, Emerging BioMEMS Technology.

UNIT V BIOMEDICAL NANOTECHNOLOGY **9 Hrs**

Nanoparticles- Nanomaterial characterization – XRD, SAXS, TEM, SEM, Scanning Tunneling microscopy, AFM, SPM technique, Biomolecular sensing for cancer diagnostics using carbon nanotubes, Carbon nanotube biosensors, Magnetic nanoparticles for MR Imaging, Nano-devices in biomedical applications.

Total Number of Hours: 45 Hrs

Text Books:

1. Steven S, Saliterman, "Fundamentals of BioMEMS and Medical Microdevices", International Society for Optical Engineering, First Edition 2006.
2. Nitaigour Premchand Mahalik, "MEMS", Tata McGraw Hill, 2nd Reprint 2008
3. Wanjun Wang and Steven A.Soper , "BioMEMS- Technologies and applications", CRC Press, First edition 2007.

Reference Books:

1. Tai-Ran Hsu, "MEMS and Microsystems- Design, Manufacture and Nanoscale Engineering", John Wiley and Sons, 2nd Edition 2008.
2. Gerald A Urban, "BioMEMS", Springer, First Edition 2006.
3. Abraham P. Lee and James L. Lee, "BioMEMS and Biomedical Nanotechnology", Volume I, Springer, First Edition 2006.
4. Paul C.H. Li, "Introduction to Microfluids and BioMEMS: A Design and Problem-Solving Textbook", CRC Press, First Edition 2009.
5. Hari Singh Nalwa, "Nanostructured Materials and Nanotechnology", Academic Press, First Edition 2002.

Subject Code: BBI17E07	**Subject Name : RADIOLOGICAL EQUIPMENTS**	**T / L/ ETL**	**L**	**T / S.Lr**	**P/ R**	**C**
	Prerequisite:	T	3	0/0	0/0	3

L : Lecture T : Tutorial SLr : Supervised Learning P : Project R : Research C: Credits
T/L/ETL : Theory/Lab/Embedded Theory and Lab

OBJECTIVE :

- To Gain Knowledge Of X-Rays
- To Study About Radio Diagnosis
- To Learn About Special Radiological Equipments
- To Learn About Various Application Of Radioisotopes
- To Study About Radiation Safety

COURSE OUTCOMES (COs) : (3- 5)

CO1	Acquires Knowledge Of X-Rays
CO2	Capable to analyze Radio Diagnosis
CO3	Understands Special Radiological Equipments
CO4	Acquires knowledge of Various Application Of Radioisotopes
CO5	Analysis Radiation Safety

Mapping of Course Outcomes with Program Outcomes (POs)

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	M	H	L	M	L	L	M	H	L	M	H	H
CO2	H	H	M	L	H	M	L	M	H	H	H	L
CO3	M	H	L	M	H	L	M	L	L	M	H	M
CO4	H	M	L	M	H	L	M	H	L	M	H	L
CO5	L	M	H	M	H	L	M	H	M	L	M	H

COs / PSOs	PSO1	PSO2	PSO3	PSO4	PSO5			
CO1	M	H	L	M	H			
CO2	M	H	L	M	H			
CO3	H	L	M	H	L			
CO4	L	M	H	L	M			
CO5	M	H	M	L	H			

H/M/L indicates Strength of Correlation H- High, M- Medium, L-Low

Category	Basic Sciences	Engineering Sciences	Humanities and Social Sciences	Program Core	Program Electives	Open Electives	Practical / Project	Internships / Technical Skill	Soft Skills			
					✓							
Approval												

RADIOLOGICAL EQUIPMENTS

UNIT I X-RAYS **9 Hrs**

Principles and production of soft and hard X-rays, selection of anodes, Heel Pattern. Scattered radiation, Porter Bucky system, Cooling system.

UNIT II RADIO DIAGNOSIS **9 Hrs**

Radiography, Angiography, Fluoroscopy, Image Intensifier, Multi section radiography.

UNIT III SPECIAL RADIOLOGICAL EQUIPMENTS **9 Hrs**

Principle, Plane of Movement, Multi section Radiography, CAT. Principle of NMR, MRI

UNIT IV APPLICATION OF RADIOISOTOPES **9 Hrs**

Alpha, Beta and Gamma emission, Principle of radiation detectors, dot scanners, nuclear angiogram, Principles of Radiation therapy.

UNIT V RADIATION SAFETY **9 Hrs**

Hazardous effect of Radiation, Radiation protection Techniques, Safety Limits, Radiation Monitoring.

Total Number of Hours: 45 Hrs

Text Books:

1. R.S.Khandpur, "Handbook of Biomedical Instrumentation", Tata McGraw-Hill Publishing Company Ltd., New Delhi, 1997.
2. Steve Webb, "The Physics of Medical Imaging ", Adam Hilger Philadelphia 1988.

Reference Books:

1. William R.Hendee, E.Russel Ritenour, " Medical Imaging Physics", Third Edition, Mosby Year Book, St. Louis, 1992.

Department of BIOMEDICAL INSTRUMENTATION ENGINEERING

Subject Code: BBI17E08	**Subject Name : BIOLOGICAL EFFECTS OF RADIATION**	**T / L/ ETL**	**L**	**T / S.Lr**	**P/ R**	**C**
	Prerequisite:	T	3	0/0	0/0	3

L : Lecture T : Tutorial SLr : Supervised Learning P : Project R : Research C: Credits
T/L/ETL : Theory/Lab/Embedded Theory and Lab

OBJECTIVE :

- To Study About Action Of Radiation On Living Cells
- To Learn About Somatic Application Of Radiation
- To Gain Knowledge On Genetic Effects Of Radiation
- To Study About Effect Of Microwave And RF With Matters
- To Gain Knowledge On UV Radiation

COURSE OUTCOMES (COs) : (3- 5)

CO1	Understands Action Of Radiation On Living Cells
CO2	Capable to analyze Somatic Application Of Radiation
CO3	Acquires Knowledge On Genetic Effects Of Radiation
CO4	Understands Effect Of Microwave And RF With Matters
CO5	Acquires Knowledge On UV Radiation

Mapping of Course Outcomes with Program Outcomes (POs)

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	M	H	M	L	H	M	L	M	H	L	M	H
CO2	M	H	L	M	H	L	M	H	L	M	H	L
CO3	H	M	L	H	M	H	M	H	L	M	H	L
CO4	L	M	H	L	M	H	L	M	H	L	M	H
CO5	H	M	L	M	H	L	M	H	L	M	H	L

COs / PSOs	PSO1	PSO2	PSO3	PSO4	PSO5			
CO1	M	H	L	M	H			
CO2	H	M	H	L	H			
CO3	L	M	H	L	M			
CO4	H	L	M	H	M			
CO5	M	L	H	L	M			

H/M/L indicates Strength of Correlation H- High, M- Medium, L-Low

Category	Basic Sciences	Engineering Sciences	Humanities and Social Sciences	Program Core	Program Electives	Open Electives	Practical / Project	Internships / Technical Skill	Soft Skills			
					✓							
Approval												

BIOLOGICAL EFFECTS OF RADIATION

UNIT I ACTION OF RADIATION ON LIVING CELLS **9 Hrs**

Various theories related to radiation at cellular level, DNA and chromosomal damages, experiments on computation of various parameters related to this radiation exposure

UNIT II SOMATIC APPLICATION OF RADIATION **9 Hrs**

Radiosensitivity protocols of different issues of human, LA\D 50/30 effective radiation on skin, bone marrow, eye, endocrine glands, basis of radiotherapy.

UNIT III GENETIC EFFECTS OF RADIATION **9 Hrs**

Thresholds and linear dose, gene control hereditary diseases, effect of dose and I Infleneceson genetic equilibrium.

UNIT IV EFFECT OF MICROWAVE AND RF WITH MATTERS **9 Hrs**

Effects on various human organs and systems, wavelength in tissues, nonthermal interaction, low frequency radiation, measurement devices used to compute the thermal effects, standards of protection, national and international standards and precautions.

UNIT V UV RADIATION **9 Hrs**

Classification of sources, measurement, photo medicine, UV radiation safety Visibleand infrared radiation, combined effect of UV and IR, dose measuring instruments sed safety standards for this radiation

Total Number of Hours: 45 Hrs

Text Books:

1. Glasser.O. Medical Physics, vol I, II, III, The year book Publishers Iinc., Chicago, 1980.
2. Baranski.S and Cherski.P, Biological effects of microwave, Hutchison and Ross Inc., Stroudsburg, 1980.

Reference Books:

1. Moselly.H non-ionizing Radiation, Adam-Hilgar, Bristol, 1988

Department of BIOMEDICAL INSTRUMENTATION ENGINEERING

Subject Code: BBI17E09	**Subject Name : COMPUTERS IN MEDICINE**	**T / L/ ETL**	**L**	**T / S.Lr**	**P/ R**	**C**
	Prerequisite:	T	3	0/0	0/0	3

L : Lecture T : Tutorial SLr : Supervised Learning P : Project R : Research C: Credits
T/L/ETL : Theory/Lab/Embedded Theory and Lab

OBJECTIVE :

- To learn about Overview Of Computer Hardware
- To gain knowledge on System Design
- To study about Computers In Patient Monitoring
- To learn Computers In Medical Systems Modeling
- To gain knowledge on Computers In Medical Research

COURSE OUTCOMES (COs) : (3- 5)

CO1	Understands the Overview Of Computer Hardware
CO2	Gains knowledge on System Design
CO3	Acquires knowledge on Computers In Patient Monitoring
CO4	Understands Computers In Medical Systems Modeling
CO5	Acquires knowledge on Computers In Medical Research

Mapping of Course Outcomes with Program Outcomes (POs)

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	M	H	L	M	H	L	M	H	M	L	M	H
CO2	H	M	L	M	H	L	M	L	H	M	L	M
CO3	L	M	H	L	M	H	L	M	H	L	M	H
CO4	H	M	L	M	H	L	M	H	L	M	H	L
CO5	M	H	L	M	H	L	M	H	L	M	H	L

COs / PSOs	PSO1	PSO2	PSO3	PSO4	PSO5			
CO1	M	L	H	M	L			
CO2	H	M	H	L	M			
CO3	M	L	H	L	M			
CO4	H	L	M	H	L			
CO5	L	M	H	L	M			

H/M/L indicates Strength of Correlation H- High, M- Medium, L-Low

Category	Basic Sciences	Engineering Sciences	Humanities and Social Sciences	Program Core	Program Electives	Open Electives	Practical / Project	Internships / Technical Skill	Soft Skills			
					✓							
Approval												

COMPUTERS IN MEDICINE

UNIT I OVERVIEW OF COMPUTER HARDWARE PC-AT 9 Hrs

8086 architecture, system connections, Instruction set and programming, Microcontrollers, Motherboard and its logic, RS232-C and IEEE bus standards, CRT controllers, FDC, HDC and Post sequence, PC based video card, modems and networking.

UNIT II SYSTEM DESIGN 9 Hrs

Multichannel computerised ECG, EMG and EEG data acquisition, storage and retrieval, transmission of signal and images.

UNIT III COMPUTERS IN PATIENT MONITORING 9 Hrs

Physiological monitoring, automated ICU, computerised arrhythmia monitoring, information flow in a clinical lab, computerised concepts, interfacing to HIS

UNIT IV COMPUTERS IN MEDICAL SYSTEMS MODELING 9 Hrs

Radiotherapy, drug design, drug delivery system, physiological system modeling and simulation

UNIT V COMPUTERS IN MEDICAL RESEARCH 9 Hrs

Role of expert systems, pattern recognition techniques in medical image classification, ANN concepts

Total Number of Hours: 45 Hrs

Text Books:

1. R.D.Lele, "Computers in Medicine", Tata McGraw-Hill, New Delhi, 1999.

Reference Books:

1. Douglas V.Hall, "Microprocessors and Interfacing : Programming and hardware", McGraw Hill, Singapore, 1999.

Subject Code: BBI17E10	**Subject Name : MEDICAL INFORMATICS**	**T / L/ ETL**	**L**	**T / S.Lr**	**P/ R**	**C**
	Prerequisite:	T	3	0/0	0/0	3

L : Lecture T : Tutorial SLr : Supervised Learning P : Project R : Research C: Credits
T/L/ETL : Theory/Lab/Embedded Theory and Lab

OBJECTIVE :

- To Gain Knowledge On Biomedical Information Technology
- To Learn About Overview Of Computer Hardware
- To Study About Hospitals Information Systems
- To Gain Knowledge On Visual Programming And Multimedia Information Systems
- To Learn About Integrated Medical Information Systems

COURSE OUTCOMES (COs) : (3- 5)

CO1	Acquires Knowledge On Biomedical Information Technology
CO2	Acquires Knowledge On Overview Of Computer Hardware
CO3	Acquires Knowledge On Hospitals Information Systems
CO4	Acquires Knowledge On Visual Programming And Multimedia Information Systems
CO5	Acquires Knowledge On Integrated Medical Information Systems

Mapping of Course Outcomes with Program Outcomes (POs)

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	H	M	L	L	L	H	M	L	M	H	L	M
CO2	M	H	L	M	H	L	M	H	L	M	H	L
CO3	L	M	H	L	M	H	L	M	H	L	M	H
CO4	M	H	L	M	H	L	M	H	L	M	H	L
CO5	L	M	L	H	L	M	H	L	M	H	L	M

COs / PSOs	PSO1	PSO2	PSO3	PSO4	PSO5			
CO1	M	H	L	M	H			
CO2	H	M	L	M	H			
CO3	L	M	H	L	M			
CO4	M	L	M	H	L			
CO5	H	M	L	M	H			

H/M/L indicates Strength of Correlation H- High, M- Medium, L-Low

Category	Basic Sciences	Engineering Sciences	Humanities and Social Sciences	Program Core	Program Electives	Open Electives	Practical / Project	Internships / Technical Skill	Soft Skills			
					✓							
Approval												

MEDICAL INFORMATICS

UNIT I BIOMEDICAL INFORMATION TECHNOLOGY 9 Hrs

Historical highlights of Healthcare Information systems – Biomedical Information systems – problems and pitfalls – History and evolution of Electric resources – Internet and Interactive Multimedia components.

UNIT II OVERVIEW OF COMPUTER HARDWARE 9 Hrs

Motherboard and its logic – memory and I/O interfacing, memory and I/O map I/O peripherals and add-on cards, RS 232-C and various IEEE standards.

UNIT III HOSPITALS INFORMATION SYSTEMS 9 Hrs

Concept of HIS and its Position on the hospital – introduction of a computerized HIS-application of HIS in project management – Automation of Medical record – hospital Inventory data protection aspects – costs and benefits of HIS – transfer of information within the hospital – Modems and computer networking in Hospitals.

UNIT IV VISUAL PROGRAMMING AND MULTIMEDIA INFORMATION SYSTEMS 9 Hrs

Visuals Basic principles and programming – Design, Production and testing of multimedia based medical information systems.

UNIT V INTEGRATED MEDICAL INFORMATION SYSTEMS 9 Hrs

Integration of Intra and Inter hospital information systems – Role of expert systems and fuzzy logic in medical information systems – Physiological system modeling and simulation – Concepts of Virtual reality, web based multimedia information systems – video conferencing.

Total Number of Hours: 45 Hrs

Text Books:

1. S.K. Chauhan, . "PC Organisation", S.K. Kataria and sons, Delhi.
2. Haroid sackman, "Biomedical Inforamtion Technology, Academic Press, New York, 1997.

Reference Books:

1. Mary Beth Fecko, "Electronic Resources: Access and Issues, Bowker-saur, London, 1997.
2. R.D. Lele, "Computers in medicine", Tata McGraw Hill, New Delhi, 1999.
3. Tay Vaughan, "Multimedia making it work", Tata McGRaw Hill, New Yotk, 1999.
4. Mark Spenik, "Visual Basic 6, Iterative Course", Techmedia, New Delhi, 1999.

Subject Code: BBI17E11	Subject Name : FIBRE OPTICS AND LASER INSTRUMENTS	T / L/ ETL	L	T / S.Lr	P/ R	C
	Prerequisite:	T	3	0/0	0/0	3

L : Lecture T : Tutorial SLr : Supervised Learning P : Project R : Research C: Credits
T/L/ETL : Theory/Lab/Embedded Theory and Lab

OBJECTIVE :

- Introduction to basic concepts of optical fibers and their industrial applications.
- Providing adequate knowledge about Industrial application of optical fibers.
- Understanding basic concepts of lasers.
- Exposure to the basic knowledge about Industrial application of lasers and the Industrial application of Holography and Medical applications of lasers

COURSE OUTCOMES (COs) : (3- 5)

CO1	Understands basic concepts of optical fibers and their industrial applications
CO2	Gains adequate knowledge about Industrial application of optical fibers
CO3	Understands basic concepts of lasers.
CO4	Understands basic knowledge about Industrial application of lasers and the Industrial application of Holography and Medical applications of lasers

Mapping of Course Outcomes with Program Outcomes (POs)

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	M	H	L	M	L	M	H	L	M	H	L	M
CO2	H	M	L	M	H	L	M	H	L	M	H	L
CO3	L	M	H	L	M	H	L	M	H	L	M	H
CO4	H	M	L	M	H	L	M	H	L	M	H	L

COs / PSOs	PSO1	PSO2	PSO3	PSO4	PSO5			
CO1	M	H	L	M	H			
CO2	M	L	H	M	L			
CO3	M	H	L	M	H			
CO4	M	H	L	M	H			

H/M/L indicates Strength of Correlation H- High, M- Medium, L-Low

Category	Basic Sciences	Engineering Sciences	Humanities and Social Sciences	Program Core	Program Electives	Open Electives	Practical / Project	Internships / Technical Skill	Soft Skills			
					✓							
Approval												

FIBRE OPTICS AND LASER INSTRUMENTS

UNIT I OPTICAL FIBERS AND THEIR PROPERTIES 9 Hrs

Principles of light propagation through a fiber – different types of fibers and their properties transmission characteristics of optical fiber – absorption losses – scattering losses – dispersion – optical fiber measurement – optical sources – optical detectors – LED – LD – PIN and APD

UNIT II INDUSTRIAL APPLICATION OF OPTICAL FIBERS 9 Hrs

Fiber optic sensors – fiber optic instrumentation system – different types of modulators – detectors – application in instrumentation – interferometric method of measurement of length – moiré fringes – measurement of pressure, temperature, current, voltage liquid level and strain – fiber optic gyroscope – polarization maintaining fibers.

UNIT III LASER FUNDAMENTALS 9 Hrs

Fundamental characteristics of lasers – three level and four level lasers – properties of laser – laser modes – resonator configuration – Q-switching and mode locking – cavity dumping – types of lasers: gas lasers, solid lasers, liquid lasers and semi conductor lasers

UNIT IV INDUSTRIAL APPLICATION OF LASERS 9 Hrs

Laser for measurement of distance, length velocity, acceleration, current, voltage and atmospheric effect – material processing – laser heating, welding melting and trimming of materials – removal and vaporization

UNIT V HOLOGRAM AND MEDICAL APPLICATION 9 Hrs

Holography – basic principle; methods; holographic interferometry and applications, holography for non – destructive testing – holographic components – medical applications of lasers; laser and tissue interaction – laser instruments for surgery, removal of tumors of vocal cords, brain surgery, plastic surgery, gynecology and oncology

Total Number of Hours: 45 Hrs

Text Books:

1. John and Harry, Industrial lasers and their applications, McGraw-Hill, 1974
2. Senior J.M., Optical Fiber Communication Principles and Practice, Prentice Hall, 1985

Reference Books:

1. John F Read, Industrial applications of lasers, Academic Press, 1978
2. MonteRoss, Laser applications, McGraw-Hill, 1968
3. Keiser G., Optical Fiber Communication, McGraw-Hill, 1991
4. Jasprit Singh, Semi conductor optoelectronics, McGraw-Hill, 1995

Subject Code: BBI17E12	**Subject Name : DIAGNOSTIC and THERAPEUTIC EQUIPMENTS I**	**T / L/ ETL**	**L**	**T / S.Lr**	**P/ R**	**C**
	Prerequisite:	T	3	0/0	0/0	3

L : Lecture T : Tutorial SLr : Supervised Learning P : Project R : Research C: Credits
T/L/ETL : Theory/Lab/Embedded Theory and Lab

OBJECTIVE :

- To learn about cardiac system
- To study about neurological system
- To gain knowledge on skeletal muscular system
- To learn about heart-lung machine
- To study about respiratory measurement and ventilator

COURSE OUTCOMES (COs) : (3- 5)

CO1	Acquires knowledge about cardiac system
CO2	Graduates gains knowledge on neurological system
CO3	Understands skeletal muscular system
CO4	Acquires knowledge about heart-lung machine
CO5	Graduate gains knowledge on respiratory measurement and ventilator

Mapping of Course Outcomes with Program Outcomes (POs)

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	M	H	L	M	L	H	L	M	H	L	M	H
CO2	M	L	H	M	L	M	H	L	M	H	L	M
CO3	M	H	L	M	H	L	M	H	L	M	H	L
CO4	L	M	H	L	M	H	L	M	H	L	M	H
CO5	H	M	L	M	H	L	M	H	L	M	H	L

COs / PSOs	PSO1	PSO2	PSO3	PSO4	PSO5			
CO1	M	H	L	M	H			
CO2	H	M	H	L	M			
CO3	L	M	L	H	M			
CO4	M	H	L	M	M			
CO5	M	H	L	M	H			

H/M/L indicates Strength of Correlation H- High, M- Medium, L-Low

Category	Basic Sciences	Engineering Sciences	Humanities and Social Sciences	Program Core	Program Electives	Open Electives	Practical / Project	Internships / Technical Skill	Soft Skills			
					✓							
Approval												

DIAGNOSTIC AND THERAPEUTIC EQUIPMENTS I

UNIT I CARDIAC SYSTEM **9 Hrs**

ECG, sources of ECG, normal and abnormal waveform, diagnosis interpretation, cardiac pacemaker-external pacemaker, implantable pacemaker, different types of pacemakers, fibrillation, defibrillator, AC defibrillator, DC defibrillator, electrodes, synchronised and unsynchronised types

UNIT II NEUROLOGICAL SYSTEM **9 Hrs**

EEG, genesis, lead system, wave characteristics, frequency bands, spontaneous and evoked response, diagnostic interpretation, epileptic discharges

UNIT III SKELETAL MUSCULAR SYSTEM **9 Hrs**

Structure of muscles, sliding theory of contraction, stimulation of muscles, muscle potential generation, recording and analysis of EMG waveforms, muscle and nerve stimulation, fatigue characteristics

UNIT IV HEART-LUNG MACHINE **9 Hrs**

Need for the unit, functioning of bubble, disc type and membrane type oxygenerators, fingerpump, roller pump, electronic monitoring of functional parameter

UNIT V RESPIRATORY MEASUREMENT AND VENTILATOR **9 Hrs**

Spirometer, Respiratory volume measurement, pnemograph, artificial respirator – IPR type, functioning

Total Number of Hours: 45 Hrs

Text Books:

1. John G. Webster, “Medical Instrumentation Application and Design”, John Wiley and sons, New York, 1998.

Reference Books:

1. Khandpur R.S, “Handbook of Biomedical Instrumentation”, Tata McGraw-Hill, New Delhi, 1997.

2. Joseph J.carr and John M. Brown, “Introduction to Biomedical equipment technology”, John wiley and sons, New York, 1997.

Subject Code: BBI17E13	**Subject Name : RECENT ADVANCES APPLIED TO HOSPITAL ENGINEERING**	**T / L/ ETL**	**L**	**T / S.Lr**	**P/ R**	**C**
	Prerequisite:	T	3	0/0	0/0	3

L : Lecture T : Tutorial SLr : Supervised Learning P : Project R : Research C: Credits
T/L/ETL : Theory/Lab/Embedded Theory and Lab

OBJECTIVE :

- To learn about Standardisation Of Hospital Equipments
- To gain knowledge on Clinical Engineering
- To study about Networking
- To gain knowledge on Fibre Optic Sensors For Measuring Physiological Parameters
- To learn about Emi And Emc Applied To Hospital Equipments

COURSE OUTCOMES (COs) : (3- 5)

CO1	Acquires knowledge on Standardisation Of Hospital Equipments
CO2	Gains knowledge on Clinical Engineering
CO3	Graduate understands Networking
CO4	Gains knowledge on Fibre Optic Sensors For Measuring Physiological Parameters
CO5	Acquires knowledge EMI And EMC Applied To Hospital Equipments

Mapping of Course Outcomes with Program Outcomes (POs)

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	H	M	L	M	L	M	H	L	M	H	L	M
CO2	M	L	H	M	L	M	H	L	M	H	L	M
CO3	L	M	H	L	M	H	L	M	H	L	M	H
CO4	H	M	L	M	H	L	M	H	L	M	H	L
CO5	M	H	L	M	H	L	M	H	L	M	H	L

COs / PSOs	PSO1	PSO2	PSO3	PSO4	PSO5			
CO1	H	M	L	M	H			
CO2	M	H	L	M	H			
CO3	L	M	H	L	M			
CO4	M	H	L	M	H			
CO5	H	M	M	H	L			

H/M/L indicates Strength of Correlation H- High, M- Medium, L-Low

Category	Basic Sciences	Engineering Sciences	Humanities and Social Sciences	Program Core	Program Electives	Open Electives	Practical / Project	Internships / Technical Skill	Soft Skills			
					✓							
Approval												

RECENT ADVANCES APPLIED TO HOSPITAL ENGINEERING

UNIT I STANDARDISATION OF HOSPITAL EQUIPMENTS 9 Hrs

Need for standardization, classification of equipments, international standards, Experimental methods of testing standards, maintenance of standards and recalibration.

UNIT II CLINICAL ENGINEERING 9 Hrs

Hospital design, electrical, air – conditioning, sanitation, ventilation, safety regulation to be incorporated in the hospital center, management and legal aspects, latest rug delivery systems for sustained delivery of medicines.

UNIT III NETWORKING 9 Hrs

Importance of networking, LAN features, network topologies, LAN components, network operating system, basic data communication concept, application, LAN and multi-user system, planning and installing LAN in hospital set up.

UNIT IV FIBRE OPTIC SENSORS FOR MEASURING PHYSIOLOGICAL PARAMETERS 9 Hrs

Different optical sources, optical detectors, principle of fiber optic cables, single mode multi mode, step index and graded index type, sensors based on polarisation, interferometer principle, magnetic sensors, application of the sensors in measuring pressure, temperature, flow, rotation and chemical activites, principles of smart sensors.

UNIT V EMI AND EMC APPLIED TO HOSPITAL EQUIPMENTS 9 Hrs

Principles of EMI, computation of EMI, measuring techniques to quantify the level of interference, method of suppressing and isolating this unit from interference

Total Number of Hours: 45 Hrs

Text Books:

1. Donald R.J. White, A Handbook of electromagnetic Interference and Compatibility, Vol 4, 5, Published by Donwhite Constant – Maryland, 1972.
2. Webster J.G. and Albert M. Cook, Clinical Engineering Principles and Practices Printice Hall Inc, Englewood Cliffs, New Jersery, 1979.
3. Bernhard Keiser, Principles of Eletromagnetic Compatibility, Artech House- 3rd Edition, 1986.

Reference Books:

1. Eric Udd, Fiber Optic Sensors and introduction for engineers and scientists, Wiley Interscience Publication, New Delhi, 1991.
2. Bajbai, P.K. Ceramic – a novel device for sustained long term delivery of drugsBio Ceramic Vol III,
3. Rose Heliman Institute of Technology, Terrahaute, Indian, 1992.
4. S.K. Basandia, Local Area Network, Golgotia Publishing Pvt Ltd., New Delhi, 1995.

Subject Code: BBI17E14	**Subject Name : DIAGNOSTIC AND THERAPEUTIC EQUIPMENTS – II**	**T / L/ ETL**	**L**	**T / S.Lr**	**P/ R**	**C**
	Prerequisite:	T	3	0/0	0/0	3

L : Lecture T : Tutorial SLr : Supervised Learning P : Project R : Research C: Credits
T/L/ETL : Theory/Lab/Embedded Theory and Lab

OBJECTIVE :

- To learn about Ultrasonic Techniques For Diagnosis
- To gain knowledge on Patient Monitoring And Biotelemetry
- To study about Diathermy
- To learn about Special Diagnostic Techniques
- To gain knowledge on Patient Safety

COURSE OUTCOMES (COs) : (3- 5)

CO1	Acquires knowledge on Ultrasonic Techniques For Diagnosis
CO2	Graduate understands Patient Monitoring And Biotelemetry
CO3	Understands Diathermy
CO4	Graduate gains knowledge on Special Diagnostic Techniques
CO5	Understands Patient Safety

Mapping of Course Outcomes with Program Outcomes (POs)

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	M	H	L	M	H	L	M	L	H	M	L	H
CO2	H	M	L	H	M	L	H	L	M	H	L	M
CO3	H	M	L	M	H	L	M	H	L	M	H	L
CO4	M	L	M	H	L	M	H	L	M	H	L	M
CO5	L	M	L	M	H	L	M	H	L	M	H	L

COs / PSOs	PSO1	PSO2	PSO3	PSO4	PSO5			
CO1	M	M	L	H	M			
CO2	H	M	L	M	H			
CO3	M	H	L	H	M			
CO4	M	H	L	M	H			
CO5	L	M	H	L	M			

H/M/L indicates Strength of Correlation H- High, M- Medium, L-Low

Category	Basic Sciences	Engineering Sciences	Humanities and Social Sciences	Program Core	Program Electives	Open Electives	Practical / Project	Internships / Technical Skill	Soft Skills			
					✓							
Approval												

DIAGNOSTIC AND THERAPEUTIC EQUIPMENTS – II

UNIT I ULTRASONIC TECHNIQUES FOR DIAGNOSIS **9 Hrs**

Basic principles of Echo technique, display techniques A, B, M modes, Echo cardiograms, Echo encephalogram, Ultrasonic applied as diagnostic tool in ophthalmology, obstetrics and gynecology.

UNIT II PATIENT MONITORING AND BIOTELEMETRY **9 Hrs**

Patient monitoring system – ICU, post operative, ICCU, single channel telemetry, Multichannel telemetry, frequency allotment, radiopill - Transmission of Biosignals over telephone lines

UNIT III DIATHERMY **9 Hrs**

Clinical applications of electrotherapy, short wave diathermy, ultrasonic diathermy, microwave diathermy, surgical diathermy unit, IR lamps, UV lamps

UNIT IV SPECIAL DIAGNOSTIC TECHNIQUES **9 Hrs**

Principles of Cryogenic technique and application, Endoscopy, Laparoscopy, Thermography

UNIT V PATIENT SAFETY **9 Hrs**

Sources of leakage current, Micro and Macro shock, monitoring circuits, earthing schemes

Total Number of Hours: 45 Hrs

Text Books:

1. Khandpur R.S, "Handbook of Biomedical Instrumentation", Tata McGraw-Hill, New Delhi, 1997.

Reference Books:

1. John G.Webster, "Medical Instrumentation Application and Design", John Wiley and sons, New York, 1998.

2. Joseph J.Carr and John M.Brown, "Introduction to Biomedical Equipment technology", John Wiley and sons, New York, 1997.

Subject Code: BBI17E15	**Subject Name : SYSTEM THEORY APPLIED TO BIO-MEIDCAL ENGINEERING**	**T / L/ ETL**	**L**	**T / S.Lr**	**P/ R**	**C**
	Prerequisite:	T	3	0/0	0/0	3

L : Lecture T : Tutorial SLr : Supervised Learning P : Project R : Research C: Credits
T/L/ETL : Theory/Lab/Embedded Theory and Lab

OBJECTIVE :

- To Learn About System Concept
- To Gain Knowledge On Transducer Function
- To Study About Impedance Concept
- To Learn About Periodic Signals, Feedback
- To Gain Knowledge On Simulation Of Biological Systems

COURSE OUTCOMES (COs) : (3- 5)

CO1	Understands System Concept
CO2	Acquires knowledge on Transducer Function
CO3	Graduate understands Impedance Concept
CO4	Understands Periodic Signals, Feedback
CO5	Simulation Of Biological Systems

Mapping of Course Outcomes with Program Outcomes (POs)

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	M	M	M	L	H	L	M	H	L	M	H	L
CO2	M	H	L	M	H	L	M	H	L	M	H	L
CO3	M	H	L	M	H	L	M	H	L	M	H	L
CO4	M	H	L	M	L	M	H	L	M	H	L	M
CO5	M	H	L	M	H	L	M	H	L	M	H	L

COs / PSOs	PSO1	PSO2	PSO3	PSO4	PSO5			
CO1	M	H	L	M	H			
CO2	M	H	L	M	H			
CO3	H	M	L	H	L			
CO4	L	M	H	L	M			
CO5	H	M	L	M	H			

H/M/L indicates Strength of Correlation H- High, M- Medium, L-Low

Category	Basic Sciences	Engineering Sciences	Humanities and Social Sciences	Program Core	Program Electives	Open Electives	Practical / Project	Internships / Technical Skill	Soft Skills			
					✓							
Approval												

SYSTEM THEORY APPLIED TO BIO-MEIDCAL ENGINEERING

UNIT I INTRODUCTION **9 Hrs**

System Concept, System Properties, Piece –Wiser Linear Approximation, Electrical Analog for Compliance, Thermal Storage, Mechanical Systems, Step response of a Resistance/Compliant Systems, Pulse Response of First Order System.

UNIT II TRANSFER FUNCTION **9 Hrs**

System as an Operator use of Transfer Function, bioengineering of a Coupled System, Example of Transformed Signals.

UNIT III IMPEDANCE CONCEPT **9 Hrs**

Circuits for the Transfer Function with Impedance Concept Prediction of Performance.

UNIT IV PERIODIC SIGNALS, FEEDBACK **9 Hrs**

Sinusoidal Functions, Sinusoidal Analysis of Instrumentation System, Evaluation of Transfer Function s from Frequency Response, Relationship between Phase Lag and Time Delay Transient Response of an Undamped Second Order system, General Description of Natural Frequency Damping, Physical Significance of Under Damped Responses. Characterization of Physiological Feedback, System, Uses and Testing of System Stability.

UNIT V SIMULATION OF BIOLOGICAL SYSTEMS **9 Hrs**

Simulation of Skeletal music servomechanism, thermo Regulation, Cardiovascular control System, Respiration controls, Occulo Motor System, Endocrine control system and Modeling of receptors.

Total Number of Hours: 45 Hrs

Text Books:

1. William B. Blesser, A System Approacg to Biomedicine, McGraw Hill Book Co., New York, 1969.

2. Manfreo Clynes and John H. Milsum, Biomedical Engineering System, McGraw Hill and Co, New York, 1970.

Reference Books:

1. Douglas S. Rigg, Control Theory and Physiological Feedback Mechancism, The William and Wilkins Co., Baltimore, 1970.

2. Riechard Skalak and Shu Chien, Handbook of Biomedical Engineering, McGraw Hill and Co., New York, 1987.

TECHNICAL SKILLS

1. BBI17TS1 LabVIEW
2. BBI17TS 2 MATLAB
3. BBI17TS3 Embedded (Keil)
4. BBI17TS4 VLSI
5. BBI17TS5 C++, JAVA
6. BBI17TS6 IOT
7. BBI17TS7 Microsoft Robotic Developer Studio(Robot Control and Simulator)

Dr.M.G.R Educational and Research Institute University

Department of BIOMEDICAL INSTRUMENTATION ENGINEERING

OPEN ELECTIVES LIST (SEMESTER 6)

1. AUTOMOTIVE ENGINEERING
2. ELECTRIC AND HYBRID VEHICLES
3. BOUNDARY LAYER THEORY
4. COMPUTATIONAL FLUID DYNAMICS
5. FINITE ELEMENT ANALYSIS
6. ARTIFICIAL INTELLIGENCE/EXPERT SYSTEMS IN DESIGN AND MANUFACTURING
7. CREATIVITY, INNOVATION AND NEW PRODUCT DEVELOPMENT
8. COMPOSITE MATERIALS AND STRUCTURES
9. MACHINE LEARNING IN BIOINFORMATICS
10. PRINCIPLES AND APPLICATIONS OF BIOINFORMATICS
11. BIOSIMULATIONS USING MATLAB
12. DATA MINING IN BIOINFORMATICS
13. BIOINFORMATICS FOR BIOENGINEERS
14. INTRODUCTION TO BIOMEDICAL DEVICES
15. FUNDAMENTALS OF BIOSIGNAL PROCESSING
16. BIOREFINERY
17. DIGITAL IMAGE PROCESSING
18. WATER POLLUTION AND ITS MANAGEMENT
19. LOBAL WARMING AND CLIMATE CHANGE
20. DISASTER MANAGEMENT AND MITIGATION
21. ENERGY ENGINEERING TECHNOLOGY AND MANAGEMENT
22. RENEWABLE ENERGY TECHNOLOGY
23. INDUSTRIAL POLLUTION PREVENTION AND CONTROL
24. PETROLEUM TECHNOLOGY
25. INTRODUCTION TO TRANSPORT PROCESSES
26. DATA STRUCTURES
27. DATABASE CONCEPTS
28. SOFT COMPUTING
29. WEB DESIGN
30. ELECTRONIC CIRCUITS AND SYSTEMS
31. TELECOMMUNICATION SYSTEMS
32. POWER PLANT INSTRUMENTATION
33. BIOMEDICAL INSTRUMENTATION
34. RENEWABLE ENERGY RESOURCES
35. MICROCONTROLLERS AND THEIR APPLICATIONS
36. ELECTRICAL MACHINES AND DRIVES
37. FUNDAMENTALS OF ELECTRIC POWER UTILIZATION
38. INDUSTRIAL ELECTRONICS
39. REAL-TIME EMBEDDED SYSTEMS
40. CONTROLLER BASED SYSTEM DESIGN
41. INSTRUMENTATION ENGINEERING
42. HUMAN NUTRITION AND HEALTH
43. TECHNOLOGY OF BAKERY AND CONFECTIONERY PRODUCTS
44. FOOD PROCESSING AND PRESERVATION TECHNOLOGY
45. DISASTER MANAGEMENT
46. CYBER SECURITY
47. DAY-TO-DAY BIOLOGY
48. INTRODUCTION TO AUTOMATION
49. VIRTUAL INSTRUMENTATION
50. FUNDAMENTALS OF MEMS

51. INFORMATION SECURITY
52. INTRODUCTION TO DATABASE MANAGEMENT SYSTEM
53. PROFICIENCY IN ENGLISH AND ACCENT TRAINING
54. CREATIVE WRITING
55. INDIAN WRITING IN ENGLISH
56. SCIENCE FICTION
57. INTELLECTUAL PROPERTY RIGHTS , INNOVATION AND TECHNOLOGY
58. PRINCIPLES OF TECHNOLOGY AND INNOVATION MANAGEMENT
59. MARKETING MANAGEMENT
60. INDUSTRIAL MARKETING
61. STRESS MANAGEMENT
62. BASICS OF BANKING AND CAPITAL MARKETS
63. FINANCE FOR NON FINANCE EXECUTIVES
64. FUNDAMENTALS OF ENTREPRENEURSHIP
65. OPERATIONS RESEARCH
66. ETHICAL VALUES FOR BUSINESS
67. INFORMATION SYSTEMS FOR ENGINEERS
68. DATA WAREHOUSING AND DATA
69. LEGAL ASPECTS OF BUSINESS
70. INDUSTRIAL ENGINEERING AND MANAGEMENT
71. BUSINESS ENVIRONMENT
72. CONCURRENT ENGINEERING
73. MEMS AND NANO MANUFACTURING
74. NON DESTRUCTIVE TESTING
75. NANO PROCESSING
76. LOW COST AUTOMATION
77. MANUFACTURING COST ESTIMATION
78. MICRO ELECTRO MECHANICAL SYSTEMS
79. INTRODUCTION TO HYDRAULICS AND PNEUMATICS
80. PLASTIC ENGINEERING
81. INTRODUCTION TO ROBOTICS
82. BASIC THERMODYNAMICS AND HEAT TRANSFER
83. RENEWABLE AND SUSTAINABLE ENERGY
84. ENERGY AUDITING
85. ENERGY CONSERVATION
86. SOLAR ENERGY UTILIZATION
87. HUMAN COMPUTER INTERFACE
88. ARTIFICIAL INTELLIGENCE AND NEURAL NETWORKS
89. APPLICATIONS OF NANOTECHNOLOGY
90. SOFTWARE DEVELOPMENT AND MANAGEMENT
91. TELECOM BILLING
92. Fire and Safety
93. NSS

S.No.	Course Work- Subject Area	Range of Total Credits (%) Min	Max	Suggested Breakdown on Credits (for Total 176)	**Dr.MGR EandR Inst University credits**
1	Humanities and Social Sciences (HS), including Management;	5(9.25)	10(18.5)	14	**13**
	TECHNICAL ENGLISH - I				**2**
	TECHNICAL ENGLISH - II				**2**
	ENVIRONMENTAL SCIENCE				**3**
	MANAGEMENT PAPER 1				**3**
	MANAGEMENT PAPER 2				**3**

S.No.	Course Work- Subject Area	Range of Total Credits (%) Min	Max	Suggested Breakdown on Credits (for Total 176)	**Dr.MGR EandR Inst University credits**
2	Basic Sciences(BS) including Mathematics, Physics, Chemistry, Biology;	15(27.75)	20(37)	30	**30**
	MATHS - I				**4**
	ENGINEERING PHYSICS				**3**
	MATERIAL SCIENCE				**3**
	ENGINEERING CHEMISTRY - I				**3**
	ENGINEERING CHEMISTRY - II				**3**
	MATHS - II				**4**
	PHYSICS LAB				**1**
	CHEMISTRY LAB				**1**
	MATHS - III				**4**
	MATHS - IV				**4**

S.No.	Course Work- Subject Area	Range of Total Credits (%) Min	Max	Suggested Breakdown on Credits (for Total 176)	**Dr.MGR EandR Inst University credits**
3	Engineering Sciences (ES), including Materials, Workshop, Drawing, Basics of Electrical/Electronics/Mechanical/Computer Engineering, Instrumentation;	15(27.75)	20(37)	30	**29**
	BASIC ELECTRICAL and ELECTRONICS ENGINEERING				**3**
	BASIC MECHANICAL and CIVIL ENGINEERING				**3**
	BASIC ENGINEERING GRAPHICS				**2**
	WORKSHOP and PROJECT LAB				**1**
	PROGRAMMING LAB				**2**
	BASIC ENGINEERING SCIENCE				**3**
	INTER DISCIPLINARY THEORY (4 PAPERS)				**12**
	INTER DISCIPLINARY LAB (3 LABS)				**3**

S.No.	Course Work- Subject Area	Range of Total Credits (%) Min	Max	Suggested Breakdown on Credits (for Total 176)	**Dr.MGR EandR Inst University credits**
4	Professional Subjects-Core (PC), relevant to the chosen specialization/branch; (May be split into Hard (no choice) and Soft (with choice), if required;)	30(55.5)	40(74)	50	**68**
	4 CREDIT DEPT CORE PAPER (9 papers)				**36**
	3 CREDIT DEPT CORE PAPER (7 papers)				**21**
	DEPARTMENT CORE LABS				**11**

S.No.	Course Work- Subject Area	Range of Total Credits (%) Min	Max	Suggested Breakdown on Credits (for Total 176)	**Dr.MGR EandR Inst University credits**
5	Professional Subjects – Electives (PE), relevant to the chosen specialization/ branch;	10(18.5)	15(27.75)	20	**15**
	DEPT CORE ELECTIVES (5 PAPERS)				**15**

S.No.	Course Work- Subject Area	Range of Total Credits (%) Min	Max	Suggested Breakdown on Credits (for Total 176)	**Dr.MGR EandR Inst University credits**
6	Open Subjects- Electives (OE), from other technical and/or emerging subject areas;	5(9.25)	10(18.5)	12	**10**
	OPEN ELECTIVE (Inter Disciplinary No Prerequisite)				**3**
	SPECIAL ELECTIVE (Emerging Technology Syllabus to be framed)				**3**
	SOFT SKILL 1				**2**
	SOFT SKILL 2				**2**

S.No.	Course Work- Subject Area	Range of Total Credits (%) Min	Max	Suggested Breakdown on Credits (for Total 176)	**Dr.MGR EandR Inst University credits**
7	Project Work, Seminar and/or Internship in Industry or elsewhere.	10(18.5)	15(27.75)	20	**20**
	TECHNICAL SKILLS (3)				**3**
	INPLANT TRAINING				**1**
	PROJECT PHASE – 1 and 2				**12**
	FOREIGN LANGUAGE				**2**
	MINI PROJECT				**1**
	ENTREPRENEURAIL SKIL DEVELOPMENT and PROJECT LAB				**1**

Credits Distribution

S. No	Description	No. of Papers	Credits
1	Department Core (3 credits) Inclusive of 3 ETL subjects	7	21
2	Department Core (4 credits)	9	36
3	Department Core Electives	5	15
4	Open Elective	1	3
5	Special Elective (ETL)	1	3
6	Management Papers	2	6
7	Core Department Lab	11	11
8	Interdisciplinary Theory	4	12
9	Interdisciplinary Lab	3	3
10	Mathematics	4	16
11	Basic Humanities and Sciences	6	16
12	Environmental Science	1	3
13	Basic Engineering Science	4	11
14	Basic Engineering and Science Labs	4	5
15	Technical Skills	3	3
16	Soft Skills	2	4
17	Foreign Language	1	2
18	Mini Project	1	1
19	Project (Phase 1 and 2)	2	12
20	In Plant Training	1	1
21	Entrepreneurial Skill Development and Project Lab	1	1
	Total	**73**	**185**

Note:

Revision-2 curriculum modified with the following changes

- In the 2nd semester curriculum, Entrepreneurial Skill Development and Project lab courses included with one credit weightage.

- Total number of Credits for the 1st year program has been increased to 41 credits and the overall credit has been increased to 185 credits.