E.G.S. PILLAY ENGINEERING COLLEGE

(Autonomous)

Approved by AICTE, New Delhi| Affiliated to Anna University, Chennai|
Accredited by NAAC with 'A' Grade| Accredited by NBA|
(CSE, EEE, MECH, ECE, CIVIL, IT)
NAGAPATTINAM–611002

B.E. Biomedical Engineering

Full Time Curriculum and Syllabus

Second Year– Third Semester

COURSE CODE	COURSE NAME	CATEGORY	L	T	P	C	MAX. MARKS		
							CA	ES	TOTAL
THEORY COURSES									
2301MA302	Probability and Stochastic Processes	BSC	3	2	0	4	40	60	100
2302BM301T & P	Biosciences in Medical Engineering (theory cum Practical Subject)	PCC	3	0	2	4	50	50	100
2302BM302	Bio Process Control Systems	PCC	3	0	0	3	40	60	100
2302BM303	Bio medical Circuits and Networks	PCC	2	0	4	4	40	60	100
2302BM304	Human Anatomy and Physiology	PCC	2	0	4	4	40	60	100
2301GEX02	Environmental Science and Sustainability	BSC	2	0	0	2	40	60	100
LABORATORY COURSES									
2302BM351	Human Anatomy and Physiology Laboratory	PCC	0	0	3	2	40	60	100
2302BM352	Devices and Circuits Laboratory	PCC	0	0	3	2	40	60	100
	Professional Development Course 1	EEC	0	0	2	1	100	--	100
TOTAL						**26**	**430**	**470**	**900**

2301MA302	PROBABILITY THEORY AND STOCHASTIC PROCESSES	L	T	P	C
	(B.E-ECE and BME)	3	1	0	4

PREREQUISITE:

1.Advanced multivariate differential calculus and integral calculus
2.Matrices

COURSE OBJECTIVES:

1. To analyze the concepts of probability, random variables and distribution functions.
2. To acquire skill in handling situation with more than one random variable with time function.
3. To analyze the concepts of Covariance and correlation.
4. To analyze the concept of Marko v process.
5. To acquire skills in Linear systems with random inputs.

COURSE OUTCOMES:

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

CO1:	Apply probability techniques to analyze the performance of Electronic systems.(K3)
CO2:	Apply standard distributions in describing real life phenomena.(K3)
CO3:	Solve problems involving more than one random variable.(K3).
CO4:	Make use of theorems related to random signals(K3)
CO5:	Interprettheresponseofrandominputtolineartimeinvariantsystems.(K3)

COs Vs POs MAPPING:

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	3	-	-	-	-	-	-	-	-	-	1
CO2	3	3	2	-	-	-	1	-	-	-	-	1
CO3	3	3	2	-	-	-	1	-	-	-	-	1
CO4	3	3	-	-	-	-	1	-	-	-	-	1
CO5	3	3	3	-	-	-	1	-	-	-	-	1

COs Vs PSOs MAPPING:

COs	PSO1	PSO2	PSO3
CO1	3	-	-
CO2	3	3	-
CO3	3	3	-
CO4	3	3	-
CO5	3	3	-

COURSE CONTENTS:

MODULE I **DRIVE CHARACTERISTICS** **8 Hours**

Electric drives - Classification, Elements of electrical drive, Equations governing motor load dynamics, Torque components; Classes of duty; Steady state stability; Multi quadrant dynamics - Acceleration, Deceleration, Starting and stopping; Typical load torque characteristics - Constant torque, Torque proportional to speed, Fan load, Torque inversely proportional to speed; Selection of motor rating.

MODULE II	**DC MOTOR DRIVE**	**9 Hours**
Converter fed drive - Review of one and two quadrant converter and its characteristics; Steady state analysis of single phase and three phase converter fed separately excited dc motor drive - Continuous and discontinuous conduction, Four quadrant operation of converter. **Chopper fed drive -** Review of dc chopper and its control strategies, Motoring mode, Braking mode and Four quadrant operation of chopper fed drive.		
MODULE III	**CLOSED LOOP CONTROL OF DC DRIVE**	**12 Hours**
Control structure of dc drive; Armature voltage and field control of separately excited dc motor drive; Transfer function of separately excited dc motor and converter; Design of controllers - Speed controller and Current controller.		
MODULE IV	**INDUCTION MOTOR DRIVE**	**12 Hours**
Review of induction motor equivalent circuit and torque speed characteristics; Speed control of induction motor drive - Stator voltage control, v/f control, VSI fed induction motor drive, Cycloconverter control and Vector control- Block diagram approach; Impact of rotor resistance on induction motor speed torque curve, Closed loop control of induction motor drive.		
MODULE V	**SYNCHRONOUS MOTOR DRIVE**	**8 Hours**
V/f and self-control of synchronous motor drive; Margin angle control and Power factor control; VSI and CSI fed synchronous motor drive; Permanent magnet synchronous motor - Construction, Types, BLPM DC motor and BLPM AC motor.		
		TOTAL: 45 HOURS

REFERENCES:

1. *G.K Dubey, "Fundamentals of Electrical Drives", 2nd Edition, Narosa Book Distributors, 2013.*
2. *N. K. De, P. K. Sen, "Electric Drives", 16th Edition, PHI Learning Pvt. Ltd., 2014.*
3. *R. Krishnan, "Electric Motor Drives: Modeling, Analysis and Control", 1st Edition, Pearson Education, 2015.*
4. *Rik De Doncker, Duco W. J. Pulle, Andre Veltman, "Advanced Electrical Drives", 1st Edition, Springer Science & Business Media, 2011.*
5. *Bimal K. Bose, "Modern Power Electronics and AC Drives", 1st Edition, Pearson Education, 2015.*
6. *R. Krishnan, "Permanent Magnet Synchronous and Brushless DC motor Drives", CRC Press, New York, 2010.*
7. *https://nptel.ac.in/courses/108/104/108104140/*
8. *https://in.mathworks.com/matlabcentral/fileexchange?q=electrical+drives*
9. *https://ied-nitk.vlabs.ac.in/*
10. *https://ems-iitr.vlabs.ac.in/List%20of%20experiments.html*

2302BM301	BIOSCIENCES IN MEDICAL ENGINEERING	L	T	P	C
	(B.E- BME)	3	0	2	4

PREREQUISITE :

Nil

COURSE OBJECTIVES:

1. To study structural and functional properties of carbohydrates, proteins, lipids and nucleic acids
2. To emphasize structural and functional aspects of living organisms
3. To discuss the concepts of microbial culture and immunopathology

COURSE OUTCOMES:

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

CO1:	Understand the fundamental concepts of biochemistry correlated to biomedical engineering
CO2:	Outline the concept of cell degeneration, cell repair and Neoplasia.
CO3:	Analyze the effect of derangement in haematology
CO4:	Analyze the growth of bacterial cultures
CO5:	Analyze the pathological conditions related to immunity

COs Vs POs MAPPING:

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	-	-	-	-	-	-	-	-	-	-	2
CO2	3	-	-	-	2	-	-	-	-	-	-	2
CO3	3	2	-	-	2	-	-	-	-	-	-	2
CO4	3	2	-	-	2	-	-	-	-	-	-	2
CO5	3	2	-	-	2	-	-	-	-	-	-	2

COs Vs PSOs MAPPING:

COs	PSO1	PSO2	PSO3
CO1	1	-	-
CO2	1	-	-
CO3	1	-	-
CO4	1	-	-
CO5	1	-	-

COURSE CONTENTS:

MODULE I	INTRODUCTION TO BIOCHEMISTRY	9 Hours

Introduction to Biochemistry, water as a biological solvent, weak acid and bases, pH, buffers, Handerson-Hassel balch equation, physiological buffers, fitness of the aqueous environment for living organism. Principle of viscosity, surface tension, adsorption, diffusion, osmosis and their applications in biological systems. Introduction to Biomolecules, Biological membrane, Clinical application of Electrolytes and radioisotopes

MODULE II	CELL DEGENERATION, REPAIR AND NEOPLASIA	9 Hours

Cell injury - Reversible cell injury and irreversible cell injury and Necrosis, Apoptosis, Intracellular accumulations, Pathological Calcification-Dystrophic and Metastatic. cellular adaptations of growth and differentiation, Inflammation and Repair including fracture healing, Neoplasia, Classification, Benign and malignant tumors, carcinogenesis, spread of tumours, autopsy and biopsy.		
MODULE III	**FLUID AND HEMODYNAMIC DERANGEMENTS**	**9 Hours**
Edema, Hyperemia/Ischemia, normal haemostasis, thrombosis, disseminated intravascular coagulation, embolism, infarction, shock, chronic venous congestion. Haematological disorders- Bleeding disorders, Leukaemia, Lymphomas Haemorrhage.		
MODULE IV	**MICROBIAL CULTURES**	**9 Hours**
Morphological features and structural organization of bacteria, growth curve, identification of bacteria, culture media and its types, culture techniques and observation of culture.		
MODULE V	**IMMUNOPATHOLOGY**	**9 Hours**
V/f and self-control of synchronous motor drive; Margin angle control and Power factor control; VSI and CSI fed synchronous motor drive; Permanent magnet synchronous motor - Construction, Types, BLPM DC motor and BLPM AC motor.		
		TOTAL: 45 HOURS

REFERENCES:

1.Rafi MD, "Textbook of Biochemistry for Medical Student", Second Edition, University Press, 2014

2.Donold Voet, Judith, G.Voet and Charlotte W. Pratt, "Principles of Biochemistry", 4th Edition, John Wiley and Sons, New Delhi, 2012.

3.David.W.Martin, Peter.A.Mayes, Victor. W.Rodwell, Harper"s Illustrated Biochemistry, LANGE Medical Publications, 2018

4.Keith Wilson, John Walker, Practical Biochemistry- Principles & Techniques, Oxford University Press,2009

5.Harsh Mohan, Text book of Pathology, Jaypee Brothers Medical publishers private Limited, 8th Edition,2019

2302BM302	BIO PROCESS CONTROL SYSTEMS	L	T	P	C
	(B.E-BME)	3	0	0	3

PREREQUISITE:

1.Biomedical circuits and networks

COURSE OBJECTIVES:

1. To develop the system modelling and various methods of representation.
2. To implement the time response analysis of a system
3. To employ the frequency response analysis of a system
4. To comprehend the biological control system.
5. To develop the models based on biological systems

COURSE OUTCOMES:

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

CO1:	Determine the mathematical model of the physical system.
CO2:	2. Calculate the transient and steady State behaviour of systems using standard test signals.
CO3:	3. Determine the frequency response of systems using different charts.
CO4:	4. Describe the biological control systems
CO5:	5. Express the applications control system in biomedical field.

COs Vs POs MAPPING:

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	2	2	1	1	-	-	-	1	-	1	-
CO2	3	2	2	1	1	-	-	-	1	-	1	-
CO3	3	2	2	1	1	-	-	-	1	-	1	-
CO4	3	2	2	1	1	-	-	-	1	-	1	-
CO5	3	2	2	1	1	-	-	-	1	-	1	-

COs Vs PSOs MAPPING:

COs	PSO1	PSO2	PSO3
CO1	1	1	-
CO2	1	1	-
CO3	1	1	-
CO4	1	1	-
CO5	1	1	-

COURSE CONTENTS:

MODULE I	INTRODUCTION TO CONTROL SYSTEM	9 Hours

Electric drives - Classification, Elements of electrical drive, Equations governing motor load dynamics, Torque components; Classes of duty; Steady state stability; Multi quadrant dynamics - Acceleration, Deceleration, Starting and stopping; Typical load torque characteristics - Constant torque, Torque proportional to speed, Fan load, Torque inversely proportional to speed; Selection of motor rating.

MODULE II	TIME RESPONSE ANALYSIS	9 Hours

Time response, Time domain specifications, Types of test input, I and I order system response, Error coefficients, Generalized error series - Steady state error, Effects of P, PI, PD PID modes of feedback control, Time response analysis.		
MODULE III	**FREQUENCY RESPONSE ANALYSIS**	**9 Hours**
Frequency response, Bode plot, Polar plot, Determination of closed loop response from open loop response, Correlation between frequency domain and time domain specifications.		
MODULE IV	**BIOLOGICAL CONTROL SYSTEM**	**9 Hours**
Introduction to Physiological control systems- Illustration, Linear models of physiological systems, Difference between engineering and physiological control systems. Simple models of muscle stretch reflex action		
MODULE V	**BIOMEDICAL APPLICATIONS**	**9 Hours**
Examples of Biological control Systems: Cardiovascular Control System, Endocrine Control Systems, Pupil Control System, Skeletal Muscle Servomechanism, Oculo - motor system, sugar level Control Mechanism. Temperature control, Blood pressure control.		
		TOTAL: 45 HOURS

REFERENCES:

1. *G.K Dubey, "Fundamentals of Electrical Drives", 2nd Edition, Narosa Book Distributors, 2013.*
2. *N. K. De, P. K. Sen, "Electric Drives", 16th Edition, PHI Learning Pvt. Ltd., 2014.*
3. *R. Krishnan, "Electric Motor Drives: Modeling, Analysis and Control", 1st Edition, Pearson Education, 2015.*
4. *Rik De Doncker, Duco W. J. Pulle, Andre Veltman, "Advanced Electrical Drives", 1st Edition, Springer Science & Business Media, 2011.*
5. *Bimal K. Bose, "Modern Power Electronics and AC Drives", 1st Edition, Pearson Education, 2015.*
6. *R. Krishnan, "Permanent Magnet Synchronous and Brushless DC motor Drives", CRC Press, New York, 2010.*
7. *https://nptel.ac.in/courses/108/104/108104140/*
8. *https://in.mathworks.com/matlabcentral/fileexchange?q=electrical+drives*
9. *https://ied-nitk.vlabs.ac.in/*
10. *https://ems-iitr.vlabs.ac.in/List%20of%20experiments.html*

2302BM303	BIO MEDICAL CIRCUITS AND NETWORKS	L	T	P	C
	(B.E-BME)	3	0	0	4

PREREQUISITE:

1.Applied Digital and Logic Design

COURSE OBJECTIVES:

1. To introduce the basic concepts of DC electrical circuits and analysis.
2. To introduce different methods of circuit analysis using Network theorems.
3. To understand resonance and coupled circuits.
4. To study the transient and steady state response of the circuits.
5. To discuss the electrical network graphs.

COURSE OUTCOMES:

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

CO1:	Calculate the circuit parameters using mesh and nodal method
CO2:	Apply various network theorems for the analysis of electrical circuits.
CO3:	Examine the concept of resonance and coupled circuits
CO4:	Determine transient response of DC circuits.
CO5:	Understand the graphs of networks

COs Vs POs MAPPING:

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	2	2	1	1	-	-	-	1	-	1	-
CO2	3	2	2	1	1	-	-	-	1	-	1	-
CO3	3	2	2	1	1	-	-	-	1	-	1	-
CO4	3	2	2	1	1	-	-	-	1	-	1	-
CO5	3	2	2	1	1	-	-	-	1	-	1	-

COs Vs PSOs MAPPING:

COs	PSO1	PSO2	PSO3
CO1	1	1	-
CO2	1	1	-
CO3	1	1	-
CO4	1	1	-
CO5	1	1	-

COURSE CONTENTS:

MODULE I	BASIC CIRCUIT ANALYSIS	9 Hours

Resistive elements - Ohm's Law- Resistors in series and parallel circuits-voltage to current and current to voltage source conversion– Kirchhoff's laws – Mesh current and node voltage methods of analysis-Solution of mesh equations by Cramer's rule

MODULE II	NETWORK REDUCTION AND THEOREMS FOR DC CIRCUITS	9 Hours

Network reduction: voltage and current division-star delta conversion-Thevenin's' and Norton Theorems – Superposition Theorem – Maximum power transfer theorem

MODULE III	**RESONANT CIRCUITS**	**9 Hours**
Series and parallel resonance – their frequency response – Quality factor and Bandwidth – concept of Self and mutual inductance – Coefficient of coupling-Dot rule convention in Coupled circuits		
MODULE IV	**TRANSIENTS FOR DC CIRCUITS**	**9 Hours**
Natural response-Forced response -Transient response of RL, RC and RLC Circuits with dc excitation -Solution of Problems in Circuit Transients		
MODULE V	**ELECTRICAL NETWORKS**	**9 Hours**
Graph of Network: Concept of Tree Branch, Tree link, junctions, Incident matrix, Tie-set matrix, Cutset matrix, determination of loop current and node voltages.		
		TOTAL: 45 HOURS

REFERANCES :

1.William F.Ganong, "Review of Medical Physiology", 26nd Edition, McGraw Hill, New Delhi,2019

2.Boylestad Robert L., Nashelsky Louis, Electronics Devices & Circuits, Pearson Education.

3.Circuits and Networks., U.A.Bakshi, A.V.Bakshi,Technical publications,2011.

2302BM304	HUMAN ANATOMY AND PHYSIOLOGY	L	T	P	C
	(B.E-BME)	2	0	4	4

PREREQUISITE:

Nil

COURSE OBJECTIVES:

1. To identify all the organelles of an animal cell and their function
2. To understand structure and functions of the various types of systems of human body
3. To demonstrate their knowledge of importance of anatomical features and physiology of human systems

COURSE OUTCOMES:

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

CO1:	Understand the structure and function of cells and tissues.
CO2:	Outline Skeletal, Muscular and Respiratory systems and their importance.
CO3:	Interpret the working of Cardiovascular and Lymphatic systems.
CO4:	Analyze the functions of Nervous, Endocrine and Special sensory systems.
CO5:	Analyze the functions of various components of the digestive system and evaluate the role ofthe urinary system in maintaining homeostasis.

COs Vs POs MAPPING:

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	-	-	-	2	-	-	-	-	-	-	-
CO2	2	-	-	-	2	-	-	-	-	-	-	-
CO3	3	-	-	1	2	-	-	-	-	-	-	-
CO4	3	2	-	1	2	-	-	-	-	-	-	-
CO5	3	2	-	1	2	-	-	-	-	-	-	-

COs Vs PSOs MAPPING:

COs	PSO1	PSO2	PSO3
CO1	1	-	-
CO2	1	-	-
CO3	1	-	-
CO4	1	-	-
CO5	1	-	-

COURSE CONTENTS:

MODULE I	BASIC ELEMENTS OF HUMAN BODY	9 Hours

Cell: Structure and organelles - Functions of each component in the cell. Cell membrane - transport across cell membrane - origin of cell membrane potential - Action potential - Cell to cell signalling- Cell Division. Tissue Types - Specialized tissues - functions.

MODULE II	SKELETAL, MUSCULAR AND RESPIRATORY SYSTEMS	9 Hours

Skeletal: Bone types and functions - Joint-Types of Cartilage and functions. Muscular: Parts of Muscle-Movements. Respiratory: Components of respiratory system-Respiratory Mechanism. Types of respiration - Oxygen and carbon dioxide transport and acid base regulation.		
MODULE III	**CARDIOVASCULAR AND LYMPHATIC SYSTEM**	**9 Hours**
Cardiovascular: Blood composition - functions of blood - functions of RBC. WBC types and their functions. Blood groups - Importance of blood groups - Identification of blood groups. Structure of heart - Conducting system of heart - Properties of Cardiac muscle - Cardiac cycle - Types of Blood Vessel - ECG - Heart sound - Volume and pressure changes and regulation of heart rate - Coronary Circulation. Factors regulating Blood flow. Lymphatic: Parts and Functions of Lymphatic systems - Types of Lymphatic organs and vessels.		
MODULE IV	**NERVOUS, ENDOCRINE AND SPECIAL SENSORY SYSTEMS**	**9 Hours**
Nervous: Structure of Neuron - Types of Neurons. Synapses and types. Condition of action potential in neuron. Brain - Divisions of brain lobes - Cortical localizations and functions - EEG. Spinal cord - Tracts of spinal cord - Reflex mechanism - Types of reflex. Autonomic nervous system and its functions. Endocrine - Pituitary and thyroid gland. Special sensory: Optics of Eye - Retina - Photochemistry of Vision - Neurophysiology of Vision - EOG. Structure and functions of Internal Ear Mechanism of Hearing - Auditory pathway, Hearing Tests.		
MODULE V	**DIGESTIVE AND URINARY SYSTEMS**	**9 Hours**
Digestive: Organs of Digestive system - Digestion and Absorption. Urinary: Structure of Kidney and Nephron. Mechanism of Urine formation and acid base regulation - Urinary reflex - Homoeostasis and blood pressure regulation by urinary system.		
		TOTAL: 45 HOURS

REFERANCES :

1.William F.Ganong, "Review of Medical Physiology", 26nd Edition, McGraw Hill, New Delhi,2019

2.Gillian Pocock, Christopher D. Richards, "The Human Body - An Introduction for Biomedicaland Health Sciences",Oxford University Press, USA,2009

3.Eldra Pearl Solomon, "Introduction to Human Anatomy and Physiology", W.B. SaundersCompany, Harcourt Brace Jovanovich, 2003

4.Frank H.Netter,"Atlas of human anatomy",Netter basic science, 7th edition 2019.

2301GEX02	ENVIRONMENTAL SCIENCE	L	T	P	C
	(Common to all Branches of B.E/ B.Tech)	1	0	2	2

PREREQUISITE :

Nil

COURSE OBJECTIVES:

1. Realize the interdisciplinary and holistic nature of the environment.
2. Understand how natural resources and environment affect the quality of life and stimulate the quest for sustainable development.

COURSE OUTCOMES:

At the end of the course the student will be able to

CO1:	Describe the importance of ecosystem.
CO2:	Describe the various environmental issues and its prevention.
CO3:	Organize various natural resources and the immediate need to conserve it.
CO4:	Select the various ways of conservation of biodiversity.
CO5:	Investigate the different types of pollution and its effects

COs Vs POs MAPPING:

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	2	1	-	-	-	-	3	-	-	-	-	-
CO2	2	1	-	-	-	-	3	-	-	-	-	-
CO3	3	2	1	1	1	1	3	2	2	2	3	-
CO4	3	2	1	1	1	1	3	2	2	2	3	-
CO5	3	2	1	1	1	1	3	2	2	2	3	-

COs Vs PSOs MAPPING:

COs	PSO1	PSO2	PSO3
CO1	-	-	-
CO2	-	-	-
CO3	-	-	-
CO4	-	-	-
CO5	-	-	-

COURSE CONTENTS:

MODULE I	ECOSYSTEM	8 Hours

Concept of an ecosystem – structure and function of an ecosystem – producers, consumers and decomposers. Introduction, types, characteristic features, structure and function of the (a) forest ecosystem (b) grassland ecosystem (c) desert ecosystem (d) aquatic ecosystems (ponds, rivers, oceans)

MODULE II	ENVIRONMENT AL ISSUES AND SOLUTIONS	7 Hours

Current Environmental Issues: Acid rain, Ozone layer depletion, Global warming, Green house effect. **Solutions:** 12 principles of green chemistry-Rain water harvesting.

MODULE III	BIODIVERSITY	10 Hours

Introduction to biodiversity -genetic, species and ecosystem diversity – value of biodiversity: consumptive use, productive use, social, ethical, aesthetic and option values – hot-spots of biodiversity – threats to biodiversity: habitat loss, poaching of wildlife, man-wildlife conflicts – conservation of biodiversity: In-situ and ex-situ conservation of biodiversity.		
MODULE IV	**NATURAL RESOURCES**	**10 Hours**
Forest resources: Use and over-exploitation, deforestation- timber extraction, mining, dams and their effects on forests and tribal people – Water resources: Use and over utilization of surface and ground water, dams-benefits and problems – Mineral resources: Use and exploitation, environmental effects of extracting and using mineral resources – Food resources: World food problems, changes caused by agriculture and overgrazing, effects of modern agriculture, fertilizer-pesticide problems, water logging, salinity– Energy resources: Growing energy needs, renewable and nonrenewable energy sources, use of alternate energy sources. Energy Conversion processes Biogas – production and uses, anaerobic digestion – Land resources: Land as a resource, land degradation, man induced landslides, soil erosion and desertification – role of an individual in conservation of natural resources – Equitable use of resources for sustainable lifestyles.		
MODULE V	**ENVIRONMENTAL POLLUTION**	**10 Hours**
Definition – Source, causes, effects and control measures of: (a) Air pollution (b) Water pollution(c) Soil pollution - soil waste management: causes, effects and control measures of municipal solid wastes – (d) Marine pollution (e) Noise pollution –(f) Nuclear pollution (g) Thermal pollution role of an individual in prevention of pollution.		
		TOTAL: 45 HOURS

REFERENCES:

1.Trivedi.R.K., "Handbook of Environmental Laws, Rules, Guidelines, Compliances and Standards", Vol. I and II, Enviro Media, 3rd edition, BPB publications, 2010.

2.Cunningham, W.P. Cooper, T.H. Gorhani, "Environmental Encyclopedia", Jaico Publ., House, Mumbai, 2001.

3.Dharmendra S. Sengar, "Environmental law", Prentice hall of India PVT LTD, New Delhi, 2007.

4.Rajagopalan, R, "Environmental Studies-From Crisis to Cure", Oxford University Press, 2005.

5.Benny Joseph, "Environmental Science and Engineering", Tata McGraw-Hill, New Delhi, 2006

6.https://en.wikipedia.org/wiki/Carbon_capture_and_storage

7.Ravikrishnan "Environmental Science and Engineering" Sri Krishna Hi-tech Publishing

2302BM351	HUMAN ANATOMY AND PHYSIOLOGY LABORATORY	L	T	P	C
		3	0	2	4

PREREQUISITE :

Nil

Course Objectives:

1. To identify all the organelles of an animal cell and their function
2. To understand structure and functions of the various types of systems of human body
3. To demonstrate their knowledge of importance of anatomical features and physiology of human systems

Course Outcomes:

After completion of the course, Student will be able to

CO1:	Understand the structure and function of cells and tissues.
CO2:	Outline Skeletal, Muscular and Respiratory systems and their importance.
CO3:	Interpret the working of Cardiovascular and Lymphatic systems.
CO4:	Analyse the functions of Nervous, Endocrine and Special sensory systems.
CO5:	Analyse the functions of various components of the digestive system and evaluate the role of the urinary system in maintaining homeostasis.

COs Vs POs MAPPING:

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	-	-	-	2	-	-	-	-	-	-	-
CO2	2	-	-	-	2	-	-	-	-	-	-	-
CO3	3	-	-	1	2	-	-	-	-	-	-	-
CO4	2	2	-	1	2	-	-	-	-	-	-	-
CO5	2	2	-	1	2	-	-	-	-	-	-	-

COs Vs PSOs MAPPING

COs	PSO1	PSO2	PSO3
CO1	-	-	-
CO2	-	-	-
CO3	-	-	-
CO4	-	-	-
CO5	-	-	-

List of Experiments:

1. Diagnosis of anemia by measuring the amount of haemoglobin in the blood.

2. Determine whether the donors blood group is compatible with the recepients blood group for a safe blood transfusion.
3. Diagnosis of leukocytosis and leukopenia by counting the WBC present in the blood.
4. Diagnosis of myocardial infarction from abnormal PQRST waveform
5. Diagnosis of myomyopathies and neuropathies using EMG
6. Diagnose the conductive and sensorineural type of hearing loss.
7. Identification of refractive errors like myopia , hyperopia and presbyopia.
References:
1.Elaine.N. Marieb, "Essential of Human Anatomy and Physiology",12th Edition, Pearson Education, New Delhi,2018
2.Gillian Pocock, Christopher D. Richards, "The Human Body - An Introduction for Biomedical and Health Sciences",Oxford University Press, USA,2009
3.William F.Ganong, "Review of Medical Physiology", 26nd Edition, McGraw Hill, New Delhi, 2019

2302BM352	DEVICES AND CIRCUITS LABORATORY	L	T	P	C
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PREREQUISITE :

1.Applied digital logic design lab

Course Objectives:

1. Be exposed to RL and RC circuits
2. Be familiar with Thevenin & Norton theorem KVL & KCL, and Super Position Theorems
3. To Know about series, parallel resonance circuits, Amplifiers and Multivibrators
4. To observe the characteristics of diodes
5. To design oscillator and multivibrator

Course Outcomes:

After completion of the course, Student will be able to

CO1:	Design RL and RC circuits
CO2:	Verify Thevenin & Norton theorem KVL & KCL, and Super Position Theorems
CO3:	Have a better understanding of diodes
CO4:	Analyze different characteristics of transistor
CO5:	Design Oscillator, rectifier and multivibrator

COs Vs POs MAPPING:

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	2	-	-	-	-	-	-	-	-	-	-
CO2	2	2	-	-	-	-	-	-	-	-	-	-
CO3	3	2	-	-	-	-	-	-	-	-	-	-
CO4	2	2	-	-	-	-	-	-	-	-	-	-
CO5	2	2	-	-	-	-	-	-	-	-	-	-

COs Vs PSOs MAPPING

COs	PSO1	PSO2	PSO3
CO1	-	-	-
CO2	-	-	-
CO3	-	-	-
CO4	-	-	-
CO5	-	-	-

List of Experiments:

1.Verification of ohm‘s law, Kirchhoff‘s law, and Thevenin‘s theorem

2.Verification of superposition theorem and Maximum power transfer theorem

3.Rectifier - Half wave rectifier & Full wave rectifier

4.Forward and reverse characteristics of PN junction diode

5.Forward and reverse characteristics of zener diode
6.Characteristics of CE Bipolar Junction transistor
7.Characteristics of CB Bipolar Junction transistor
8.Characteristics of JFET & UJT
9.Design of RC Phase shift oscillator
10.Design of multivibrator
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