E.G.S. PILLAY ENGINEERING COLLEGE

(Autonomous)

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NAGAPATTINAM–611002

B.E. Biomedical Engineering

Full Time Curriculum and Syllabus

Second Year– Fourth Semester

Course Code	CourseName	L	T	P	C	Maximum Marks		
						CA	ES	Total
Theory Course								
1901MA401	Probability and Stochastic Processes	3	2	0	4	40	60	100
1902BM401	Bio Mechanics	3	2	0	3	40	60	100
1902BM402	Basics of Pathology and Microbiology	3	0	0	3	40	60	100
1902BM403	Control Systems	3	0	0	4	40	60	100
1902BM404	Biomedical Instrumentation	3	0	0	3	40	60	100
1902BM405	Digital Electronics and Integrated Circuits	3	0	0	3	40	60	100
Laboratory Course								
1902BM451	Pathology and Microbiology Laboratory	0	0	2	1	50	50	100
1902BM452	Biomedical Instrumentation Laboratory	0	0	2	1	50	50	100
1902BM453	Analog and Digital and IntegratedCircuits Laboratory	0	0	2	1	50	50	100
1902GE451	Life Skills: Verbal Reasoning	0	0	2	1	100	-	100
Mandatory Course								
1901MCX01	Environmental Science	2	0	0	0			
	Total	**18**	**04**	**08**	**24**	**490**	**510**	**1000**

L–Lecture|T–Tutorial|P–Practical|C–Credit|CA –ContinuousAssessment| ES–EndSemester

1901MA401		PROBABILITY AND STOCHASTIC PROCESSES	L	T	P	C
			3	2	0	4

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 understand the concepts of Covariance and correlation.
4. To analyze the concept of Markov process.
5. To acquire skills in Linear systems with random inputs.

UNIT I	PROBABILITY	12 Hours

Probability- Theorems on Probability, Conditional Probability ,Baye's Theorem- Discrete and continuous random variables ,Moments – Moment generating functions ,Real Time Problems

UNIT II	ONE DIMENSIONAL RANDOM VARIABLE	12 Hours

Discrete Distributions- Binomial, Poisson, Geometric - Continuous Distributions- Uniform, Exponential, Normal distributions- Application of Distribution in Engineering Problems

UNIT III	TWO - DIMENSIONAL RANDOM VARIABLES	12 Hours

Joint distributions – Marginal and conditional distributions – Covariance – Correlation and Linear regression

UNIT IV	MARKOV PROCESSES AND MARKOV CHAINS	12 Hours

Classification – Stationary process – Markov process – Markov chains, transition probabilities – Limiting distributions – Poisson process.

UNIT V	SPECTRAL DENSITIES AND LINEAR SYSTEMS WITH RANDOM INPUTS	12 Hours

Auto correlation-cross correlation, power spectral density, cross spectral density, Properties-Wiener-Khintchine relation-relationship between cross power spectrum and correlation function. Linear time invariant system- system transfer function, Linear system with random inputs, White noise.

Total:	45+15 Hours

Further Reading:

Probabilistic manner which evolve with time

- Discrete time Markov chains in modeling Electronic systems.

Course Outcomes:

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

1. To apply basic probability techniques to analyze the performance of Electronic systems.(K3)
2. To apply standard distributions in describing real life phenomena.(K3)
3. To solve problems involving more than one random variable.(K3)
4. To apply probability technique which evolve with respect to time.(K3)
5. To interpret the response of random input to linear time invariant systems. (K3)

Text Books:

1. O.C. Ibe, Fundamentals of Applied Probability and Random Processes, Elsevier, 1st Indian Reprint, 2007
2. H. Pishro-Nik, "Introduction to probability, statistics, and random processes",2014.

References:

1. D. Gross and C.M. Harris, Probability and random processes, WileyStudent edition, 2004.
2. Yates. R.D. and Goodman. D.J., "Probability and Stochastic Processes", 2nd Edition, Wiley India Pvt. Ltd., Bangalore, 2012.
3. Stark. H., and Woods. J.W., "Probability and Random Processes with Applications to Signal Processing", 3rd Edition,Pearson Education, Asia, 2002.
4. Miller. S.L. and Childers. D.G., "Probability and Random Processes with Applications to Signal Processing and Communications", Academic Press, 2004.

1902BM401		**Bio Mechanics**	**L**	**T**	**P**	**C**
			3	**0**	**0**	**3**
		(For B.E, BME)				

Course Objectives: The student should be made to:

- To explain the principle of mechanics.
- Discuss the mechanics of physiological systems.
- Explain the mechanics of joints.
- Illustrate the mathematical models used in the analysis of biomechanical systems.
- Tounderstand about Kinetics and kinematics.

UNIT I **INTRODUCTION TO MECHANICS** **9 Hours**

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

UNIT II **BIOFLUID MECHANICS** **9 Hours**

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

UNIT III **BIOSOLID MECHANICS** **9 Hours**

Constitutive equation of viscoelasticity – Maxwell &Voight models, anisotropy, Hard Tissues – Structure, blood circulation, elasticity and strength, viscoelastic properties, functional adaptation, Soft Tissues – Structure, functions, material properties and modeling of Soft Tissues – Cartilage, Tendons and Ligaments Skeletal Muscle – Muscle action, Hill's models, mathematical modeling, Bone fracture mechanics, Implants for bone fractures.

UNIT IV **BIOMECHANICS OF JOINTS** **9 Hours**

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

UNIT V **MODELING AND ERGONOMICS** **9 Hours**

Introduction to Finite Element Analysis, finite element analysis of lumbar spine; Ergonomics – Musculoskeletal disorders, Ergonomic principles contributing to good workplace design, Design of a Computer work station, Whole body vibrations, Hand transmitted vibrations. T

Total: 45 Hours

Further Readings:

Basic orthopaedic biomechanics & mechano-biology, Mechanical tribology : materials, characterization, and applications

Course Outcomes:

After completion of the course, Student will be able to

1. Understand the principles of mechanics.
2. Outline the principles of biofluid dynamics.
3. Explain the fundamentals of bio-solid mechanics.
4. Apply the knowledge of joint mechanics.
5. Give Examples of computational mathematical modelling applied in biomechanics.

TextBooks:

1. Y.C. Fung, ―Bio-Mechanics- Mechanical Properties of Tissues‖, Springer-Verlag, 1998.
2. Subrata Pal, ―Textbook of Biomechanics‖, Viva Books Private Limited, 2009.

References:

1. Krishna B. Chandran, Ajit P. Yoganathan and Stanley E. Rittgers, ―Biofluid Mechanics: The Human Circulation‖, Taylor and Francis, 2007.
2. Sheraz S. Malik and Shahbaz S. Malik, ―Orthopaedic Biomechanics Made Easy‖, Cambridge University Press, 2015
3. Jay D. Humphrey, Sherry De Lange, ―An Introduction to Biomechanics: Solids and Fluids, Analysis and Design‖, Springer Science Business Media, 2004.

4. Shrawan Kumar, ―Biomechanics in Ergonomics‖, Second Edition, CRC Press 2007
5. Neil J. Mansfeild, ―Human Response to Vibration‖, CRC Press, 2005.

1902BM402		BASICS OF PATHOLOGY AND MICROBIOLOGY	L	T	P	C
			3	0	0	3

Course Objectives:

1. To understand the structural and functional aspects of living organisms.
2. To know the etiology and remedy in treating the pathological diseases.
3. To practice on chemical and structural examinations.
4. To know about the microbial cultures.
5. To learn about the antibody reactions and diseases caused by microbes.

UNIT I **CELL DEGENERATION, REPAIR AND NEOPLASIA** **9 Hours**

Cellinjury and Necrosis- Apoptosis, Intracellular accumulations, Pathological calcification- cellular adaptations of growth and differentiation, Inflammation and Repair including fracture healing, Neoplasia- Classification, Benign and Malignant tumours, carcinogenesis, spread of tumours. Autopsy and biopsy.

UNIT II **FLUID AND HEMODYNAMIC DERRANGEMENTS** **9 Hours**

Edema- normal hemostasis- thrombosis, disseminated intravascular coagulation, embolism, infarction, shock. Hematological disorders-Bleeding disorders, Leukaemias, Lymphomas.

UNIT III **MICROSCOPES** **9 Hours**

Light microscope – bright field, dark field, phase contrast, fluorescence, Electron microscope (TEM& SEM). Preparation of samples for electron microscope. Staining methods – simple, gram staining and AFB staining. Parts of compound microscope- Flow cytometry and its applications.

UNIT IV **MICROBIAL CULTURES** **9 Hours**

Morphological features and structural organization of bacteria- growth curve, Sterilization techniques – physical and chemical methods, identification of bacteria, culture media and its types, culture techniques and observation of culture.

UNIT V **IMMUNOLOGY** **9 Hours**

Natural and artificial immunity- opsonization- phagocytosis, inflammation, Immune deficiency syndrome, antibodies and its types, antigen and antibody reactors, immunological techniques-immune diffusion, immuno electrophoresis, radioimmunoassay and enzyme linked immune sorbent assay, monoclonal antibodies. Disease caused by bacteria, fungi, protozoal, virus and helminths.

Total: 45 Hours

Further Reading:

- Comprehend and appreciate the significance and role of this course in the present contemporary world.
- Analyze structural and functional aspects of living organisms.
- Explain the function of microscopes.
- Discuss on the importance of public health.
- Describe treatment methods involved in curing the pathological diseases.

Course Outcomes:

After completion of the course, Student will be able to

1. Analyze structural and functional aspects of living organisms
2. Explain the function of microscopes.
3. Discuss on the importance of public health.
4. Describe treatment methods involved in curing the pathological diseases.
5. Perform practical experiments on tissue processing, sterilization techniques and staining processes

Text Books:

1. Harsh Mohan, “Text book of Pathology”. Jaypee Brothers Medical publishers private Limited, 7th Edition, 2014.
2. Anantha Narayanan, “Text Book of Microbiology”,Orient Longman,6th edition,2012.

References:

1. Ramzi S Cotran, Vinay Kumar & Stanley L Robbins, “Pathologic Basis of diseases”, WB Saunders Co. 7th Edition, 2005.
2. Underwood JCE, “General and Systematic Pathology”, Churchill Livingstone, 3rd, Edition, 2000.
3. Ananthanarayanan, “Microbiology”, Panicker University press. 9th Edition, 2013
4. Prescott, Harley,Klein, “Microbiology”, Mc Graw Hill, 9th Edition, 2013.

1902BM403		CONTROL SYSTEMS	L	T	P	C
			3	0	0	4

Course Objectives:

1. In this course it is aimed to introduce to the students the principles and applications of control systems.
2. To the basic concepts of block diagram reduction, time domain analysis solutions to time invariant systems.
3. In deals with the different aspects of stability analysis of systems in frequency domain and time domain.
4. To understand the application of control system.
5. In this course it is aimed to introduce to the students the principles and applications of control systems.

UNIT I	INTRODUCTION OF CONTROL SYSTEMS	9 Hours

Basic concept of control systems - Open loop, closed loop control systems and their differences,Block diagram algebra, Representation by signal flow graph - Reduction using Mason's gain formula - Feedback characteristics and effect of feedback

UNIT II	TIME RESPONSE ANALYSIS	9 Hours

Time response analysis - Time response of first order system, Transient response of second order system, Time domain specification - steady state response, Steady state error,Effect of proportional, derivatives, Proportionalintegral system

UNIT III	FREQUENCY RESPONSE ANALYSIS	9 Hours

Frequency response - Frequency domain specification,stability analysis frombode plot, polar plot, Nyquist plot - Compensation techniques - Lag,Lead, lead-lag controllers design in frequency domain.

UNIT IV	STABILITY ANALSIS AND ROOT LOCUS TECHNIQUES	9 Hours

Concept of stability - Routh Hurwitz criterion,Nyquist stability criterion - Routh locus concept - construction of root locus

UNIT V	APPLICATIONS OF CONTROL SYSTEMS	9 Hours

Aircraft flight control systems - Director(military) , Embedded instrumentation - Fire control system - Guidance navigation and control - Laser ignition - Weight shift control

Total:	45 Hours

Further Reading:

- Biocontrol and disease modelling

Course Outcomes:

After completion of the course, Student will be able to

1. Have a better understanding on open loop and closed loop control system, concept of feedback in control systems.
2. Transfer function representation through block diagram algebra and signal flow graph, time response analysis.
3. Frequency response analysis through bode plot, polar plot, Nyquist plot and basics of state space analysis.
4. Better understanding on root locus techniques.
5. Apply control system concepts on real time applications.

Text Books:

1. I.J.Nagrath,Madan Gopal "Text book of control system Engineering" by,New Age International, 2008
2. B.S.Manke, "Control system design",Stylus publishing,2017.

References:

1. Automatic control systems, third edition, Benjamin C.Kuo.
2. Control and Dynamical Systems,Karl Johan Aström ˚ Richard M. Murray, Version v2.10c (March 4, 2010),princeton university press.
3. Modern Control Systems, twelfth edition, Richard C. Dorf University of California, Davis, Robert H. Bishop Marquette University.
4. Katshuikoogata, "Modern Control engineering", 5th edition, 2012

1902BM404		BIOMEDICAL INSTRUMENTATION	L	T	P	C
			3	0	0	3

Course Objectives:

1. To understand the basic theory of Bio potential Electrodes and Bio potential measurement.
2. To Understand the design of Bio potential amplifiers.
3. To know about bioelectric signals and amplifiers
4. To analyse the biomedical recording systems
5. Study the various non-electrical physiological measurement and bio chemical measurements.

UNIT I	BIOPOTENTIAL ELECTRODES	9 Hours

Origin of bio potential and its propagation. Electrode-electrolyte interface, electrode–skin interface, half-cell potential, Contact impedance, polarization effects of electrode – non polarizable electrodes. Types of electrodes - surface, needle and micro electrodes and their equivalent circuits. Recording problems - motion artifacts, measurement with two electrodes.

UNIT II	BIOPOTENTIAL MEASUREMENTS	9 Hours

Bio signals characteristics – frequency and amplitude ranges. ECG – Einthoven‘s triangle, standard 12 lead system, Principles of vector cardiography.EEG – 10-20 electrode system, unipolar, bipolar and average mode. EMG– unipolar and bipolar mode. Recording of ERG, EOG and EGG

UNIT III	BIOELECTRIC AMPLIFIERS	9 Hours

Need for bio-amplifier - single ended bio-amplifier, differential bio-amplifier, Impedance matching circuit, isolation amplifiers – transformer and optical isolation - isolated DC amplifier and AC carrier amplifier., Power line interference, Right leg driven ECG amplifier, Band pass filtering

UNIT IV	MEASUREMENT OF NON-ELECTRICAL PARAMETERS	9 Hours

Temperature, respiration rate and pulse rate measurements. Blood Pressure: indirect methods -Auscultatory method, oscillometric method, direct methods: electronic manometer, Pressure amplifiers, Systolic, diastolic, mean detector circuit. Blood flow and cardiac output measurement: Indicator dilution, thermal dilution and dye dilution method, Electromagnetic and ultrasound blood flow measurement.

UNIT V	PATIENT MONITORING SYSTEMS	9 Hours

System concepts- Cardiac monitor-selection of system parameters, Bedside monitors, Central monitors, Heart rate meter, Pulse rate meter, sphygmomanometers- Holtermonitor and Cardiac stress test, Cardiac cauterization instrumentation-Organization and equipment used in ICCU & ITU.

Total:	45 Hours

Further Reading:

- Medical Imaging,Biomedical Image Processing.

Course Outcomes:

After completion of the course, Student will be able to

1. Comprehend and appreciate the significance and role of this course in the present contemporary world.
2. Describe the fundamentals of Bio potential recording.
3. Design various bio amplifiers.
4. Measure various physiological and bio chemical parameters.
5. Understand the concepts of patient monitoring systems.

Text Books:

1. Joseph J. Carr and John M. Brown, “Introduction to Biomedical equipment technology”, Pearson Education, 4th Edition, 2014.
2. R.S.Khandphur, “ Handbook on Biomedical Instrumentation”, 2014

References:

1. John G.Webster, “Medical Instrumentation Application and Design”, John Wiley and Sons, New York, 4th Edition, 2009.
2. Khandpur R.S, “Handbook of Biomedical Instrumentation”, Tata McGraw Hill, New Delhi, 3rd Edition, 2014.
3. L.A Geddes and L.E.Baker, “Principles of Applied Biomedical Instrumentation”, John Wiley and Sons, 3rd Edition, Reprint 2008.
4. Leslie Cromwell, Fred J. Weibell, Erich A. Pfeiffer, Biomedical Instrumentation and Measurements, Pearson Education India, 2nd Edition, 2015.
5. Myer Kutz, “Standard Handbook of Biomedical Engineering & Design”, McGraw-Hill Publisher, 2003.

1902BM405		DIGITAL ELECTRONICS AND INTEGRATED CIRCUITS	L	T	P	C
			3	0	0	4

Course Objectives:

1. To study the circuit configuration and introduce practical applications of linear integrated circuits.
2. To introduce the concept of application of ADC and DAC in real time systems and Phase Locked loop with applications.
3. To introduce the number systems and Logic gates.
4. To analyse combinational logic circuits.
5. To bring out the analysis and design procedures for sequential circuits.

UNIT I	INTRODUCTION TO OPERATIONAL AMPLIFIER AND ITS APPLICATIONS	9 Hours

Operational amplifier –ideal characteristics, Performance Parameters, Linear and Nonlinear Circuits and their analysis-voltage follower, Inverting amplifier, Noninverting Amplifiers, Differentiator, Integrator, Voltage to Current converter, Instrumentation amplifier- Low pass, High pass filter and band pass filters, Comparator-Multivibrator and Schmitt trigger- Triangular wave generator.

UNIT II	DIGITAL TO ANALOG AND ANALOG TO DIGITAL CONVERTERS	9 Hours

Analog switches- High speed sample and hold circuit and IC's,-Types of D/A converter -Weighted resistor, R-2R ladder DAC, D/A Accuracy and Resolution. A/D converter - Flash, Dual slope, Successive approximation, A/D Accuracy and Resolution. Voltage controlled oscillator -Voltage to Frequency converters.

UNIT III	THE BASIC GATES ANDCOMBINATIONAL LOGIC CIRCUITS	9 Hours

Number Systems – Decimal, Binary, Octal, Hexadecimal, 1's and 2's complements, Codes – Binary, BCD, 84-2-1, 2421, Excess 3, Biquinary, Gray, Alphanumeric codes, Boolean theorems, Logic gates, Universal gates, Sum of products and product of sums, Minterms and Maxterms, Karnaugh map and Tabulation methods.

UNIT IV	COMBINATIONAL LOGIC CIRCUITS	9 Hours

Problem formulation and design of combinational circuits - Code-Converters, Half and Full Adders, Binary Parallel Adder – Carry look ahead Adder, BCD Adder, Magnitude Comparator, Decoder, Encoder, Priority Encoder, Mux/Demux, Implementation of combinational logic using standard ICs- ROM, PLA and PAL.

UNIT V	SEQUENTIAL LOGIC CIRCUITS	9 Hours

Flip flops – SR, JK, T, D, Master/Slave FF, Triggering of FF, Analysis and design of clocked sequential circuits – state minimization, state assignment, circuit implementation. Counters, Ripple Counters, Ring Counters.

Total:	45 Hours

Further Reading:

- Study aboutTimer IC 555,Monolithic PLL IC 565, IC 723 general purpose regulator

Course Outcomes:

After completion of the course, Student will be able to

1. Ability to design new analog linear circuits and develop linear IC based Systems.
2. Understand the concept of application of ADC and DAC in real time systems and Phase Locked Loop with applications.
3. Use Boolean algebra and apply it to digital systems.
4. Design various combinational digital circuits using logic gates.
5. Bring out the analysis and design procedures for synchronous and asynchronous sequential circuits.

Text Books:

1. ChoudaryD.Roy, Linear integrated circuits, New age international Publishers, 2018
2. Ken Martin, "Digital Integrated circuit design", Oxford University press,2012.

References:

1. Sergio Franco, "Design with operational amplifiers and analog integrated circuits", Mc Graw Hill Education, 3rd Edition, 2017.
2. M. Morris Mano and Michael D.Ciletti, "Digital Design", Pearson, 5th Edition, 2013.
3. Charles H.Roth, Jr, "Fundamentals of Logic Design", Jaico Books, 7th Edition, 2013.
4. Gray and Meyer, "Analysis and Design of Analog Integrated Circuits", Wiley International, 2009.

1901MCX01		ENVIRONMENTAL SCIENCE AND ENGINEERING	L	T	P	C
			3	0	0	3
		(For B.E.,BME)				

Course Objectives:	The student should be made to:
	1. To study the nature and facts about environment.
	2. To finding and implementing scientific, technological, economic and political solutions to environmental problems
	3. To study the interrelationship between living organism and environment.
	4. To appreciate the importance of environment by assessing its impact on the human world; envision the surrounding environment, its functions and its value.
	5. To study the dynamic processes and understand the features of the earth‟s interior and surface

UNIT I	ENVIRONMENT, ECOSYSTEMS AND BIODIVERSITY	9 Hours

Definition, scope and importance of environment – need for public awareness - concept of an ecosystem – structure and function of an ecosystem – producers, consumers and decomposers – energy flow in the ecosystem – ecological succession – food chains, food webs and ecological pyramids – Introduction, types, characteristic features, structure and function of the (a) forest ecosystem (b) grassland ecosystem (c) desert ecosystem (d) aquatic ecosystems (ponds, streams, lakes, rivers, oceans, estuaries) – Introduction to biodiversity definition: genetic, species and ecosystem diversity – biogeographical classification of India – value of biodiversity: consumptive use, productive use, social, ethical, aesthetic and option values – Biodiversity at global, national and local levels – India as a mega-diversity nation – hot-spots of biodiversity – threats to biodiversity: habitat loss, poaching of wildlife, man-wildlife conflicts – endangered and endemic species of India – conservation of biodiversity: In-situ and ex-situ conservation of biodiversity. Field study of common plants, insects, birds; Field study of simple ecosystems – pond, river, hill slopes, etc

UNIT II	ENVIRONMENTAL POLLUTION	9 Hours

Definition – causes, effects and control measures of: (a) Air pollution (b) Water pollution (c) Soil pollution (d) Marine pollution (e) Noise pollution (f) Thermal pollution (g) Nuclear hazards – solid waste management: causes, effects and control measures of municipal solid wastes – role of an individual in prevention of pollution – pollution case studies – disaster management: floods, earthquake, cyclone and landslides. Field study of local polluted site – Urban / Rural / Industrial / Agricultural.

UNIT III	NATURAL RESOURCES	9 Hours

Forest resources: Use and over-exploitation, deforestation, case studies- timber extraction, mining, dams and their effects on forests and tribal people – Water resources: Use and over- utilization of surface and ground water, floods, drought, conflicts over water, dams-benefits and problems – Mineral resources: Use and exploitation, environmental effects of extracting and using mineral resources, case studies – Food resources: World food problems, changes caused by agriculture and overgrazing, effects of modern agriculture, fertilizer-pesticide problems, water logging, salinity, case studies – Energy resources: Growing energy needs, renewable and non renewable energy sources, use of alternate energy sources. case studies – 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. Field study of local area to document environmental assets – river / forest / grassland / hill / mountain.

UNIT IV	SOCIAL ISSUES AND THE ENVIRONMENT	9 Hours

From unsustainable to sustainable development – urban problems related to energy – water conservation, rain water harvesting, watershed management – resettlement and rehabilitation of people; its problems and concerns, case studies – role of non-governmental organization- environmental ethics: Issues and possible solutions – climate change, global warming, acid rain, ozone layer depletion, nuclear accidents and holocaust, case studies. – wasteland reclamation – consumerism and waste products – environment production act – Air (Prevention and Control of Pollution) act – Water (Prevention and control of Pollution) act – Wildlife protection act – Forest conservation act – enforcement machinery involved in environmental legislation- central and state pollution control boards- Public awareness.

UNIT V	HUMAN POPULATION AND THE ENVIRONMENT	9 Hours

, Population growth, variation among nations – population explosion – family welfare programme – environment and human health – human rights – value education – HIV / AIDS – women and child welfare – role of information technology in environment and human health – Case studies

	Total:	45 Hours

Further Reading:	
	Analyze the continuous pollution signals & systems and its biosignal applications.

Course Outcomes:	
	After completion of the course, Student will be able to
	1. Environmental Pollution or problems cannot be solved by mere laws. Public participation is an important aspect which serves the environmental Protection.
	2. Public awareness of environmental is at infant stage.
	3. Development and improvement in std. of living has lead to serious environmental disasters
	4. Ignorance and incomplete knowledge has lead to misconceptions

Text Book:
1. Benny Joseph, _Environmental Science and Engineering‘, Tata McGraw-Hill, New Delhi, 2006.
2. Gilbert M.Masters, _Introduction to Environmental Engineering and Science‘, 2nd edition, Pearson Education, 2004.

References:
1. Benny Joseph, _Environmental Science and Engineering‘, Tata McGraw-Hill, New Delhi, 2006.
2. Dharmendra S. Sengar, _Environmental law‘, Prentice hall of India PVT LTD,New Delhi, 2007.
3. 2. Erach Bharucha, ―Textbook of Environmental Studies‖, Universities Press(I) PVT, LTD, Hydrabad, 2015
4. Rajagopalan, R, _Environmental Studies-From Crisis to Cure‘, Oxford University Press, 2005.
5. G. Tyler Miller and Scott E. Spoolman, ―Environmental Science‖, Cengage Learning India PVT, LTD, Delhi, 2014.

1902BM451		PATHOLOGY AND MICROBIOLOGY LABORATORY	L	T	P	C
			0	0	4	2

Course Objectives:

1. The student should learn how to use Compound microscope, Practice on chemical examinations
2. To learn how to use Cryoprocessing, Histopathological examinations
3. To understand the concepts of staining
4. Microscopic visualisation of the microorganisms for disease determination.
5. Practical explanation of techniques used in tissue processing

List of Experiments:

1. Study of bone marrow charts.
2. Steam Sterilization using Autoclave
3. Manual paraffin tissue processing and section cutting
4. Cryo processing of tissue and cryosectioning
5. Basic staining – Hematoxylin and eosin staining.
6. Special stains – Cresyl Fast Blue (CFV)- Trichrome – oil red O – PAS
7. Simple stain, Gram stain, AFB stain.
8. Slides of malarial parasites, micro filaria and leishmania donovani.
9. Haematology slides of anemia and leukemia.
10. Urine physical and chemical examination (protein, reducing substances, ketones, bilirubin and blood)

Additional Experiments:

1. Histopathological slides of benign and malignant tumours.
2. Differential count of different WBCs and blood group identification.

Course Outcomes:

After completion of the course, Student will be able to

1. List the laboratory tests performed for urine analysis.
2. Staining procedures are explained completely for the identification of microorganisms.
3. Practical knowledge about microscopes.
4. Explains the bleeding and clotting time for analysis of the fluid in the body.
5. Practical description about the structure and organisation of microorganisms andpathogens.

Text book:

1. Harsh Mohan, “Text book of Pathology”. Jaypee Brothers Medical publishers private Limited, 7th Edition, 2014.

References:

1. “Molecular Pathology: The Molecular Basis of Human Disease” by William B Coleman and Gregory J Tsongalis
2. Ramzi S Cotran, Vinay Kumar & Stanley L Robbins, “Pathologic Basis of diseases”, WB Saunders Co. 7th Edition, 2005.
3. Underwood JCE, “General and Systematic Pathology”, Churchill Livingstone, 3rd, Edition, 2000.

1902BM452		BIO MEDICAL INSTRUMENTATION LABORATORY	L	T	P	C
			0	0	4	2

Course Objectives:

1. To study and design Bio amplifiers.
2. To provide hands on training on Measurement of physiological parameters.
3. To study about blood flow and blood measurement
4. To understand about patient monitoring system
5. To study about pH meter

List of Experiments:

1. Design of low noise pre-amplifier
2. Recording of ECG signal and analysis using Simulation
3. Simulation and analysis of EMG amplifier.
4. Simulation and analysis of EEG with Simulation
5. Measurement of respiration rate.
6. Measurement of blood flow velocity using ultrasound transducer.
7. Measurement of blood pressure using sphygmomanometer.
8. Study of characteristics of Baby Ventilator.
9. Measurement of vital parameters using Patient Monitoring System
10. Measurement of Hydrogen Ion using pH Meter

Additional Experiments:

1. Understand & Implement Isolation Techniques in designing Biomedical Instruments
2. Measurement of vital parameters using patient Monitoring Systems

Course Outcomes:

After completion of the course, Student will be able to

1. Design the amplifier for Bio signal measurements .
2. Measure heart rate and heart sounds.
3. Record and analyze pulse rate and respiration rate.
4. Measure blood pressure and blood flow.
5. Design isolation amplifier.

Text Book:

1. "Principles of Biomedical Instrumentation and Measurement" by Richard Aston

References:

1. Medical Instrumentation – Application and Design" by John G Webster
2. "Transducers for Biomedical Measurements: Principles and Applications" by Richard S C Cobbold
3. Measurement Systems, Application and Design" by Ernest O Doeblin

1902BM453		ANALOG AND DIGITAL AND INTEGRATED CIRCUITS LABORATORY	L	T	P	C
			0	0	4	2

Course Objectives:

1. To design digital logic and circuits
2. To learn the function of different ICs
3. To understand the applications of operation amplifier.
4. To learn the working of multivibrators
5. To design circuits for generating waveforms using ICs.

List of Experiments:

1. Inverting, non-inverting amplifier and comparator
2. Integrator and Differentiator
3. Design and analysis of active filters using op-amp
4. Schmitt trigger using operational amplifier
5. Instrumentation amplifier using operational amplifier
6. Phase shift oscillators
7. Multivibrators using IC555 Timer
8. Study of logic gates, Half adder and Full adder
9. Universal shift register using flip flops
10. Multiplexer and demultiplexer using digital ICs

Additional Experiments:

1. Design of mod-N counter
2. Simulation and analysis of circuits using software

Course Outcomes:

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

1. Design Combinational Circuits using logic gates CO2: CO3: CO4: CO5:
2. Design and implement arithmetic circuits for different applications using opamp
3. Design Sequential Circuits using logic gates
4. Design wave form generators and analyse their characteristics
5. Simulate and analyse circuits using ICs

Text Book:

1. M.MorrisMano,"DigitalDesign",4th Edition,PrenticeHallofIndiaPvt.Ltd.,2008/Pearson Education (Singapore)Pvt.Ltd., NewDelhi,2003

References:

1. Ronald J. Tocci, Neal S. Widmer & Gregory L. Moss, "Digital Systems: Principles and Applications", 10th Edition, Pearson Prentice Hall, 2007
2. Joseph Cavanagh, "Verilog HDL: Digital Design and Modeling", Taylor & Francis, 2007
3. John F.Wakerly, "DigitalDesign",FourthEdition,Pearson/PHI,2008