JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD

B.TECH. BIO-MEDICAL ENGINEERING

COURSE STRUCTURE AND SYLLABUS (2016-17)

II YEAR I SEMESTER

S. No	Course Code	Course Title	L	T	P	Credits
1	MA301BS	Mathematics - IV	4	1	0	4
2	EI302ES	Electronic Devices and Circuits	4	0	0	4
3	EI303ES	Signals and Systems	4	0	0	4
4	CH304BS	Applied Biochemistry	3	0	0	3
5	BM305ES	Bioelectricity	3	0	0	3
6	EC306ES	Electronic Devices and Circuits Lab	0	0	3	2
7	BM308ES	Medical Sciences and Biochemistry Lab	0	0	3	2
8	EC307ES	Basic Simulation Lab	0	0	3	2
9	*MC300ES	Environmental Science and Technology	3	0	0	0
		Total Credits	**21**	**1**	**9**	**24**

II YEAR II SEMESTER

S. No	Course Code	Course Title	L	T	P	Credits
1	BM401ES	Biomedical Equipment	4	0	0	4
2	EI402ES	Digital Logic and Pulse Circuits	4	0	0	4
3	BM403ES	Bio Transducers and Applications	4	0	0	4
4	BM404ES	Clinical Sciences	3	0	0	3
5	SM405MS	Business Economic and Financial Analysis	3	0	0	3
6	BM406ES	Biomedical Equipment Lab	0	0	3	2
7	EI407ES	Digital Logic and Pulse Circuits Lab	0	0	3	2
8	BM408ES	Bio Transducers and Applications Lab	0	0	3	2
9	*MC400HS	Gender Sensitization Lab	0	0	3	0
		Total Credits	**18**	**0**	**12**	**24**

*** Satisfactory / Unsatisfactory**

MA301BS: MATHEMATICS - IV
(Complex Variables and Fourier Analysis)

B.Tech. II Year I Sem.

L	T	P	C
4	1	0	4

Prerequisites: Foundation course (No Prerequisites)**.**

Course Objectives: To learn

- differentiation and integration of complex valued functions
- evaluation of integrals using Cauchy's integral formula
- Laurent's series expansion of complex functions
- evaluation of integrals using Residue theorem
- express a periodic function by Fourier series and a non-periodic function by Fourier transform
- to analyze the displacements of one dimensional wave and distribution of one dimensional heat equation

Course Outcomes: After learning the contents of this paper the student must be able to

- analyze the complex functions with reference to their analyticity, integration using Cauchy's integral theorem
- find the Taylor's and Laurent's series expansion of complex functions
- the bilinear transformation
- express any periodic function in term of sines and cosines
- express a non-periodic function as integral representation
- analyze one dimensional wave and heat equation

UNIT–I

Functions of a complex variable: Introduction, Continuity, Differentiability, Analyticity, properties, Cauchy, Riemann equations in Cartesian and polar coordinates**.** Harmonic and conjugate harmonic functions-Milne-Thompson method

UNIT-II

Complex integration: Line integral, Cauchy's integral theorem, Cauchy's integral formula, and Generalized Cauchy's integral formula, Power series: Taylor's series- Laurent series, Singular points, isolated singular points, pole of order m – essential singularity, Residue, Cauchy Residue theorem (Without proof).

UNIT–III

Evaluation of Integrals: Types of real integrals:

(a) Improper real integrals $\int_{-\infty}^{\infty} f(x)dx$ (b) $\int_{c}^{c+2\pi} f(\cos\theta, \sin\theta)d\theta$

Bilinear transformation- fixed point- cross ratio- properties- invariance of circles.

UNIT–IV

Fourier series and Transforms: Introduction, Periodic functions, Fourier series of periodic function, Dirichlet's conditions, Even and odd functions, Change of interval, Half range sine and cosine series.

Fourier integral theorem (without proof), Fourier sine and cosine integrals, sine and cosine, transforms, properties, inverse transforms, Finite Fourier transforms.

UNIT–V

Applications of PDE: Classification of second order partial differential equations, method of separation of variables, Solution of one dimensional wave and heat equations.

TEXT BOOKS:

1. A first course in complex analysis with applications by Dennis G. Zill and Patrick Shanahan, Johns and Bartlett Publishers.
2. Higher Engineering Mathematics by Dr. B. S. Grewal, Khanna Publishers.
3. Advanced engineering Mathematics with MATLAB by Dean G. Duffy

REFERENCES:

1. Fundamentals of Complex Analysis by Saff, E. B. and A. D. Snider, Pearson.
2. Advanced Engineering Mathematics by Louis C. Barrett, McGraw Hill.

EI302ES: ELECTRONIC DEVICES AND CIRCUITS

B.Tech. II Year I Sem.

L	T	P	C
4	0	0	4

Pre-requisites: Nil.

Course Objectives: This is a fundamental course, basic knowledge of which is required by all the circuit branch engineers. This course focuses:

- To familiarize the student with the principle of operation, analysis and design of Junction diode, BJT and FET amplifier circuits, transistors and field effect transistors.
- To understand diode as rectifier.
- To study basic principle of filter circuits and various types.

Course Outcomes: At the end of the course, the student will be able to:

- Understand and Analyse the different types of diodes, operation and its characteristics
- Design and analyse the DC bias circuitry of BJT and FET
- Design biasing circuits using diodes and transistors.
- To analyze and design diode application circuits, amplifier circuits and oscillators employing BJT, FET devices.

UNIT - I

P-N Junction Diode: Qualitative Theory of P-N Junction, P-N Junction as a Diode, Diode Equation, Volt-Ampere Characteristics, Temperature dependence of VI characteristic, Ideal versus Practical – Resistance levels (Static and Dynamic), Transition and Diffusion Capacitances, Diode Equivalent Circuits, Load Line Analysis, Breakdown Mechanisms in Semiconductor Diodes, Zener Diode Characteristics.

Special Purpose Electronic Devices: Principle of Operation and Characteristics of Tunnel Diode (with the help of Energy Band Diagram), Varactor Diode, SCR and Semiconductor Photo Diode.

UNIT - II

Rectifiers and Filters: The P-N junction as a Rectifier, Half wave Rectifier, Full wave Rectifier, Bridge Rectifier, Harmonic components in a Rectifier Circuit, Inductor Filters, Capacitor Filters, L- Section Filters, π- Section Filters, Comparison of Filters, Voltage Regulation using Zener Diode.

UNIT - III

Bipolar Junction Transistor and UJT: The Junction Transistor, Transistor Current Components, Transistor as an Amplifier, Transistor Construction, BJT Operation, BJT Symbol, Common Base, Common Emitter and Common Collector Configurations, Limits of Operation , BJT Specifications, BJT Hybrid Model, Determination of h-parameters from

Transistor Characteristics, Comparison of CB, CE, and CC Amplifier Configurations, UJT and Characteristics.

UNIT - IV

Transistor Biasing and Stabilization: Operating Point, The DC and AC Load lines, Need for Biasing, Fixed Bias, Collector Feedback Bias, Emitter Feedback Bias, Collector - Emitter Feedback Bias, Voltage Divider Bias, Bias Stability, Stabilization Factors, Stabilization against variations in V_{BE} and β, Bias Compensation using Diodes and Transistors, Thermal Runaway, Thermal Stability, Analysis of a Transistor Amplifier Circuit using h-Parameters.

UNIT - V

Field Effect Transistor: The Junction Field Effect Transistor (Construction, principle of operation, symbol) – Pinch-off Voltage - Volt-Ampere characteristics, The JFET Small Signal Model, MOSFET (Construction, principle of operation, symbol), MOSFET Characteristics in Enhancement and Depletion modes.

TEXT BOOKS:

1. Millman's Electronic Devices and Circuits – J. Millman, C. C. Halkias, and Satyabrata Jit, 2 Ed., 1998, TMH.
2. Electronic Devices and Circuits – David A. Bell, 5 Ed, Oxford
3. Electronic Devices and Circuits – Mohammad Rashid, Cengage Learning, 2013

REFERENCE BOOKS:

1. Integrated Electronics – J. Millman and Christos C. Halkias, 1991 Ed., 2008, TMH.
2. Electronic Devices and Circuits – R.L. Boylestad and Louis Nashelsky, 9 Ed., 2006, PEI/PHI.
3. Electronic Devices and Circuits – B. P. Singh, Rekha Singh, Pearson, 2 Edn, 2013.
4. Electronic Devices and Circuits – Anil K. Maini, Varsha Agarwal, 1Ed, 2009, Wiley India Pvt. Ltd.

EI303ES: SIGNALS AND SYSTEMS

B.Tech. II Year I Sem.

L	T	P	C
4	0	0	4

Pre-requisites: Nil.

Course Objectives: This is a core subject, basic knowledge of which is required by all the engineers. This course focuses to get an in-depth knowledge about signals, systems and analysis of the same using various transforms.

Course Outcomes: Upon completing this course the student will be able to:

- Represent any arbitrary signals in terms of complete sets of orthogonal functions and understands the principles of impulse functions, step function and signum function.
- Express periodic signals in terms of Fourier series and express the spectrum and express the arbitrary signal (discrete) as Fourier transform to draw the spectrum.
- Understands the principle of linear system, filter characteristics of a system and its bandwidth, the concepts of auto correlation and cross correlation and power Density Spectrum.
- Can design a system for sampling a signal.
- For a given system, response can be obtained using Laplace transform, properties and ROC of L.T.
- Study the continuous and discrete signal relation and relation between F.T., L.T. & Z.T, properties, ROC of Z Transform.

UNIT - I

Signal Analysis and Fourier Series: Signal Analysis: Analogy between Vectors and Signals, Orthogonal Signal Space, Signal approximation using Orthogonal functions, Mean Square Error, Closed or complete set of Orthogonal functions, Orthogonality in Complex functions, Exponential and Sinusoidal signals, Concepts of Impulse function, Unit Step function, Signum function.

Fourier Series: Representation of Fourier series, Continuous time periodic signals, Properties of Fourier Series, Dirichlet's conditions, Trigonometric Fourier Series and Exponential Fourier Series, Complex Fourier spectrum.

UNIT - II

Fourier Transforms and Sampling: Fourier Transforms: Deriving Fourier Transform from Fourier Series, Fourier Transform of arbitrary signal, Fourier Transform of standard signals, Fourier Transform of Periodic Signals, Properties of Fourier Transform, Fourier Transforms involving Impulse function and Signum function, Introduction to Hilbert Transform.

Sampling: Sampling theorem – Graphical and analytical proof for Band Limited Signals, Types of Sampling - Impulse Sampling, Natural and Flat top Sampling, Reconstruction of

signal from its samples, Effect of under sampling – Aliasing, Introduction to Band Pass sampling.

UNIT - III

Signal Transmission Through Linear Systems: Linear System, Impulse response, Response of a Linear System, Linear Time Invariant (LTI) System, Linear Time Variant (LTV) System, Transfer function of a LTI system, Filter characteristics of Linear Systems, Distortion less transmission through a system, Signal bandwidth, System bandwidth, Ideal LPF, HPF and BPF characteristics, Causality and Paley-Wiener criterion for physical realization, Relationship between Bandwidth and Rise time.

UNIT - IV

Convolution and Correlation of Signals: Concept of convolution in Time domain and Frequency domain, Graphical representation of Convolution, Convolution property of Fourier Transforms, Cross Correlation and Auto Correlation of functions, Properties of Correlation function, Energy density spectrum, Parseval's Theorem, Power density spectrum, Relation between Auto Correlation function and Energy/Power spectral density function, Relation between Convolution and Correlation, Detection of periodic signals in the presence of Noise by Correlation, Extraction of signal from noise by filtering.

UNIT – V

Laplace Transforms: Review of Laplace Transforms (L.T), Partial fraction expansion, Inverse Laplace Transform, Concept of Region of Convergence (ROC) for Laplace Transforms, Constraints on ROC for various classes of signals, Properties of L.T, Relation between L.T and F.T of a signal, Laplace Transform of certain signals using waveform synthesis.

Z–Transforms: Fundamental difference between Continuous and Discrete time signals, Discrete time signal representation using Complex exponential and Sinusoidal components, Periodicity of Discrete time signal using complex exponential signal, Concept of Z-Transform of a Discrete Sequence, Distinction between Laplace, Fourier and Z Transforms, Region of Convergence in Z-Transform, Constraints on ROC for various classes of signals, Inverse Z-transform, Properties of Z-transforms.

TEXT BOOKS:

1. Signals, Systems & Communications - B.P. Lathi, BS Publication, 2003.
2. Signals and Systems - A.V. Oppenheim, A.S. Willsky and S.H. Nawab, 2 Ed.,PHI.
3. Principles of Linear Systems and Signals, 2nd Ed, B. P. Lathi, 2009,Oxford.

REFERENCE BOOKS:

1. Signals & Systems - Simon Haykin and Van Veen, Wiley, 2 Ed.
2. Signals and Systems – A. Rama Krishna Rao – 2008, TMH.
3. Fundamentals of Signals and Systems - Michel J. Robert, 2008, MGH International Edition.

CH304BS: APPLIED BIOCHEMISTRY

B.Tech. II Year I Sem.

L	T	P	C
3	0	0	3

Pre-requisites: Nil.

UNIT - I

Properties of water: pH& Buffers, Physiological buffer. The Henderson Hasselbalch equation, determination of pKa values. Structural aspects of carbohydrates, amino acids and lipids. Carbohydrate metabolism: respiration-types. Glycolysis and kreb's cycle and energetics involved, Protein& Lipid metabolism (Briefly).

UNIT - II

Biochemistry of Living Cell: Types of cells, pro and eukaryotes. Sub-cellular - Fractionation using the Differential Centrifugation Method. Functions of each Organelle, Chemical Composition of cell walls Membrane lipids. Transport of Substances across Biological Membrane. Redox potential, components in electron transport systems in mitochondria, respiratory chain. Oxidative phosphorylation - Energetics,

UNIT - III

Chemical nature of Enzymes: Study of the Properties of Enzymes and kinetics by Spectrophotometer. Diagnostic and therapeutic uses of Enzymes. Metalions in biological catalysis (explanation with few examples).

UNIT - IV

Nucleic Acid chemistry: Protein synthesis. Transcription and Translation, Replication, Polymerase Chain Reaction (PCR) Immunological Techniques or Immunoassay – Radio Immuno Assay (RIA), Enzyme- Linked Immunosorbent Assay (ELISA), Chemiluminiscence.

UNIT - V

Blood Chemistry: Chemical Composition of Blood, Separation of Serum Proteins and lipoproteins by Electrophoresis and Ultracentrifugation Acid Base Balance and Biochemical Measurements of Acid-Base and Electrolyte status of the patients, Urine Analysis. General methods of biochemical analysis carried out in the estimation of blood constituents, such as glucose etc. Principles and different methods of chromatography – fluorometry, flame photometry, Automation and Biochemical Analysis. Applications of isotopes in biochemistry.

TEXT BOOKS:

1. Lehninger A.L, Nelson O.'L. M.M. Cox, Principles of Biochemistry 3rd edition, 2000 CBS
2. Robert Murray, Peter A. Mayes, Victor W. Rodwell, Daryl K. Granner, Harper's Biochemistry, 26th Edition,McGraw-Hill Companies, February 2003.

REFERENCE BOOKS:

1. Rao, N. Mallikarjuna, Medical Biochemistry, New Age International Pvt Ltd, 2002.
2. Lalit M. Srivastava, Nibhriti Das & Subrata sinha, Essentials of practical Biochemistry, CBS Publishers, Ist edition, 2002.
3. Bertini I, Gray HB, Stiefel EI, Valentine JS Biological inorganic chemistry. University Science Books, Sausalito, 2006.
4. Frausto da Silva JJR, Williams RJP The biological chemistry of the elements: the inorganic chemistry of life. Oxford University Press, New York, 2001
5. Bertini I, Sigel A, Sigel H Handbook on metalloproteins. Marcel Dekker, New York, 2001.

BM305ES: BIOELECTRICITY

B.Tech. II Year I Sem.

L	T	P	C
3	0	0	3

Pre-requisites: Nil.

UNIT - I

Bioelectricity generation at the cellular & sub cellular level. Different bio-potentials and their characteristics. Nernst Equation: Derivations and its significance. Refractory Period Characteristics of Stimulus. Strength - Duration relationship. Electrical equivalent circuit of Axon. Membrane time and space constants.

UNIT - II

Biopotential electrodes: classification & characteristics. Electrode-Electrolyte Interface, Equivalent Circuit Properties of Needle & Micro Electrodes,

Application of Bioelectric phenomena: Forward, Inverse problems. Impedance Plethysmography, Measurement of Tissue Resistance.

UNIT - III

Characteristics of Action potentials at SA Node, Atria, A V Node, Purkinje fibers and Ventricles. ECG Complexes, 12 lead ECG. Standard leads of Einthoven, Pericardial leads and augmented limb leads. Relationship between unipolar extremity leads and standard Bipolar leads.

UNIT - IV

Hodgkin- huxley formulation, Membrane conductance, Nerve conduction, membrane properties from current-voltage relations, Models of squid axon, Propagation of impulses in unmyelinated and myelinated nerve fiber, Electrical properties of receptors, Intensity-frequency relationship, Electrical properties of synaptic junctions - EPSP and IPSP. Electro Encephalogram: EEG lead system, behavior of EEG signal.

UNIT - V

Electrical activity of skeletal muscles, Motor unit potentials, neuromuscular transmission, EMG wave form, Velocity and their changes in normal and abnormal states, Fatigue and conduction, Chemical significance, Gradation of muscular activity.

TEXT BOOKS:

1. Robert Plonsey and Roger Barr, Bioelectricity, McGraw Hill, 1986.
2. John Webster. Medical Instrumentation.- Application and Design. John Wiley and Sons. Inc., New York. Third edition 2003.

REFERENCE BOOKS:

1. L. A Geddes, Principles of Applied Biomedical Instrumentation, John Wiley & Sons.
2. Plonsey Robert and Flemming David G. Bioelectrical phenomena, McGraw Hill.

EC306ES: ELECTRONIC DEVICES AND CIRCUITS LAB

B.Tech. II Year I Sem.

L	T	P	C
0	0	3	2

PART A: (Only for Viva-voce Examination)

Electronic Workshop Practice (In 3 Lab Sessions):

1. Identification, Specifications, Testing of R, L, C Components (Colour Codes), Potentiometers, Switches (SPDT, DPDT, and DIP), Coils, Gang Condensers, Relays, Bread Boards, PCB's
2. Identification, Specifications and Testing of Active Devices, Diodes, BJT's, Low power JFET's, MOSFET's, Power Transistors, LED's, LCD's, SCR, UJT.
3. Study and operation of
   i. Multimeters (Analog and Digital)
   ii. Function Generator
   iii. Regulated Power Supplies
   iv. CRO

PART B: (For Lab Examination)

1. Forward & Reverse Bias Characteristics of PN Junction Diode.
2. Zener diode characteristics and Zener as voltage Regulator.
3. Input & Output Characteristics of Transistor in CB Configuration and h-parameter calculations.
4. Input & Output Characteristics of Transistor in CE Configuration and h-parameter calculations.
5. Half Wave Rectifier with & without filters.
6. Full Wave Rectifier with & without filters.
7. FET characteristics.
8. Design of Self-bias circuit.
9. SCR characteristics.
10. UJT Characteristics

PART C: Equipment required for Laboratories:

1. Regulated Power supplies (RPS) : 0-30 V
2. CRO's : 0-20 MHz.
3. Function Generators : 0-1 MHz.
4. Multimeters
5. Decade Resistance Boxes/Rheostats
6. Decade Capacitance Boxes
7. Ammeters (Analog or Digital) : 0-20 μA, 0-50μA, 0-100μA, 0-10 mA.
8. Voltmeters (Analog or Digital) : 0-50V, 0-100V, 0-250V
9. Electronic Components : Resistors, Capacitors, BJTs, LCDs, SCRs, UJTs, FETs, LEDs, MOSFETs, Diodes - Ge & Si type, Transistors – NPN, PNP type.

BM308ES: MEDICAL SCIENCES AND BIOCHEMISTRY LAB

B.Tech. II Year I Sem.

L	T	P	C
0	0	3	2

Human Anatomy and Physiology:

Video/Practical Demonstrations:

1. **Skeletal System**: Classification of Bones, Joints and Muscles- Structure and function
2. **Cardiovascular System**: Heart and vascular system, ECG, Blood Pressure, Homeostasis, Cardiac Output, Coronary and Peripheral Circulation, Heart Sounds
3. Recording of B. P. and Effects of Physical Exertion and Posture on this Parameter.
4. **Nervous System**: Structure and functions of Neurons, Synapse, Reflex action and Receptors, Velocity of Conduction of Nerve Impulses, Nervous control of Heart.
5. **Respiratory System**: Trachea and Lungs. Respiratory Physiology.
6. **Endocrine System**: Endocrine Glands, Physiology of Endocrine Regulatory System.
7. **Digestive System**: Oesophagus, Stomach, Intestines, Liver, Gall Bladder and Pancreas
8. **Lymphatic System**: Spleen, glands and Lymph nodes
9. **Optics of Eye**: Retina, Photochemistry of Vision, Accommodation Neurophysiology of Vision, EOG.
10. **Structure and functions Internal Ear**: Mechanism of Hearing, Auditory pathway, Hearing Tests.
11. Body Mass Index, Glucometer

Applied/Bio Chemistry:

1. Quantitative estimation of Glucose, Urea, Creatinine
2. Quantitative estimation of Serum proteins, A/G Ratio
3. Test for presence of (a) Reducing Sugars (b) Proteins. (c) Ketone Bodies
4. Test for presence of (a) Blood. (b) Bile Salts. (c) Bile Pigments
5. Study of Flame photometry-Analysis of Na and K in an unknown sample
6. Study of Plasma protein electrophoresis.
7. Study of Colorimetry
8. Study of Spectrophotometry

Equipment required

1. Sphygmomanometer	2. Stethoscope
3. BMI apparatus	4. Glucometer (digital)
5. Electrophoresis apparatus	6. Chromatograph
7. Colorimeter.	8. Spectrophotometer.
9. pH meter	10. Flame photometer
11. Kymograph	12. Flame photometer

EC307ES: BASIC SIMULATION LAB

B.Tech. II Year I Sem.

L	T	P	C
0	0	3	2

Course Objective is to simulate various signals, systems and their characteristics in different domains like Fourier transform, Laplace transform and Z-transform using MATLAB.

Course Outcomes: Students successfully simulate various signals, systems and characteristics in different domain

List of Experiments:

1. Basic Operations on Matrices.
2. Generation of Various Signals and Sequences (Periodic and Aperiodic), such as Unit Impulse, Unit Step, Square, Saw tooth, Triangular, Sinusoidal, Ramp, Sinc.
3. Operations on Signals and Sequences such as Addition, Multiplication, Scaling, Shifting, Folding, Computation of Energy and Average Power.
4. Finding the Even and Odd parts of Signal/Sequence and Real and Imaginary parts of Signal.
5. Convolution between Signals and sequences.
6. Auto Correlation and Cross Correlation between Signals and Sequences.
7. Verification of Linearity and Time Invariance Properties of a given Continuous/Discrete System.
8. Computation of unit sample, unit step and sinusoidal responses of the given LTI system and verifying its physical realiazability and stability properties.
9. Gibbs Phenomenon
10. Finding the Fourier Transform of a given signal and plotting its magnitude and phase spectrum.
11. Waveform Synthesis using Laplace Transform.
12. Locating the Zeros and Poles and plotting the Pole-Zero maps in S-plane and Z-Plane for the given transfer function.
13. Generation of Gaussian noise (Real and Complex), Computation of its mean, M.S. Value.
14. Sampling Theorem Verification.
15. Removal of noise by Autocorrelation / Cross correlation.
16. Extraction of Periodic Signal masked by noise using Correlation.
17. Verification of Weiner-Khinchine Relations.

MC300ES: ENVIRONMENTAL STUDIES

B.Tech. II Year I Sem.

L	T	P	C
3	0	0	0

Course Objectives:

- Understanding the importance of ecological balance for sustainable development.
- Understanding the impacts of developmental activities and mitigation measures
- Understanding the environmental policies and regulations

Course Outcomes: Based on this course, the Engineering graduate will understand /evaluate / develop technologies on the basis of ecological principles and environmental regulations which in turn helps in sustainable development

UNIT - I

Ecosystems: Definition, Scope and Importance of ecosystem. Classification, structure and function of an ecosystem, Food chains, food webs and ecological pyramids. Flow of energy, Biogeochemical cycles, Bioaccumulation, Biomagnification, ecosystem value, services and carrying capacity, Field visits.

UNIT - II

Natural Resources: Classification of Resources: Living and Non-Living resources,
Water resources: use and over utilization of surface and ground water, floods and droughts, Dams: benefits and problems. **Mineral resources:** use and exploitation, environmental effects of extracting and using mineral resources, **Land resources:** Forest resources.
Energy resources: growing energy needs, renewable and non renewable energy sources, use of alternate energy source, case studies.

UNIT - III

Biodiversity And Biotic Resources: Introduction, Definition, genetic, species and ecosystem diversity. Value of biodiversity; consumptive use, productive use, social, ethical, aesthetic, and optional values. India as a mega diversity nation, Hot spots of biodiversity. Field visit. Threats to biodiversity: habitat loss, poaching of wildlife, man-wildlife conflicts; conservation of biodiversity: In-Situ and Ex-situ conservation. National Biodiversity act.

UNIT - IV

Environmental Pollution and Control Technologies: Environmental Pollution: Classification of pollution, **Air Pollution:** Primary and secondary pollutants, Automobile and Industrial pollution, Ambient air quality standards. **Water pollution:** Sources and types of pollution, drinking water quality standards. **Soil Pollution:** Sources and types, Impacts of modern agriculture, degradation of soil. **Noise Pollution:** Sources and Health hazards, standards, **Solid waste:** Municipal Solid Waste management, composition and characteristics of e-Waste and its management. **Pollution control technologies:** Wastewater Treatment methods: Primary, secondary and Tertiary.

Overview of air pollution control technologies, Concepts of bioremediation.

Global Environmental Problems and Global Efforts: Climate change and impacts on human environment. Ozone depletion and Ozone depleting substances (ODS). Deforestation and desertification. International conventions / Protocols: Earth summit, Kyoto protocol and Montréal Protocol.

UNIT - V

Environmental Policy, Legislation & EIA: Environmental Protection act, Legal aspects Air Act- 1981, Water Act, Forest Act, Wild life Act, Municipal solid waste management and handling rules, biomedical waste management and handling rules, hazardous waste management and handling rules. EIA: EIA structure, methods of baseline data acquisition. Overview on Impacts of air, water, biological and Socio-economical aspects. Strategies for risk assessment, Concepts of Environmental Management Plan (EMP).

Towards Sustainable Future: Concept of Sustainable Development, Population and its explosion, Crazy Consumerism, Environmental Education, Urban Sprawl, Human health, Environmental Ethics, Concept of Green Building, Ecological Foot Print, Life Cycle assessment (LCA), Low carbon life style.

SUGGESTED TEXT BOOKS:

1. Textbook of Environmental Studies for Undergraduate Courses by Erach Bharucha for University Grants Commission.
2. Environmental Studies by R. Rajagopalan, Oxford University Press.

REFERENCE BOOKS:

1. Environmental Science: towards a sustainable future by Richard T. Wright. 2008 PHL Learning Private Ltd. New Delhi.
2. Environmental Engineering and science by Gilbert M. Masters and Wendell P. Ela .2008 PHI Learning Pvt. Ltd.
3. Environmental Science by Daniel B. Botkin & Edward A. Keller, Wiley INDIA edition.
4. Environmental Studies by Anubha Kaushik, 4th Edition, New age international publishers.
5. Text book of Environmental Science and Technology - Dr. M. Anji Reddy 2007, BS Publications.

BM401ES: BIOMEDICAL EQUIPMENT

B.Tech. II Year II Sem.

L	T	P	C
4	0	0	4

Pre-requisites: Nil.

UNIT - I

Diagnostic Equipment – I: Bio Amplifiers and signal conditioning circuits. Bioelectric Amplifiers - Different types of bioelectric amplifiers.

Recorders & Display Devices: General features of Thermal, Ink Jet, Photo graphic, Dot Recorders. General features of Display Devices for Bio -Signals.

UNIT - II

Diagnostic Equipment -II: E.C.G, T.M.T, E.E.G, E.M.G, P.F.T, Phonocardiography. (Working principle, Types of Electrodes used, Calibration, Basic Trouble Shooting). Ophthalmoscope, Retinoscope.

Analytical equipment: pH Meter, Conductivity Meter, Electrophoresis, Chromatography, Flame Photometer, Spectrophotometer, Biochemistry Analyzers, Electrolyte Analyzers, Cell Counter, Blood Gas Analyzer. (Working principle, Types of Electrodes, Calibration. Basic Trouble Shooting)

UNIT - III

Monitoring Equipment: Bedside monitors, Multi parameter monitors, Arrhythmia monitors, Holter monitor. Blood Pressure Monitors, Central monitoring stations in critical care units, Ambulatory monitors, foetal monitors, Apnea monitors.

UNIT - IV

Therapeutic Equipment - I: Infusion pumps, Suction Apparatus. Pacemaker: Synchronous - Asynchronous, External -Internal, Demand & Fixed type Pacemaker, Programmable Pacemakers. Defibrillators: AC & DC Defibrillators, Synchronous & Asynchronous. Electrical Safety. Nerve stimulators, Bladder stimulators, Implant able Stimulators,

UNIT - V

Therapeutic Equipment – II: Short wave Diathermy, Micro wave Diathermy, Ultra Sound Diathermy, Heart Lung machine: Governing principle, Qualitative Requirements, Functional details of thin film membrane type blood oxygenators. I. A. B. P:-principle & application.

TEXT BOOKS:

1. Handbook of Bio Medical Instrumentation -R. S. Khandpur. 2003
2. Joseph J. Carr, John Michael Brown; Introduction to Biomedical Equipment Technology, Pearson. 2001
3. John Webster. Medical Instrumentation.- Application and Design. John Wiley and Sons. Inc., New York. Third edition 2003.

REFERENCE BOOKS:

1. Bronzino, Joseph; Handbook of Biomedical Engineering. 2nd edition, CRC Press, 2000.
2. Bio-Medical Instruments Theory & Design. Welkowitz, Walter & Others, 2nd Edition, Academic Press, 1991

EI402ES: DIGITAL LOGIC AND PULSE CIRCUITS

B.Tech. II Year II Sem.

L	T	P	C
4	0	0	4

Prerequisite: Nil.

Course Objectives: This course provides in-depth knowledge of switching theory and the design techniques of digital circuits, which is the basis for design of any digital circuit. The main objectives are:

- To learn basic techniques for the design of digital circuits and fundamental concepts used in the design of digital systems.
- To understand common forms of number representation in digital electronic circuits and to be able to convert between different representations.
- To implement simple logical operations using combinational logic circuits
- To design combinational logic circuits, sequential logic circuits.
- To explain the complete response of R-C and R-L-C transient circuits.
- To explain clippers, clampers, switching characteristics of transistors and sampling gates.
- To construct various multivibrators using transistors, and design of sweep circuits.

Course Outcomes: Upon completion of the course, students should possess the following skills:

- Be able to manipulate numeric information in different forms, e.g. different bases, signed integers, various codes such as BCD.
- Be able to manipulate simple Boolean expressions using the theorems and postulates of Boolean algebra and to minimize combinational functions.
- Be able to design and analyze small combinational circuits and to use standard combinational functions/building blocks to build larger more complex circuits.
- Be able to design and analyze small sequential circuits and devices and to use standard sequential functions/building blocks to build larger more complex circuits.
- Understand the applications of diode as integrator, differentiator, clippers, and clamper circuits.
- Learn various switching devices such as diode, transistor, SCR. Difference between logic gates and sampling gates
- Design Mutivibrators for various applications, synchronization techniques and sweep circuits.

UNIT - I

Number System and Boolean algebra And Switching Functions: Review of number systems, Complements of Numbers, Codes- Binary Codes, Binary Coded Decimal Code and its Properties, Unit Distance Codes, Error Detecting and Correcting Codes.

Boolean Algebra: Basic Theorems and Properties, Switching Functions, Canonical and Standard Form, Algebraic Simplification of Digital Logic Gates, Properties of XOR Gates, Universal Gates, Multilevel NAND/NOR realizations.

UNIT - II

Minimization and Design of Combinational Circuits: Introduction, The Minimization of switching function using theorem, The Karnaugh Map Method-Up to Five Variable Maps, Tabular Method, Design of Combinational Logic: Adders, Subtractors, comparators, Multiplexers, Demultiplexers.

UNIT - III

Sequential Machines Fundamentals and Applications: Basic Architectural Distinctions between Combinational and Sequential circuits, The Binary Cell, Fundamentals of Sequential Machine Operation, Latches, Flip Flops: SR, JK, Race Around Condition in JK, JK Master Slave, D and T Type Flip Flops, Conversion from one type of Flip-Flop to another, Shift Registers, Operation of Shift Registers, Bidirectional Shift Registers, Design and Operation of ripple, Ring and BCD Counter, Simple operation of Asynchronous and Synchronous Counters.

UNIT - IV

Linear Wave Shaping: High pass and low pass RC circuits and their response for Sinusoidal, Step, Pulse, Square, & Ramp inputs, High pass RC network as Differentiator, Low pass RC circuit as an Integrator, Ringing Circuit.

Non-Linear Wave Shaping: Diode clippers, Transistor clippers, Clipping at two independent levels, Comparators, Clamping Operation, Clamping circuit taking Source and Diode resistances into account, Clamping Circuit Theorem.

UNIT – V

Multivibrators: Qualitative Analysis and Design of Bistable, Monostable, Astable Multivibrators and Schmitt trigger using Transistors.

Time Base Generators: General features of a Time base Signal, Methods of Generating Time Base Waveform, Transistor Miller Time Base generator, Transistor Bootstrap Time Base Generator, Transistor Current Time Base Generators.

TEXT BOOKS:

1. Switching and Finite Automata Theory- Zvi Kohavi & Niraj K. Jha, 3rd Edition, Cambridge.
2. Millman's Pulse, Digital and Switching Waveforms –J. Millman, H. Taub and Mothiki S. Prakash Rao, 2 Ed., 2008, TMH.
3. Pulse, Switching and Digital Circuits – 5th Edition, David A. Bell, Oxford, 2015.

REFERENCE BOOKS:

1. Digital Design- Morris Mano, PHI, 3rd Edition.
2. Digital Logic and State Machine Design – Comer, 3rd, Oxford, 2013.
3. Pulse and Digital Circuits – A. Anand Kumar, 2005, PHI.

BM403ES: BIOTRANSDUCERS AND APPLICATIONS

B.Tech. II Year II Sem.

L	T	P	C
4	0	0	4

UNIT - I

Introduction: Classification, Basic requirements of bio transducers, Quasi state effects (linearity, Hysteresis), Amplitude distortion, Phase distortion, Sampling errors, Input and Output impedance effects, Factors influencing the choice and design of the transducer in Measuring the Physiological Parameters. Temperature Transducers (Measurement Principle, Design and Applications): Thermo resistive, Thermo electric, PN junction diode-Thermometers, frequency change temperature Transducers, Chemical Thermometry, Radiation Thermometry.

UNIT - II

Displacement, Transducers: Potentiometric Transducers: Resistive, Resistive strain gauges. LVDT, Inductive displacement transducer, capacitive displacement transducers, Ultrasonic methods.

Force & Velocity Transducers: Differentiation and Integration methods, Doppler system, Methods based on the mass bauer effect, Electromagnetic methods. Acceleration transducers: Piezo electric transducers

UNIT - III

Pressure Transducers: Occlusive cuff methods. Force balance methods. Direct hydraulically coupled Catheter transducer system, Diaphragm displacement pressure transducers. Electrical transduction methods for Catheter tip transducer. Optical transducers. Implantable pressure transducer, Micro pressure transducer.

UNIT - IV

Flow Transducers: Flow probe design and application: Catheter tip electromagnetic Intra vascular probe & electronic system. Doppler shift flow meters, Pressure gradient technique, Intra vascular Thermistor probe, Water filled plethysmography, Air filled plethysmography, Fick & Rapid injection indicator dilution methods.

UNIT - V

Biotelemetry: Radio Telemetry principles, FM, AM, PCM. Transmission of biological data through radio telemetry. Single channel, multi-channel systems. Block diagrams and functions of bio signal transmitters and receivers.

TEXT BOOKS:

1. L. A Geddes, L. E. Baker, Principles of Applied Biomedical Instrumentation, John Wiley India.
2. Tatsuo Togawa, Toshiyo Tamura & P, Ake Oberg, Biomedical Transducers and Instruments, CRC Press, Boca Raton, 1997.

3. Introduction to Measurements and Instrumentation, second edition, Arun K Ghosh, PHI, New Delhi 2007

REFERENCE BOOKS:

1. Richard. S. C. Cobbold; Transducers for Biomedical Measurements- principles and application; Krieger pub Co,
2. John Webster. Medical Instrumentation. - Application and Design. John Wiley and Sons. Inc., New York. Third edition 2003.

BM404ES: CLINICAL SCIENCES

B.Tech. II Year II Sem.

L	T	P	C
3	0	0	3

UNIT - I

Nephrology: Diseases in Nephrology, Principles of dialysis, Haemodialysis, Acetate dialysis, Bicarbonate dialysis. Peritonial dialysis, Chronic ambulatory peritoneal dialysis, Haemoperfusion, Sequential ultra-filtration. Haemofiltration, Adequacy of dialysis, Clearance, dialysance, Components of dialysing system, Dialysate, composition of dialysate, Types of dialysers, controls and monitoring devices for dialysers. Clinical significance. Renal transplantation: Basic principles.

UNIT - II

Neurology: Diseases of nervous system, spinal cord lesions, motor nervous disease, Prolapsed intravertebral disc, Neuropathies, Myasthenia gravis, Diseases of muscle, Disorders of neuromuscular transmission

Diagnostic Investigations in Neurology: Electro Encephalography (EEG). Computerized axial tomography, Angiography, Pneumoencephalography, Neuro-Muscular Stimulation, Electromyography, Clinical applications and significance, Diseases of muscle, Motor neuron disorders, The electrical study of reflexes, The silent period, The F response, The H reflex, The axion reflexes.

UNIT - III

Cardiology: Cardio vascular measurements, Normal and abnormal ECG, interpretation of ECG, Prosthetic devices, Monitors, Heart lung machine applications and Clinical significance, CVP and SWAN catheters. Diagnostic applications, Cardiac pacing. Diagnostic indications. Criteria for selection. Therapeutic indications. Complications. Temporary pacing. Permanent pacing.

UNIT - IV

Cardiac Assist Devices: Arterial and Ventricular fibrillation, application of cardiac assist devices. Cardiac catheterization. Echocardiography, Cine angiography, Treadmill and Ergo meter Applications and Clinical significance. Diagnostic usage of ultrasound scanners. Doppler ultrasound measurement. Clinical significance. Open heart surgery grafts, bypass surgery. Instrumentation used for open-heart surgery, Organization of I.C.C.U Clinical aspects.

UNIT - V

Gastroenterology: G.I.T its clinically significant symptoms, signs and diseases. Nutritional support and parenteral therapy. Height and weight estimations according to age. Intravenous cannulae, I. V Sets, Infusion pumps, stomach wash tubes. Various endoscopic procedures, liver biopsy etc.

TEXT BOOKS:

1. Strauss, Maurice B. &Louis G. Welt. Diseases of kidney, vol. 1&2 Little Brown. 1997
2. James G. Mcleod, Physiological Approach to Clinical Neurology, Butterworth-Heinemann Ltd, 3rd edition, 1981

REFERENCE BOOKS:

1. D. Goldstein, mehmet Oz, Cardiac Assist Devices, Blackwell Future, 2002.
2. Robert F Rushmer, Cardio vascular Dynamics. WB Saunders, 1976.
3. T.L Dent. W.E. Stodel, J. G. Turcotte, Surgical Endoscopy, year book Medical pub, 1985.
4. Jones DB, Wu JS, Soper NJ, Laproscopic surgery: Principles and Procedures, 2nd Ed, Marcel Dekker, 2004.

SM405MS: BUSINESS ECONOMICS AND FINANCIAL ANALYSIS

B.Tech. II Year II Sem.

L	T	P	C
3	0	0	3

Course Objective: To learn the basic Business types, impact of the Economy on Business and Firms specifically. To analyze the Business from the Financial Perspective.

Course Outcome: The students will understand the various Forms of Business and the impact of economic variables on the Business. The Demand, Supply, Production, Cost, Market Structure, Pricing aspects are learnt. The Students can study the firm's financial position by analysing the Financial Statements of a Company.

UNIT – I

Introduction to Business and Economics:

Business: Structure of Business Firm, Theory of Firm, Types of Business Entities, Limited Liability Companies, Sources of Capital for a Company, Non-Conventional Sources of Finance.

Economics: Significance of Economics, Micro and Macro Economic Concepts, Concepts and Importance of National Income, Inflation, Money Supply in Inflation, Business Cycle, Features and Phases of Business Cycle. Nature and Scope of Business Economics, Role of Business Economist, Multidisciplinary nature of Business Economics.

UNIT – II

Demand and Supply Analysis:

Elasticity of Demand: Elasticity, Types of Elasticity, Law of Demand, Measurement and Significance of Elasticity of Demand, Factors affecting Elasticity of Demand, Elasticity of Demand in decision making, Demand Forecasting: Characteristics of Good Demand Forecasting, Steps in Demand Forecasting, Methods of Demand Forecasting.

Supply Analysis: Determinants of Supply, Supply Function & Law of Supply.

UNIT- III

Production, Cost, Market Structures & Pricing:

Production Analysis: Factors of Production, Production Function, Production Function with one variable input, two variable inputs, Returns to Scale, Different Types of Production Functions.

Cost analysis: Types of Costs, Short run and Long run Cost Functions.

Market Structures: Nature of Competition, Features of Perfect competition, Monopoly, Oligopoly, and Monopolistic Competition.

Pricing: Types of Pricing, Product Life Cycle based Pricing, Break Even Analysis, and Cost Volume Profit Analysis.

UNIT - IV

Financial Accounting: Accounting concepts and Conventions, Accounting Equation, Double-Entry system of Accounting, Rules for maintaining Books of Accounts, Journal, Posting to Ledger, Preparation of Trial Balance, Elements of Financial Statements, Preparation of Final Accounts.

UNIT - V

Financial Analysis through Ratios: Concept of Ratio Analysis, Liquidity Ratios, Turnover Ratios, Profitability Ratios, Proprietary Ratios, Solvency, Leverage Ratios (simple problems). Introduction to Fund Flow and Cash Flow Analysis (simple problems).

TEXT BOOKS:

1. D. D. Chaturvedi, S. L. Gupta, Business Economics - Theory and Applications, International Book House Pvt. Ltd. 2013.
2. Dhanesh K Khatri, Financial Accounting, Tata McGraw Hill, 2011.
3. Geethika Ghosh, Piyali Gosh, Purba Roy Choudhury, Managerial Economics, 2e, Tata Mc Graw Hill Education Pvt. Ltd. 2012.

REFERENCES:

1. Paresh Shah, Financial Accounting for Management 2e, Oxford Press, 2015.
2. S. N. Maheshwari, Sunil K Maheshwari, Sharad K Maheshwari, Financial Accounting, 5e, Vikas Publications, 2013.

BM406ES: BIOMEDICAL EQUIPMENT LAB

B.Tech. II Year II Sem.

L	T	P	C
0	0	3	2

All experiments are to be conducted.

Study, Operation and Trouble Shooting of:

1. ECG Recorder and Monitor
2. EEG, EMG Recorder
3. Pace Maker
4. DC Defibrillator
5. Short Wave Diathermy Unit
6. Ultrasound Diathermy Unit
7. Safety Evaluation Circuits
8. Audiometer
9. Hearing Aids
10. Pneumotachograph and signal conditioners (PFT)
11. Ultra Sound Scanner
12. Electro surgical generators.

Equipment required doing the above experiments:

1. ECG simulator, amplifier, Monitor
2. EEG simulator , amplifier
3. EMG simulator, amplifier.
4. Arrhythmia simulator, Pace Maker
5. Arrhythmia simulator, DC Defibrillator
6. Short Wave Diathermy
7. Ultrasound Diathermy
8. Safety analyzer
9. Audiometer
10. Hearing Aids
11. Pneumo tachograph and signal conditioners (PFT)
12. Ultra Sound Scanner
13. Electro surgical generators.
14. C.R.O
15. Digital storage C.R.O
16. Multimeter

EI407ES: DIGITAL LOGIC AND PULSE CIRCUITS LAB

B.Tech. II Year II Sem.

L	T	P	C
0	0	3	2

Minimum of 14 experiments are to be conducted:

1. Linear wave Shaping
    a. RC Low Pass Circuit for different time constants
    b. RC High Pass Circuit for different time constants
2. Non-linear wave shaping
    a. Transfer characteristics and response of Clippers:
3. Positive and Negative Clippers
4. Clipping at two independent levels
5. Positive and Negative Clampers
6. Clamping at different reference voltage
7. Design a Bistable Multivibrator and draw its waveforms
8. Design an Astable Multivibrator and draw its waveforms
9. Design a Monostable Multivibrator and draw its waveforms
10. Response of Schmitt Trigger circuit for loop gain less than and greater than one
11. The output- voltage waveform of Boot strap sweep circuit
12. The output- voltage waveform of Miller sweep circuit
13. Design of 2 input logic gates.
14. Design of multiplexer and demultiplexer.
15. Design of 4-bit parallel load and serial out shift register.
16. Design of ripple/ring/decade counters.
17. Design of Asynchronous and Synchronous counters.

BM408ES: BIOTRANSDUCERS AND APPLICATIONS LAB

B.Tech. II Year II Sem.

L	T	P	C
0	0	3	2

All experiments are to be conducted.

1. L.V.D.T & STRAIN GAUGE Designing of Oscillator & proportional amplifier
2. Resistance Thermometry (R. T. D)
3. Thermister & Thermocouple Designing of Bridge Circuit & Reference Junction Compensation Circuit
4. Photo Sensors: Photo Diode, Solar Cell, and Photo Transistor
5. pH Measurement
6. Pressure Measurement Designing of Instrumentation Amp With Different Gains
7. Level Measurement
8. P. I. D P.I, P.D, P. I. D Designing Of Integrator & Differentiator Using Components
9. Op-Amp As Adder Subtractor Designing of Adder & Subtractor Using Components
10. Speed Measurement
11. L. D. R & Piezo Electric Transducers
12. Inductive & Capacitive Pickup

The transducers/ equipment required to do the above experiments:

1. L.V.D.T
2. STRAIN GAUGE (cantilever strain gauge)
3. Resistance Thermometry (R. T. D)
4. Thermister
5. Thermocouple
6. Photo Sensors: Photo Diode, Solar Cell, and Photo Transistor, L. D. R
7. pH Meter
8. Sealed pressure transducer for Pressure Measurement
9. Micro controller based Level Measurement system
10. P. I. D setup
11. Electric pickup and magnetic pickup for Speed Measurement
12. Piezo Electric Transducer
13. Inductive & Capacitive Pickup
14. Signal generators
15. C.R.O
16. Digital storage C.R.O
17. Multimeter

MC400HS: GENDER SENSITIZATION LAB

B.Tech. II Year II Sem.

L	T	P	C
0	0	3	2

Course Objectives:

- To develop students' sensibility with regard to issues of gender in contemporary India.
- To provide a critical perspective on the socialization of men and women.
- To introduce students to information about some key biological aspects of genders.
- To expose the students to debates on the politics and economics of work.
- To help students reflect critically on gender violence.
- To expose students to more egalitarian interactions between men and women.

Course Outcomes:

- Students will have developed a better understanding of important issues related to gender in contemporary India.
- Students will be sensitized to basic dimensions of the biological, sociological, psychological and legal aspects of gender. This will be achieved through discussion of materials derived from research, facts, everyday life, literature and film.
- Students will attain a finer grasp of how gender discrimination works in our society and how to counter it.
- Students will acquire insight into the gendered division of labour and its relation to politics and economics.
- Men and women students and professionals will be better equipped to work and live together as equals.
- Students will develop a sense of appreciation of women in all walks of life.
- Through providing accounts of studies and movements as well as the new laws that provide protection and relief to women, the textbook will empower students to understand and respond to gender violence.

UNIT - I

UNDERSTANDING GENDER

Gender: Why Should We Study It? (*Towards a World of Equals*: Unit -1)

Socialization: Making Women, Making Men (*Towards a World of Equals*: Unit -2)

Introduction. Preparing for Womanhood. Growing up Male. First lessons in Caste. Different Masculinities.

UNIT - II

GENDER AND BIOLOGY

Missing Women: Sex Selection and Its Consequences (*Towards a World of Equals*: Unit -4)

Declining Sex Ratio. Demographic Consequences.

Gender Spectrum: Beyond the Binary (*Towards a World of Equals*: Unit -10)

Two or Many? Struggles with Discrimination.

UNIT - III

GENDER AND LABOUR

Housework: the Invisible Labour (*Towards a World of Equals*: Unit -3)

"My Mother doesn't Work." "Share the Load."

Women's Work: Its Politics and Economics (*Towards a World of Equals*: Unit -7)

Fact and Fiction. Unrecognized and Unaccounted work. Additional Reading: Wages and Conditions of Work.

UNIT - IV

ISSUES OF VIOLENCE

Sexual Harassment: Say No! (*Towards a World of Equals*: Unit -6)

Sexual Harassment, not Eve-teasing- Coping with Everyday Harassment- Further Reading: "*Chupulu"*.

Domestic Violence: Speaking Out (*Towards a World of Equals*: Unit -8)

Is Home a Safe Place? -When Women Unite [Film]. Rebuilding Lives. Additional Reading: New Forums for Justice.

Thinking about Sexual Violence (*Towards a World of Equals*: Unit -11)

Blaming the Victim-"I Fought for my Life…." - Additional Reading: The Caste Face of Violence.

UNIT - V

GENDER: CO - EXISTENCE

Just Relationships: Being Together as Equals (*Towards a World of Equals*: Unit -12)

Mary Kom and Onler. Love and Acid just do not Mix. Love Letters. Mothers and Fathers. Additional Reading: Rosa Parks-The Brave Heart.

TEXTBOOK

All the five Units in the Textbook***, "Towards a World of Equals: A Bilingual Textbook on Gender"*** written by A. Suneetha, Uma Bhrugubanda, Duggirala Vasanta, Rama Melkote, Vasudha Nagaraj, Asma Rasheed, Gogu Shyamala, Deepa Sreenivas and Susie Tharu and published by **Telugu Akademi, Hyderabad**, Telangana State in the year **2015**.

Note: Since it is an Interdisciplinary Course, Resource Persons can be drawn from the fields of English Literature or Sociology or Political Science or any other qualified faculty who has expertise in this field from engineering departments.

REFERENCE BOOKS:

1. Menon, Nivedita. Seeing like a Feminist. New Delhi: Zubaan-Penguin Books, 2012
2. Abdulali Sohaila. "*I Fought For My Life…and Won*."Available online at: http://www.thealternative.in/lifestyle/i-fought-for-my-lifeand-won-sohaila-abdulal/