T K R COLLEGE OF ENGINEERING & TECHNOLOGY
(AUTONOMOUS)

B.TECH ELECTRICAL AND ELECTRONICS ENGINEERING

COURSE STRUCTURE & SYLLABUS

B.TECH III SEMESTER

S.No.	Course Code	Course Title	L	T	P	Credits
1	A23HS1	Mathematics–IV	3	1	0	4
2	A23PC2	Electromagnetic Fields	3	1	0	4
3	A23PC3	Electrical Machines-I	3	1	0	4
4	A23PC4	Network Theory	3	0	0	3
5	A23PC5	Electronic Circuits	3	0	0	3
6	A23PC6	Electrical Machines Lab–I	0	0	3	2
7	A23PC7	Electronic Devices &Circuits Lab	0	0	3	2
8	A23PC8	Networks Lab	0	0	3	2
9	A23MC3	*Environmental Science and Technology	3	0	0	0
		Total Credits	**18**	**3**	**9**	**24**

*** Mandatory Course**

B.TECH IV SEMESTER

S.No.	Course Code	Course Title	L	T	P	Credits
1	A24PC1	Switching Theory & Logic Design	3	1	0	3
2	A24PC2	Power Systems–I	3	1	0	4
3	A24PC3	Electrical Machines–II	3	1	0	4
4	A24PC4	Control Systems	3	1	0	4
5	A24HS5	Business Economics and Financial Analysis	3	0	0	3
6	A24PC6	Control Systems Lab	0	0	3	2
7	A24PC7	Electrical Machines Lab–II	0	0	3	2
8	A24PC8	Electronic Circuits Lab	0	0	3	2
9	A24MC4	*Gender Sensitization Lab	0	0	3	0
		Total Credits	**15**	**4**	**12**	**24**

***Mandatory Course**

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B.Tech III Semester **L/T/P/C**
4/1/0/4

MATHEMATICS- IV (A23HS1)

Course Objectives:
To learn
1. Differentiation and integration of complex valued functions
2. Evaluation of integrals using Cauchy's integral formula and residue theorem.
3. Laurent's series expansion of complex functions
4. Express a periodic function by Fourier series
5. Express a non-periodic function by Fourier transform

Course Outcomes:
After learning the contents of this paper the student must be able to
1. Analyse the complex functions with reference to their analyticity, integration using Cauchy's integral theorem
2. Find the Taylor's and Laurent's series expansion of complex functions
3. The bilinear transformation
4. Finding any periodic function in term of sine's and cosines
5. Finding a non-periodic function as integral representation

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

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

UNIT–III
Evaluation of integrals:
Singular points, isolated singular points, pole of order m – essential singularity, Residue, Cauchy Residue

theorem (Without proof).
Types of real integrals:

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

UNIT–IV

Fourier series:

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

UNIT–V

Fourier transforms

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

Applications Fourier Transforms: Heat Equation and Wave Equation

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

Reference Books:

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

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ELECTRONIC MAGNETIC FIELDS (A23PC2)

Course Objectives

- To introduce the concepts of electric field, magnetic field.
- Applications of electric and magnetic fields in the development of the theory for power transmission lines and electrical machines.

Course Outcomes

Upon completion of course, student will be able to

- Apply vector calculus to static electric – magnetic fields.
- Compute the force, fields & Energy for different charge & current configurations &evaluate capacitance and inductance
- Analyze Maxwell's equation in different forms (Differential and integral) in Electrostatic, Magnetic time varying fields

UNIT – I

Electrostatics

Introduction to co-ordinate systems-rectangular-cylindrical and spherical co- ordinate system-introduction to line surface volume integrals, Electrostatic Fields – Coulomb's Law – Electric Field Intensity (EFI) – EFI due to a line and a surface charge – Work done in moving a point charge in an electrostatic field – Electric Potential – Properties of potential function – Potential gradient Guass's law– Application of Guass's Law – Maxwell's first law,

div (D)=□v –
variable.

Laplace's and Poison' sequations – Solution of Laplace's equation in one

UNIT-II

Conductors, Dielectrics& Capacitance

Electric dipole – Dipole moment– potential and EFI due to an electric dipole – Torque on an Electric dipole in an electric field– Behavior of conductors in an electric field – Conductors and Insulators.

Dielectrics & Capacitance

Behavior of conductors in an electric field – Conductors and Insulators – Electric field inside a dielectric material – polarization – Dielectric – Conductor and Dielectric – Dielectric boundary conditions – Capacitance – Capacitance of parallel plots– spherical co-axial capacitors – with composite dielectrics – Energy stored and energy density in a static electric field – Current density – conduction and Convection current densities – Ohm's law in point form – Equation of continuity

UNIT – III

Magneto Statics

Static magnetic fields – Biot-Savart's law – Magnetic field intensity (MFI)– MFI due to a straight current carrying filament – MFI due to circular, square and solenoid current –Carrying wire – Relation between magnetic flux, magnetic flux density and MFI – Maxwell's second Equation, div(B)=0,

Ampere's Law & Applications

Ampere's circuital law and its applications viz. MFI due to an infinite sheet of current and a long current carrying filament – Point form of Ampere's circuital law – Maxwell's third equation, Curl (H)=Jc

UNIT – IV

Force in Magnetic fields and Magnetic Potential

Magnetic force - Moving charges in a Magnetic field – Lorentz force equation – force on a current element in a magnetic field –Force on a straight and a long current carrying conductor in a magnetic field – Force between two straight long and parallel current carrying conductors – Magnetic dipole and dipole moment – a differential current loop as a magnetic dipole – Torque on a current loop placed in a magnetic field Scalar Magnetic potential and its limitations – vector magnetic potential and its properties – vector magnetic potential due to simple configurations – vector Poisson's equations. Self and Mutual inductance – Neumann's formulae – determination of self-inductance of a solenoid and toroid and mutual inductance between a straight long wire and a square loop wire in the same plane – energy stored and density in magnetic field. Introduction to permanent magnets, their characteristics and applications.

UNIT – V

Time Varying Fields

Time varying fields Faraday's laws of electromagnetic induction –Its integral and point forms – Maxwell's fourth equation, Curl (E)=−∂B/∂t Statically and Dynamically induced EMFs – Simple problems -Modification of Maxwell's equations for time varying fields – Displacement current.

TEXT BOOKS

1. "William H. Hayt& John. A. Buck", "Engineering Electromagnetics" ,Mc. Graw-Hill Companies, 7th Edition, 2009.
2. "Sadiku", "Electromagnetic Fields", Oxford Publications, 4th Edition, 2009.

REFERENCE BOOKS

1. "CR Paul and S. A. Nasar", "Introduction to Electromagnetic", Mc-Graw Hill Publications, 3rd Edition, 1997.
2. "Nathan Ida", "Engineering Electromagnetic", Springer (India) Pvt. Ltd. 2nd Edition, 2015.
3. "D J Griffiths", "Introduction to Electro Dynamics", Prentice-Hall of India Pvt. Ltd, 3rd edition, 1999.
4. D J Griffiths", "Introduction to Electro Dynamics", Pearson New International, 4th edition, 2014.
5. "J. D Kraus", "Electromagnetics", McGraw-Hill Inc. 4th edition, 1992.

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B.Tech III Semester **L/T/P/C**
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ELECTRICAL MACHINES I (A23PC3)

Course Objectives

- To study and understand different types of DC generators, Motors and Transformers, their construction, operation and applications.
- To analyze performance aspects of various testing methods.

Course Outcomes

After this course, the student will be able to

- Identify different parts of a DC machine &Transformer and understand their operation
- Know the different types of DC machines & Transformers
- Carry out different testing methods to predetermine the efficiency of DC machines & Transformer
- Understand different excitation and starting methods of DC machines
- Control the voltage and speed of a DC machines

UNIT – I

D.C. Generators

Principle of operation – Action of commutator – constructional features – armature windings – lap and wave windings – simplex and multiplex windings – use of laminated armature – E. M.F Equation. Armature reaction – Cross magnetizing and de-magnetizing AT/pole – compensating winding– commutation – reactance voltage – methods of improving commutation. Methods of Excitation – separately excited and self-excited generators – build-up of E.M.F - critical field resistance and critical speed - causes for failure to self-excite and remedial measures. Load characteristics of shunt, series and compound generators.

UNIT – II

D.C Motors

Principle of operation – Back E.M.F. - Torque equation – characteristics and application of shunt, series and compound motors – Armature reaction and commutation. Speed control of D.C. Motors - Armature voltage and field flux control methods. Motor starters (3 point and 4 point starters) Testing of D.C. machines - Losses – Constant & Variable losses – calculation of efficiency – condition for maximum efficiency.

UNIT - III

Methods of Testing – direct, indirect, and regenerative testing – Brake test – Swinburne's test Hopkinson's test – Field's test - separation of stray losses in a d.c. motor test.

UNIT - IV

Single phase transformers:

Types - constructional details-minimization of hysteresis and eddy current losses- EMF equation - operation on no load and on load – phase or diagrams Equivalent circuit - losses and efficiency – regulation - All day efficiency - effect of variations of frequency & supply voltage on iron losses.

UNIT - V

OC and SC tests - Sumpner's test - predetermination of efficiency and regulation-separation of losses test-parallel operation with equal and unequal voltage ratios - auto transformers equivalent circuit-comparison with two winding transformers. Poly phase transformers – Poly phase connections - Y/Y, Y/Δ, Δ/Y, Δ /

Δ and open circuit

TEXT BOOKS

1. "I.J. Nagrath & D.P. Kothari", "Electric Machines", Tata McGraw Hill Publishers, 3rd edition, 2004.
2. "P.S. Bimbra", "Electrical Machines", Khanna Publishers, 7th Edition, 2014.

REFERENCE BOOKS

1. E. Clayton & N. M. Hancock "The Performance and Design of Direct Current Machines" 3rd Edition Pitman, London 1959.
2. "A. E. Fritzgerald, C. Kingsley and S. Umans", "Electric Machinary", McGraw Hill Companies, 6th edition, 2003.
3. "Abhijith Chakrabarthi & Subitha Debnath", "Electrical Machines", McGraw Hill, 2015.

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B.Tech III Semester **L/T/P/C**
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NETWORK THEORY (A23PC4)

Course Objectives

- To understand Magnetic Circuits, Network Topology and Three phase circuits.
- To analyse transients in Electrical systems.
- To evaluate Network parameters of given Electrical network
- To design basic filter configurations.

Course Outcomes

After this course, the student will be able to

- Analyse the Electrical Circuits with the concept of Network topology
- Apply the concepts of Magnetic circuit & Analyse Magnetic circuits
- Determine self and mutually induced EMF's for Magnetically coupled coils
- understand the importance of three phase circuits and Analyse the three phase circuits
- with Star & Delta connected balanced and unbalanced loads
- Analyse the transient behaviour of electrical networks for various excitations
- Obtain the various network parameters for the given two port networks
- Represent the transfer function for the given network
- Determine the parameters for the design of various filters

UNIT – I

Magnetic Circuits

Faraday's laws of electromagnetic induction – concept of self and mutual inductance – dot convention – coefficient of coupling – composite magnetic circuit -Analysis of series and parallel magnetic circuits

Network topology

Definitions– Graph – Tree, Basic cut set and Basic Tie set matrices for planar networks – Loop and Nodal methods of analysis of Networks with dependent &independent voltage and current sources - Duality & Dual networks.

UNIT – II

Three phase circuits

Phase sequence – Star and delta connection – Relation between line and phase voltages and currents in balanced systems – Analysis of balanced and Unbalanced 3 phase circuits –Measurement of active and reactive power.

UNIT – III

Transient Analysis

Transient response of R-L, R-C, R-L-C circuits (Series and Parallel combinations) for D.C. and sinusoidal excitations – Initial conditions – Classical method and Laplace transforms methods of solutions. Transient response of the above circuits for different inputs such as step, ramp, pulse and impulse by using Laplace transforms method.

UNIT – IV

Network Parameters

Network functions driving point and transfer impedance function networks- poles and zeros –necessary conditions for driving point function and for transfer function Two port network parameters – Z, Y, ABCD

and hybrid parameters and their relations– 2- port network parameters using transformed variables.

UNIT – V

Filters

Introduction to filters –low pass – high pass and band pass – RC, RL, filters- constant K and m derived filters and composite filter design.

TEXT BOOKS

1. "William Hayt and Jack E. Kemmerly", "Engineering circuit analysis", McGraw Hill Company, 6th edition, 2016.
2. "D. Roy Chowdary", "Networks and systems", New age international publishers, 2009.
3. "N. C. Jagan& C. Lakshminarayana", "Network Theory", B.S Publications, 2014.
4. "A. Chakrabarthy", Circuit Theory, DhanpatRai, 2005.

REFERENCE BOOKS

1. "Van Valkenburg", "Network Analysis", PHI, 3rd Edition, 2014
2. "Franklin F Kuo," "Network Analysis & Synthesis", Wiley India PVT. Ltd., second Edition, 2006.
3. "K.C. A. Smith & R. E. Alley", "Electrical Circuits", Cambridge University Press, 1992
4. "K. Rajeswaran", "Electric Circuit theory", Pearson Education, 2004.
5. "A. Bruce Carlson", "Circuits", Thomson Publishers, 1999.

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ELECTRONIC CIRCUITS (A23PC5)

Course Objectives

- To explain configurations of Transistor.
- To explain the operation, design and Analysis of amplifiers using BJT and MOSFET.
- To analyse feedback amplifiers, large signal and oscillators.
- To explain the operation of linear and nonlinear wave shaping circuits
- To understand the switching characteristics of diode and transistor

Course Outcomes

After completion of this course the student is able to

- Apply the knowledge of BJT to design practical amplifier circuits.
- Design electronic sub systems such as feedback amplifiers, oscillators and power amplifiers to meet the required specifications.
- Design linear and nonlinear wave shaping circuits with different inputs.
- Analyze multi vibrators using transistors.

UNIT-I

Transistor Configurations

BJT Hybrid modeling, Determination of h-parameters, Analysis of CE, CB and CC configurations using h-parameters, Comparison of CE, CB and CC configurations.

Amplifiers

Classification of Amplifiers, CE, CB and CC Amplifiers, Distortion in Amplifiers, Comparison of CE, CB, CC Amplifiers.

UNIT –II

Feedback Amplifiers

Concept of feedback Amplifiers, General characteristics of negative feedback amplifiers, Effect of Feedback on Amplifier characteristics, Voltage series, voltage shunt ,Current series and current shunt Feedback configurations, Illustrative problems.

Oscillators

Conditions for oscillations, Frequency and Amplitude Stability of Oscillators, Generalized analysis of LC Oscillators, Quartz, Hartley, and Colpitt's Oscillators, RC –phase shift and Wein Bridge oscillators.

UNIT-III

Large Signal Amplifiers

Class A Power Amplifier, Maximum Efficiency of Class –A Amplifier, Transformer Coupled Amplifier, Push Pull Amplifier complimentary Symmetry Class-B Power Amplifier, Phase Inverters, Transistor Power Dissipation, Thermal Runway, Heat Sinks.

UNIT - IV

Wave Shaping

High Pass, Low Pass RC Circuits, their response for Sinusoidal, Step, Pulse and Ramp Inputs. Diode Clippers, Transistor Clippers, Clipping at Two Independent Levels, Transfer Characteristics of Clippers,

Comparators, Clamping Operation, Clamping Circuits using Diode with different inputs, Clamping Circuit Theorem, Practical Clamping Circuits.

UNIT - V

Switching Characteristics of Devices

Diode as a Switch, Piecewise Linear Diode Characteristics, Transistor as a Switch, Breakdown Voltage Consideration of Transistor, Transistor Switching Times.

Multivibrators

Analysis and Design of Bistable, Monostable, Astable, Multivibrators and Schmitt Trigger using Transistors.

TEXT BOOKS

1. Robert L Boylestead and Louis Nashelsky", "Electronic Devices and circuit theory", Pearson, Tenth edition 2009
2. "S. Salivahanan, N. Suresh Kumar and A. Vallava Raj", "Electronic Devices and circuits", TMH, 2nd Edition 2008.
3. "David A. Bell", "Solid state Pulse Circuits", PHI, 4th Edition 2007.

REFERENCE BOOKS:

1. "Robert T. Paynter", "Introductory Electronic Devices and Circuits", PEI, 7 Edition, 2009.
2. "Anil. K. Maini, Varsha Agarwal", "Electronic Devices and Circuits", Wiley, 1st Edition 2009.
3. "Jacob Milliman, HarbertTaub and Mothiki S Prakash Rao", "Pulse Digital & Switching Waveforms", TMH, 2nd Edition 2008.

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ELECTRICAL MACHINES LAB I (A23PC6)

Course Objectives

- To expose the students to the operation of DC Generator
- To expose the students to the operation of DC Motor.
- To examine the self-excitation in DC generators.

Course Outcomes

After completion of this lab the student is able to

- Start and control the Different DC Machines
- Assess the performance of different machines using different testing methods.
- Identify different conditions required to be satisfied for self-excitation of DC Generators.
- Separate iron losses of DC Machines into different components.

The following experiments are required to be conducted compulsory experiments

1. Magnetization characteristics of DC shunt generator. Determination of critical field resistance and critical speed.
2. Load test on DC shunt generator. Determination of characteristics.
3. Load test on DC series generator. Determination of characteristics.
4. Load test on DC compound generator. Determination of characteristics.
5. Hopkinson's test on DC shunt machines. Predetermination of efficiency.
6. Fields test on DC series machines. Determination of efficiency.
7. Swinburne's test and speed control of DC shunt motor. Predetermination of efficiencies.
8. Brake test on DC compound motor. Determination of performance curves.
9. Brake test on DC shunt motor. Determination of performance curves.
10. Retardation test on DC shunt motor. Determination of losses at rated speed.
11. Separation of losses in DC shunt motor.
12. Brake test on DC series motor. Determination of performance curves.

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ELECTRONIC DEVICES AND CIRCUITS LAB (A23PC7)

Course Objectives

To identify various components and testing of active devices.

- To study and operation of millimeters, function generators, regulated power supplies and CRO to know the characteristics of various active devices.
- To study frequency response amplifier.

Course Outcomes

After Completion of the course the student is able to

- Apply various devices to real time problems.
- Compute frequency response of amplifiers.
- Design different transistor biasing circuits.

Part A: (Only for viva-voce Examination)

ELECTRONIC WORKSHOP PRACTICE (in 3 lab sessions):

1. Identification, Specification, testing of R,L,C components (color codes), Potentiometers (SPDT, DPDT, and DIP), Coils, Gang Condensers, Relays, Bread Board, PCB's
2. Identification, Specification, testing of Active devices: Diodes, BJT, Low power JFET's, MOSFET's, Power Transistors, LED's, LCD's, SCR,
3. Study and operation of: Multi-meters (Analog and Digital), Function Generator, Regulated Power Supplies, CRO

Part B: (For Laboratory Examination – Minimum of 12 experiments)

1. Forward And Reverse Bias V-I Characteristics Of PN Junction Diode.
2. Zener Diode V-I Characteristics.
3. Zener Diode as a Voltage Regulator.
4. Half Wave Rectifier With and With Out Filter.
5. Full Wave Rectifier With and With Out Filter.
6. Input and Output Characteristics of BJT in CE Configuration.
7. Input and Output Characteristics of BJT in CB Configuration.
8. FET Characteristics in CS Configuration.
9. Calculation Of h-Parameters from Transistor CE Configuration
10. Design of Fixed Bias Circuit.
11. Design of Collector to Base Bias Circuit.
12. Design Of Self Bias Circuit
13. SCR Characteristics.
14. Frequency Response of CC Amplifier.

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NETWORKS LAB (A23PC8)

Course Objectives

- To design electrical systems.
- To analyse a given network by applying various Network Theorems.
- To measure three phase Active and Reactive power.
- To understand the locus diagrams.

Course Outcomes

After Completion of this lab the student is able to

- Analyse complex DC and AC linear circuits
- Apply concepts of electrical circuits across engineering
- Evaluate response in a given network by using theorems

The following experiments are required to be conducted as compulsory experiments

1. Verification of KVL and KCL.
2. Verification of Mesh Analysis
3. Verification of Thevenin's and Norton's Theorems
4. Verification of Superposition, Reciprocity and Maximum Power Transfer theorems
5. Locus Diagrams of RL and RC Series Circuits
6. Series and Parallel Resonance
7. Time response of first order RC / RL network for periodic non – sinusoidal inputs – Time constant and Steady state error determination.
8. Two port network parameters – Z – Y parameters, Analytical verification.
9. Two port network parameters – A, B, C, D & Hybrid parameters, Analytical verification
10. Separation of Self and Mutual inductance in a Coupled Circuit. Determination of Coefficient of Coupling.

In addition to the above eight experiments, at least any two of the experiments from the following list are required to be conducted

11. Verification of compensation &Milliman's theorems
12. Harmonic Analysis of non-sinusoidal waveform signals using Harmonic Analyzer and plotting frequency spectrum.
13. Determination of form factor for non-sinusoidal waveform
14. Measurement of Active Power for Star and Delta connected balanced loads
15. Measurement of Reactive Power for Star and Delta connected balanced loads

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ENVIRONMENT SCIENCE AND TECHNOLOGY (A23MC3)

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, Bio magnification, ecosystem value, services and carrying capacity, Field visits.

UNIT-II

Natural Resources: Classification of Resources

Living and Non-Living resources.

Water resources

Use and overutilization 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 nonrenewable 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, Hotspots 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 AirAct-1981,WaterAct,ForestAct, Wildlife 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 base line data acquisition. Over view on Impacts of air, water, biological and Socio-economic 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 car bon lifestyle.

TEXTBOOKS

1 Text book of Environmental Studies for Undergraduate Courses by Erach Bharucha for University Grants Commission.

2 Environmental Studies by R.Rajagopalan, Oxford University Press.

REFERENCEBOOKS

1. Environmental Science: towards a sustainable future by Richard T.Wright.2008PHL Learning Private Ltd. New Delhi.
2. Environmental Engineering and science by Gilbert M.Masters and WendellP. Ela. 2008PHILearningPvt.Ltd.
3. Environmental Science by Daniel B. Botkin & Edward A. Keller, Wiley INDIA edition.
4. Environmental Studies by Anubha Kaushik, 4thEdition, New age international publishers.
5. Textbook of Environmental Science and Technology-Dr.M.AnjiReddy2007, BS Publications.

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SWITCHING THEORY AND LOGIC DESIGN (A24PC1)

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 impart to student the concepts of sequential circuits, enabling them to analyze sequential systems in terms of state machines.
- To implement synchronous state machines using flip-flops.
- To implement memory devices using RAM and ROM.

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 ASCII, Gray, and 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 analyse small combinational circuits and to use standard combinational functions/building blocks to build larger more complex circuits.
- Be able to design and analyse small sequential circuits and devices and to use standard sequential functions/building blocks to build larger more complex circuits.

UNIT -I

Number System and Boolean algebra And Switching Functions

Number Systems, Base Conversion Methods, 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/NO Realizations.

UNIT -II:

Minimization and Design of Combinational Circuits

Introduction, The Minimization with theorem, The Karnaugh Map Method, Five and Six Variable Maps, Prime and Essential Implications, Don't Care Map conditions, Tabular Method,

Combinational circuits

Introduction, Adders, subtractors, Multiplexers, Demultiplexers, Encoders, Decoders, Comparator, Code Converters, Hazards. Applications: Design of BCD to 7-Segment Decoder.

UNIT -III

Sequential Circuits I

Introduction, Basic Differences between Combinational and Sequential circuits, The Binary Cell, Latch, Flip-Flop-Types, and Race around condition, Excitation tables and characteristic equations. Conversion from one type of Flip-Flop to another, preset and Clear inputs, Timing and Triggering Consideration, Clock Skew.

UNIT -IV

Sequential Circuits II

Introduction, Register-Types, Counters –Types, Design of Ripple (mod-N) Counters, Ring Counter. Memory types- RAM, ROM, Realisation of switching functions using PLD's.

UNIT -V

Sequential Machines

State Diagram, Analysis of Synchronous Sequential Circuits, Approaches to the Design of Synchronous Sequential Finite State Machines, Finite state machine-capabilities and limitations, Mealy and Moore models-minimization of completely specified and incompletely specified sequential machines, Partition techniques and Merger chart methods- concept of minimal cover table. Application: Design of sequence detector, Binary adder.

TEXT BOOKS

1. Digital Design- Morris Mano, PHI, 3rd Edition.
2. Switching and Finite Automata Theory- ZviKohavi&Niraj K. Jha, 3rd Edition, Cambridge.

REFERENCES

1. Anand Kumar, "Switching Theory and Logic Design" PHI, 2008
2. Charles H. Roth, "Fundamentals of Logic Design" Thomson Publications, 5th Edition, 2004.

T K R COLLEGE OF ENGINEERING & TECHNOLOGY
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ELECTRICAL AND ELECTRONICS ENGINEERING

B.Tech IV Semester **L/T/P/C**
3/1/0/4

POWER SYSTEMS I (A24PC2)

Course Objectives

- To understand the hydro, thermal, nuclear and gas generating stations.
- To examine A.C. and D.C. distribution systems.
- To understand and compare air insulated and gas insulated substations.
- To illustrate the economic aspects of power generation and tariff methods.

Course Outcomes

After Completion of this course the student is able to

- Draw the layout of hydro power plant, thermal power station, Nuclear power plant and gas power plant and explain its operation.
- Describe A.C. and D.C. distribution systems and its voltage drop calculations.
- Illustrate various economic aspects of the power plant erection, operation and different tariff methods.

UNIT- I

Thermal Power Stations:

Line diagram of Thermal Power Station (TPS) showing paths of coal, steam, water, air, ash and flue gasses. - Brief description of TPS components: Economizers, Boilers, Super heaters, Turbines, Condensers, Chimney and cooling towers

Gas and Nuclear Power Stations

Nuclear Power Stations: Nuclear Fission and Chain reaction. Nuclear fuels. - Principle of operation of nuclear reactor.-Reactor Components: Moderators, Control rods, Reflectors and Coolants. - Radiation hazards: Shielding and Safety precautions. - Types of Nuclear reactors and brief description of PWR, BWR and FBR.

Gas Power Stations

Principle of Operation and Components (Block Diagram Approach Only)

UNIT – II

Hydroelectric Power Stations

Elements of hydroelectric power station-types-concept of pumped storage plants-storage requirements, mass curve (explanation only) estimation of power developed from a given catchment area; heads and efficiencies.

Hydraulic Turbines

Classification of turbines, impulse and reaction turbines, Pelton wheel, Francis turbine and Kaplan turbine-working proportions, work done, efficiencies , hydraulic design - draft tube- theory- functions and efficiency.

UNIT – III

D.C. Distribution Systems

Classification of Distribution Systems.- Comparison of DC vs AC and Under-Ground vs. Over- Head Distribution Systems.- Requirements and Design features of Distribution Systems.-Voltage Drop Calculations (Numerical Problems) in D.C Distributors for the following cases: Radial D.C Distributor fed one end and at the both the ends (equal/unequal Voltages) and Ring Main Distributor.

A.C. Distribution Systems

Voltage Drop Calculations (Numerical Problems) in A.C. Distributors for the following cases: Power Factors referred to receiving end voltage and with respect to respective load voltages.

UNIT-IV

Substations

Classification of substations

Air insulated substations

Indoor & Outdoor substations: Substations layout showing the location of all the substation equipment. Bus bar arrangements in the Sub-Stations: Simple arrangements like single bus bar, sectionalized single bus bar, main and transfer bus bar system with relevant diagrams.

Gas insulated substations (GIS)

Advantages of Gas insulated substations, different types of gas insulated substations, single line diagram of gas insulated substations, bus bar, construction aspects of GIS, Installation and maintenance of GIS, Comparison of Air insulated substations and Gas insulated substations.

UNIT-V

Economic Aspects of Power Generation:

Load curve, load duration and integrated load duration curves-load, demand, diversity, capacity, utilization and plant use factors- Numerical Problems.

Tariff Methods

Costs of Generation and their division into Fixed, Semi-fixed and Running Costs. Desirable Characteristics of a Tariff Method.-Tariff Methods: Flat Rate, Block-Rate, two- part, three –part, and power factor tariff methods and Numerical Problems.

TEXT BOOKS

1. "C. L. Wadhawa", "Generation and utilization of Electrical Energy", New age International (P) Limited, Publishers 1997.
2. "C. L. Wadhawa", "Electrical Power Systems", New age International (P) Limited, Publishers 1997.
3. "M. L. Soni, P. V. Gupta, U. S. Bhatnagar and A. Chakraborti", "A Text Book on Power System Engineering", DhanpatRai and Co. Pvt. Ltd, 1999.

REFERENCE BOOKS

1. "M.V. Deshpande", "Elements of Power Station design and practice", Wheeler Publishing, 3rd Edition 1999.
2. "S. N. Singh", "Electrical Power Generation, Transmission and Distribution", PHI, 2003.
3. "V.K Mehta and Rohit Mehta", "Principles of Power Systems", S. Chand& Company Ltd, New Delhi, 2004.

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ELECTRICAL AND ELECTRONICS ENGINEERING

B.Tech IV Semester **L/T/P/C**
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ELECTRICAL MACHINES II (A24PC3)

Course Objectives

- To deal with the detailed analysis of poly phase induction motors & Synchronous generators and motors
- To understand operation, construction and types of single phase motors and their applications in house hold appliances and control systems.
- To introduce the concept of parallel operation of synchronous generators.
- To introduce the concept of regulation and its calculations.

Course Outcomes

After this course, the student

- Identify different parts of transformers and induction motors and specify their functions
- Understand the operation of transformers and induction motors
- Carry out different testing methods and assess the performance of transformers and induction motors
- Start and control the induction motor

UNIT – I

Poly phase Induction Motors

Constructional details of cage and wound rotor machines production of a rotating magnetic field - principle of operation - rotor EMF and rotor frequency - rotor reactance, rotor current and Power factor at standstill and during operation.

Characteristics of Induction Motors

Rotor power input, rotor copper loss and mechanical power developed and their inter relation-torque equation-deduction from torque equation - expressions for maximum torque and starting torque - torque slip characteristic – equivalent circuit – phase or diagram - crawling and cogging.

UNIT – II

Circle diagram and speed control methods of induction motors

No-load Test and Blocked rotor test –Predetermination of performance-Methods of starting and starting current and Torque calculations.

Speed Control Methods

Change of voltage, change of frequency, voltage/frequency, injection of an EMF into rotor circuit (qualitative treatment only)-induction generator principle of operation.

UNIT – III

Construction, Principle of operation, Characteristics & Regulation of Synchronous Generator:

Constructional Features of round rotor and salient pole machines – Armature windings – Integral slot and fractional slot windings; Distributed and concentrated windings – distribution, pitch and winding factors – E.M.F Equation. Harmonics in generated e.m.f. – suppression of harmonics – armature reaction – leakage reactance – synchronous reactance and impedance – experimental determination –phase or diagram – load characteristics. Regulation by synchronous impedance method, M.M.F. method, Z.P.F. method and A.S.A.methods – salient pole alternators – two reaction analysis – experimental determination of Xd and Xq(Slip test) Phase or diagrams – Regulation of salient pole alternators.

UNIT - IV

Parallel Operation of Synchronous Generator:

Synchronizing alternators with infinite bus bars – synchronizing power torque – parallel operation and load sharing - Effect of change of excitation and mechanical power input. Analysis of short circuit current wave form – determination of sub-transient, transient and steady state reactance.

Synchronous Motors – Principle of Operation:

Theory of operation – phasor diagram – Variation of current and power factor with excitation – synchronous condenser –Mathematical analysis for power developed .- hunting and its suppression – Methods of starting – synchronous induction motor.

UNIT - V

Single Phase Motors & Special Motors:

Single phase induction motor – Constructional features-Double revolving field theory – split-phase motors – shaded pole motor.

TEXT BOOKS

1. "I. J. Nagrath & D. P. Kothari", "Electric Machines", Tata McGraw Hill, 7th Edition, 2009
2. "PS Bhimbra", "Electrical machines", Khanna Publishers, 2014.

REFERENCE BOOKS

1. "M. G. Say", "Performance and Design of AC Machines", CBS Publishers, 3rd Edition, 2002.
2. "A.E. Fitzgerald, C. Kingsley and S. Umans", "Electric machinery", McGraw Hill Companies, 7th edition, 2013
3. "Langsdorf", "Theory of Alternating Current Machinery", Tata McGraw-HillCompanies, 2nd edition, 1984.
4. "M.V Deshpande", "Electrical Machines", Wheeler Publishing, 2011.

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ELECTRICAL AND ELECTRONICS ENGINEERING

B.Tech IV Semester **L/T/P/C**
3/1/0/4

CONTROL SYSTEMS (A24PC4)

Course objectives

- To understand the different ways of system representations such as Transfer function representation and state space representations and to assess the system dynamic response
- To assess the system performance using time domain analysis and methods for improving it
- To assess the system performance using frequency domain analysis and techniques for improving the performance
- To understand the different types compensators performance.

Course outcomes

After completion of this course the student is able to

- Improve the system performance by selecting a suitable controller and/or compensator for a specific application.
- Apply various time domain and frequency domain techniques to assess the system performance.
- Apply various control strategies to different applications (example: Power systems, electrical drives etc…).
- Test system Controllability and Observability using state space representation and applications of state space representation to various systems.

UNIT – I

Introduction

Concepts of Control Systems- Open Loop and closed loop control systems and their differences- Different examples of control systems- Classification of control systems, Feed- Back Characteristics, Effects of feedback. Mathematical models – Differential equations - Impulse Response and transfer functions - Translational and Rotational mechanical systems.

Transfer Function Representation

Transfer Function of DC Servo motor - AC Servo motor- Synchro transmitter and Receiver, Block diagram representation of systems considering electrical systems as examples - Block diagram algebra – Representation by Signal flow graph - Reduction using mason's gain formula.

UNIT-II

Time Response Analysis

Standard test signals - Time response of first order systems – Characteristic Equation of Feedback control systems, Transient response of second order systems, Time domain specifications – Steady state response - Steady state errors and error constants – Effects of proportional, integral, derivative, proportional derivative, proportional integral and proportional integral & derivative controllers.

UNIT – III

Stability Analysis

The concept of stability - Routh stability criterion – qualitative stability and conditional stability.

Root Locus Technique

The root locus concept - construction of root loci-effects of adding poles and zeros to G(s) H(s) on the root loci.

UNIT - IV

Frequency Response Analysis

Introduction, Frequency domain specifications-Bode diagrams- Determination of Frequency domain specifications and transfer function from the Bode Diagram-Phase margin and Gain margin-Stability Analysis from Bode Plots.

Stability Analysis in Frequency Domain

Polar Plots, Nyquist Plots and applications of NY Quist criterion to find the stability - Effects of adding poles and zeros to G(s)H(s) on the shape of the NY Quist diagrams.

Compensation techniques

Lag, Lead, and Lead-Lag compensator.

UNIT – V

State Space Analysis of Continuous Systems

Concepts of state, state variables and state model, derivation of state models from block diagrams, Diagonalization- Solving the Time invariant state Equations- State Transition Matrix and its Properties, Controllability and Observability.

TEXT BOOKS

1. "Control systems by NagoorKani", "RBA Publishers
2."I. J. Nagrath and M. Gopal", "Control Systems Engineering", New Age International (P) Limited, Publishers, 5th edition, 2009
3. "B. C. Kuo", "Automatic Control Systems", John wiley and sons, 8th edition, 2003.

REFERENCE BOOKS

1. "Advanced Control systems by NagoorKani", "RBA Publishers
2. "N. K. Sinha", "Control Systems", New Age International (P) Limited Publishers, 3rd Edition, 1998.
3. "NISE", "Control Systems Engineering", John wiley, 6th Edition, 2011.
4. "Katsuhiko Ogata", "Modern Control Engineering", Prentice Hall of India Pvt. Ltd., 3rd edition, 1998.

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ELECTRICAL AND ELECTRONICS ENGINEERING

B.Tech IV Semester **L/T/P/C**
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CONTROL SYSTEMS LAB (A24PC5)

Course Objectives

- To understand the different ways of system representations such as Transfer function representation and state space representations and to assess the system dynamic response
- To assess the system performance using time domain analysis and methods for improving it
- To assess the system performance using frequency domain analysis and techniques for improving the performance
- To design various controllers and compensators to improve system performance

Course Outcomes:

After completion of this lab the student is able to

- How to improve the system performance by selecting a suitable controller and/or a compensator for a specific application.
- Apply various time domain and frequency domain techniques to assess the system performance
- Apply various control strategies to different applications (example: Power systems, electrical drives etc).
- Test system controllability and observability using state space representation and applications of state space representation to various systems.

The following experiments are required to be conducted compulsorily as a part of curriculum:

1. Time response of Second order system.
2. Characteristics of Synchronous.
3. Programmable logic controller – Study and verification of truth tables of logic gates, simple Boolean expressions, and application of speed control of motor.
4. Effect of feedback on DC servo motor.
5. Transfer function of DC motor.
6. Transfer function of DC generator.
7. Temperature controller using PID.
8. Characteristics of AC servo motor.

In addition to the above eight experiments, at least any two of the experiments from the following list are required to be conducted.

9. Effect of P, PD, PI, PID Controller on a second order systems.
10. Lag and lead compensation – Magnitude and phase plot.
11. (a) Simulation of P, PI, PID Controller.
    (b) Linear system analysis (Time domain analysis, Error analysis) using suitable software.
12. Stability analysis (Bode, Root Locus, NY Quist) of Linear Time Invariant system using suitable Software.
13. State space model for classical transfer function using suitable software -Verification.
14. Design of Lead-Lag compensator for the given system and with specification using suitable Software.

REFERENCE BOOKS AND SOFTWARE

a. Manuals of related software.
b. PSPICE
c. MATLAB

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ELECTRICAL AND ELECTRONICS ENGINEERING

B.Tech IV Semester **L/T/P/C**
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ELECTRICAL MACHINES LAB II (A24PC6)

Course Objectives

- To understand the operation of synchronous machines.
- To understand the analysis of power angle curve of a synchronous machine.
- To understand the equivalent circuit of a single phase transformer and single phase induction motor.
- To understand the circle diagram of an induction motor by conducting a blocked rotor test.

Course Outcomes

After the completion of this laboratory course, the student will be able

- Assess the performance of different machines using different testing methods.
- To convert the Phase from three phase to two phase and vice versa.
- Compensate the changes in terminal voltages of synchronous generator after estimating the change by different methods
- Control the active and reactive power flows in synchronous machines.
- Start different machines and control the speed and power factor.

The following experiments are to be conducted as compulsory experiments

1. O.C. & S.C. Tests on Single phase Transformer.
2. Sumpner's test on a pair of single phase transformers.
3. No-load & Blocked rotor tests on three phase Induction motor.
4. Regulation of a three –phase alternator by synchronous impedance &m.m.f. methods.
5. V and Inverted V curves of a three—phase synchronous motor.
6. Equivalent Circuit of a single phase induction motor.
7. Determination of Xd and Xq of a salient pole synchronous machine.
8. Load test on three phase Induction Motor.

In addition to the above experiments, at least any two of the following experiments are required to be conducted from the following list:

1. Separation of core losses of a single phase transformer.
2. Efficiency of a three-phase alternator.
3. Parallel operation of Single phase Transformers.
4. Regulation of three-phase alternator by Z.P.F. and A.S.A methods.
5. Heat run test on a bank of 3 Nos. of single phase Delta connected transformers.
6. Measurement of sequence impedance of a three-phase alternator.
7. Vector grouping of Three Transformer.
8. Scott Connection of transformer.

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B.Tech IV Semester **L/T/P/C**
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ELECTRONIC CIRCUITS LAB (A24PC7)

Course Objectives

- To design and simulate various BJT and FET Voltage and Power amplifiers.
- To design and simulate various BJT Feedback amplifiers.
- To design and simulate various BJT Oscillators.
- To design and simulate linear and nonlinear wave shaping circuits

Course Outcomes

After completion of this lab the student is able to apply the concepts of amplifier in the design of Public Addressing System.

- Generate Sinusoidal waveforms.
- Designs table system using feedback concepts.
- Design multi vibrator using transistor.

The following experiments are to be conducted as compulsory experiments:

1. CE amplifier.
2. CC amplifier (Emitter Follower).
3. FET amplifier (Common Source).
4. Wien Bridge and RC Phase shift Oscillator.
5. Current series and Voltage series Feedback.
6. Colpitt and Hartley Oscillator.
7. Double stage RC coupled amplifier.
8. Clippers and Clampers.

In addition to the above eight experiments, at least any two of the experiments from the following list are required to be conducted:

9. Transistor as a switch.
10. Study of Logic gates & some applications
11. Study of Flip-Flops and some applications.
12. Mono stable & Astable multivibrators.
13. Bistable multivibrator & Schmitt trigger.

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GENDER SENSITIZATION LAB (A24MC4)

Course Objectives

- To develop student sensibility with regard to issues of gender in contemporary India.
- To provide a critical perspective on the socialization of men and women.
- Tointroducestudentstoinformationaboutsomekeybiologicalaspectsofgenders.
- 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 in sight in to 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 text book will empower students to understand 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 (TowardsaWorldofEquals: Unit-4) Declining Sex Ratio. Demo graphic Consequences.

Gender Spectrum

Beyond the Binary (Towards a World of Equals: Unit-10) Two or any? 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 Komand Onler.Love and AcidjustdonotMix. Love Letters. Mothers and Fathers. Additional Reading: Rosa Parks – The Brave Heart.

TEXTBOOK

All the five Units in the Text book**, "*Towards a World of Equals: A Bilingual Text book on Gender"*** written by A.Suneetha, UmaBhrugu banda, DuggiralaVasanta ,RamaMelkote, VasudhaNagaraj, AsmaRasheed, GoguShyamala, Deepa Sreenivas and SusieTharuand published by **TeluguAkademi, Hyderabad**, Telangana Stateintheyear**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.

REFERENCEBOOKS:

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