# E.G.S. PILLAY ENGINEERING COLLEGE

**(Autonomous)**

Approved by AICTE, New Delhi | Affiliated to Anna University, Chennai|
NAGAPATTINAM – 611 002

## B.E ELECTRICAL AND ELECTRONICS ENGINEERING

**Full Time Curriculum and Syllabus**

## Second Year – Third Semester

| Course Code | Course Name | L | T | P | C | Maximum Marks | | |
|---|---|---|---|---|---|---|---|---|
| | | | | | | CA | ES | Total |
| **Theory Course** | | | | | | | | |
| 2301MA305 | Engineering Mathematics-III ( Transforms & Optimization) | 3 | 2 | 0 | 4 | 40 | 60 | 100 |
| 2302EE301 | Electrical Machines-I | 3 | 2 | 0 | 4 | 40 | 60 | 100 |
| 2302EE302 | Analog Electronics | 3 | 0 | 0 | 3 | 40 | 60 | 100 |
| 2302EE303 | Digital Electronics | 3 | 0 | 0 | 3 | 40 | 60 | 100 |
| **Theory Cum Laboratory Course** | | | | | | | | |
| 2302EE304 | Measurements & Instrumentation | 3 | 0 | 2 | 4 | 50 | 50 | 100 |
| 2301GEX07 | Environmental Science and sustainability | 1 | 0 | 2 | 2 | 50 | 50 | 100 |
| **Laboratory Course** | | | | | | | | |
| 2302EE351 | Electrical Machines–I Laboratory | 0 | 0 | 2 | 1 | 60 | 40 | 100 |
| 2302EE352 | Analog and Digital Electronics Laboratory | 0 | 0 | 2 | 1 | 60 | 40 | 100 |
| 2304GE301 | Professional Development Course – I | 0 | 0 | 2 | 1 | 100 | 0 | 100 |
| 2301LS301 | Life Skills - III | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Total | | **16** | **04** | **10** | **23** | **480** | **420** | **900** |

**L – Lecture | T – Tutorial | P – Practical | CA – Continuous Assessment | ES – End Semester**

| 2301MA305 | ENGINEERING MATHEMATICS – III | L | T | P | C |
|---|---|---|---|---|---|
| | | 3 | 2 | 0 | 4 |

**PREREQUISITE:**

1. Integration calculus.
2. Differential calculus.

**COURSE OBJECTIVES:**

1. To introduce Fourier series analysis for the applications in engineering.
2. To understand the analytical tools such as Fourier transforms and Z-Transforms required for digital signal processing.
3. To expose the basics of wavelet theory and to illustrate the use of wavelet processing for waveform study, data compression and noise suppression.
4. To impart knowledge on theory of optimization and conditions for optimality for unconstraint and constraint optimization problems.

**COURSE OUTCOMES:**

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

| | |
|---|---|
| **CO1:** | Determine the Fourier series expansion for different periodic functions. |
| **CO2:** | Make use of the Fourier transform techniques in multiplicity of Engineering situations. |
| **CO3:** | Solve differential equations by using Z transforms. |
| **CO4:** | Classify wavelet basis and characterize continuous and discrete wavelet transforms. |
| **CO5:** | Comply necessary and sufficient conditions for a given optimization problem for optimality. |

**COs Vs POs MAPPING:**

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

**COs Vs PSOs MAPPING:**

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

**COURSE CONTENTS:**

| MODULE I | FOURIER SERIES | 9 Hours |
|---|---|---|

Dirichlet‟s conditions – General Fourier series – Odd and even functions – Half range sine series – Half range cosine series – Parseval‟s identity – Harmonic analysis.

| MODULE II | FOURIER TRANSFORMS | 9 Hours |
|---|---|---|

Fourier transforms pair – Fourier sine and cosine transforms – Properties - Parsevals identity.

| **MODULE III** | **Z –TRANSFORMS** | **9 Hours** |
|---|---|---|
| Z- transforms - Elementary properties – Inverse Z - transform (using partial fraction and residues) – Convolution theorem - Formation of difference equations – Solution of difference equations using Z – transform. | | |
| **MODULE IV** | **INTRODUCTION TO WAVELETS TRANSFORMS** | **9 Hours** |
| The origins of wavelets, Wavelets and other wavelet like transforms, Continuous Wavelet Transform: Continuous time-frequency representation of signals, Properties of wavelets used in continuous wavelet transform, Continuous versus discrete wavelet transform. Discrete Wavelet Transform: Haar scaling functions and function spaces, Translation and scaling of $\phi(t)$. | | |
| **MODULE V** | **INTRODUCTION TO OPTIMIZATION** | **9 Hours** |
| Introduction to Optimization: Engineering applications of Optimization – Statement of an Optimization problem – Optimal Problem formulation – Classification of Optimization problem. Optimum design concepts: Definition of Global and Local optima – Optimality criteria – Review of basic calculus concepts – Global optimality. | | |
| | | **TOTAL: 45 + 15 = 60 HOURS** |

**REFERENCES:**

1. *Grewal B.S., 41st Edition, 2011, "Higher Engineering Mathematics", Khanna Publishers, New Delhi.*
2. *Ramana B.V., 11th Reprint, 2010, "Higher Engineering Mathematics", Tata McGraw Hill Co. Ltd., NewDelhi*
3. *Veerarajan T., Engineering Mathematics for first year, Tata McGraw-Hill, New Delhi, 2018.*
4. *K. P. Soman, K. I. Rmachandran, N. G. Resmi, "Insight into Wavelets: From Theory to Practice, (Third Edition)", PHI Learning Pvt. Ltd., 2010.*
5. *C. S. Burrus, Ramose and A. Gopinath, Introduction to Wavelets and Wavelet Transform, Prentice Hall Inc.*
6. *Rao S. S. - 'Engineering Optimization, Theory and Practice' - New Age International Publishers - 2012 - 4th Edition.*
7. *Arora J. - 'Introduction to Optimization Design' - Elsevier Academic Press, New Delhi - 2004*
8. *http://www.nptelvideos.in/2012/12/probability-random-variables.html (Link for NPTEL/SWAYAM/MOOC Courses)*
9. *https://matlabacademy.mathworks.com/details/introduction-to-symbolic-math-with-matlab/symbolic (Link for modern tool usage)*
10. *Grewal B.S., 41st Edition, 2011, "Higher Engineering Mathematics", Khanna Publishers, New Delhi.*
11. *Ramana B.V., 11th Reprint, 2010, "Higher Engineering Mathematics", Tata McGraw Hill Co. Ltd., NewDelhi*

| 2302EE301 | ELECTRICAL MACHINES - I | L | T | P | C |
|---|---|---|---|---|---|
| | | 3 | 2 | 0 | 4 |

**PREREQUISITE:**

1. Electric circuit analysis

**COURSE OBJECTIVES:**

1. To understand the concept of electromechanical energy conversion system in DC machines.
2. To identify the appropriate test to determine the performance parameters of a given machine.
3. To deliberate the working of single and three phase transformers.

**COURSE OUTCOMES:**

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

| | |
|---|---|
| **CO1:** | Report the behavior of DC generator in various phenomenon such as armature reaction , commutation. |
| **CO2:** | Understand the operation and characteristics of DC motor. |
| **CO3:** | Compute the efficiency and regulation of DC machines by conducting various test. |
| **CO4:** | Report the behavior of single-phase transformer with equivalent circuit and load sharing. |
| **CO5:** | Understand the operation, applications of three phase and special purpose transformers. |

**COs Vs POs MAPPING:**

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

**COs Vs PSOs MAPPING:**

| COs | PSO1 | PSO2 | PSO3 |
|---|---|---|---|
| **CO1** | 3 | - | 1 |
| **CO2** | 3 | - | 1 |
| **CO3** | 3 | - | - |
| **CO4** | 3 | - | - |
| **CO5** | 3 | - | - |

**COURSE CONTENTS:**

**MODULE I** **DC GENERATOR** **12 Hours**

Fundamentals of Magnetic circuits - Statically and dynamically induced EMF; Principle of operation-constructional details- Single and double layer winding -Types -EMF equation-armature reaction-commutation-methods of improving commutation; OCC and load characteristics; Applications; Simulation studies on DC generator.

**MODULE II** **DC MOTOR** **12 Hours**

Principle of operation - Significance of back EMF; Torque equations and power developed by armature; Characteristics of DC motor; starters; Speed control methods; Applications of DC motors; Simulation studies on DC motor.

| | | |
|---|---|---|
| **MODULE III** | **TESTING OF DC MACHINES** | **12 Hours** |
| Losses and efficiency in DC machine - Condition for maximum efficiency; Testing of DC Machines-Brake test, Swinburne's test, Hopkinson's test, Field test, Retardation test, Separation of core losses. | | |
| **MODULE IV** | **SINGLE PHASE TRANSFORMER** | **12 Hours** |
| Construction and principle of operation- EMF equation- Equivalent circuit- ; Phasor diagrams- Testing of transformer - Polarity test, Open and short circuit tests, Sumpners test, Efficiency and regulation, All day efficiency; Parallel operation; Applications of single-phase transformer. | | |
| **MODULE V** | **THREE PHASE & SPECIAL PURPOSE TRANSFORMERS** | **12 Hours** |
| Three phase transformer – Construction-Connection; Zig-Zag Transformer; Autotransformer - Copper saving; Power transformer -Types; Distribution transformer- Construction- Roles; Instrument transformer - Role of CT & PT in power system protection; Welding Transformers, Traction Transformers, Pulse Transformers, Energy efficient transformer. | | |
| | | **TOTAL: 60 HOURS** |

**REFERENCES:**

1. *D. P. Kothari and I. J. Nagrath, Electric Machines, Tata McGraw Hill Publishing Company Ltd, 2010.*
2. *J.B. Gupta, Theory & Performance of Electrical Machines, Kataria, S. K., & Sons, 2013.*
3. *Edward Hughes, Electrical and Electronic Technology, 12$^{m}$ edition, Pearson, 2016.*
4. *P. S. Bimbhra, Electrical Machinery, Khanna Publishers, 7th edition, 2011.*
5. *B. L. Theraja and A. K. Theraja, —Text Book of Electrical Technology: AC & DC Machines (Volume- 2), S.Chand& Company Ltd., New Delhi, 2008.*
6. *M.N.Bandyopadhyay, Electrical Machines Theory and practice, PHI Learning Pvt. Ltd, New Delhi 2007.*
7. *http://nptel.ac.in/courses/117106086/*

| 2302EE302 | ANALOG ELECTRONICS | L | T | P | C |
|---|---|---|---|---|---|
| | | 3 | 0 | 0 | 3 |

**PREREQUISITE:**

1. Physics

**COURSE OBJECTIVES:**

1. To understand the structure and operation of electronic devices.
2. To explain the operation and characteristics of electronic circuits.
3. To analyze the BJT and FET based amplifier circuits.

**COURSE OUTCOMES:**

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

| | |
|---|---|
| **CO1:** | Explain the structure, V-I Characteristics and applications of diodes& operation of special diodes. |
| **CO2:** | Describe the V-I characteristics of BJT in CB,CE & CC configurations also able to design and analyze amplifier circuits containing BJT as a device. |
| **CO3:** | Discuss the structure, operation and V-I characteristics of FET & MOSFET. |
| **CO4:** | Explain the need and operation of differential amplifiers, power amplifiers able to analyze differential and Power amplifiers. |
| **CO5:** | Analyze RC, LC and crystal oscillators to find out frequency of oscillations. |

**COs Vs POs MAPPING:**

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

**COs Vs PSOs MAPPING:**

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

**COURSE CONTENTS:**

**MODULE I** **CONVENTIONAL & SPECIAL DIODES** **9 Hours**

**PN Junction Diode**: Structure - Operation and V-I characteristics; Capacitance effect – Diffusion capacitance and transition capacitance; Diode model; Applications- Clippers and clampers.

**Zener Diode**: V-I Characteristics - Breakdown mechanism; Application - Voltage regulator.

**Special Function Diodes**: Structure and operation of LED, Tunnel diode, Schottky diode and Photodiode.

| | | |
|---|---|---|
| **MODULE II** | **BIPOLAR JUNCTION TRANSISTOR AND CIRCUITS** | **9 Hours** |
| **BJT**: Structure- Operation- Biasing circuits; V-I characteristics in common base, common emitter and common collector configurations; DC and AC load line analysis- Determination of Q point; Small signal model; Analysis and comparison of CB, CE and CC amplifiers. | | |
| **MODULE III** | **FIELD EFFECT TRANSISTOR AND CIRCUITS** | **9 Hours** |
| **JFET:** Structure- Operation - n channel and p channel; V-I characteristics and biasing circuits of JFET.<br>**MOSFET:** Structure and operation of D-MOSFET & E-MOSFET; V-I characteristics- Biasing circuits- small signal model; Analysis of common source and common drain amplifiers. | | |
| **MODULE IV** | **DIFFERENTIAL AND POWER AMPLIFIERS** | **9 Hours** |
| **Differential Amplifier:** Common mode and difference mode analysis of BJT based differential amplifier.<br>**Power Amplifiers:** Class A, class B, class C and class AB Amplifiers. | | |
| **MODULE V** | **OSCILLATORS** | **9 Hours** |
| Basics about feedback, Barkhausen criterion; RC oscillators – RC phase shift and Wien bridge oscillators; LC oscillators – Hartley, Colpitts and Clapp; Crystal oscillators – Miller and Pierce crystal oscillators. | | |
| | | **TOTAL: 45 HOURS** |

**REFERENCES:**

1. *Milman, Halkias and Satyabrata Jit, Electronic Devices and Circuits, McGraw Hill Education (India) Private Ltd., 4th Edition, 2015.*
2. *Robert L. Boylestad and Louis Nashelsky, Electronic Devices and Circuit Theory, PHI Ltd., 11th Edition, 2015.*
3. *David A. Bell, Electronic Devices and Circuits‖, Oxford University Press, 5th Edition, 2008.*
4. *Thomas L. Floyd, Electronic Devices, An Imprint of Mc Millan publishing company, 10th Edition, 2017.*
5. *Prof.A.N.Chandorkar, IIT Bombay online lecture series on Analog Electronics http://nptel.ac.in/courses/117101106/*
6. *Prof. S.Karmalkar, IIT Madras, online lecture series on Solid State Devices. http://nptel.ac.in/courses/117106091/*
7. *Albert Malvino and David Bates, Electronic Principles, 8th Edition,*
8. *https://onlinecourses.nptel.ac.in/noc24_ee69/preview*
9. *https://onlinecourses.swayam2.ac.in/nou24_ec04/preview*
10. *http://vlabs.iitkgp.ac.in/psac/newlabs2020/vlabiitkgpAE/exp6/index.html*

| 2302EE303 | DIGITAL ELECTRONICS | L | T | P | C |
|---|---|---|---|---|---|
| | | 3 | 0 | 0 | 3 |

**PREREQUISITE:**

1. Applied Physics for Engineers
2. Electric Circuit Analysis

**COURSE OBJECTIVES:**

1. To study the fundamentals of digital systems, programmable logic devices and logic families.
2. To design and analyze digital systems.
3. To apply the digital simulation techniques for application oriented digital circuits.

**COURSE OUTCOMES:**

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

| | |
|---|---|
| **CO1:** | Solve digital system problems using number systems, binary codes, logic gates, Boolean algebra and Karnaugh Map |
| **CO2:** | Construct combinational logic circuits using logic gates and multiplexers |
| **CO3:** | Build synchronous sequential logic circuits using excitation table, stable table and state diagrams |
| **CO4:** | Construct asynchronous sequential logic circuits using flow table, transition table, state assignment and state reduction techniques |
| **CO5:** | Implement Boolean functions and combinational logic circuits using memories, programmable logic devices and logic families |

**COs Vs POs MAPPING:**

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

**COs Vs PSOs MAPPING:**

| COs | PSO1 | PSO2 | PSO3 |
|---|---|---|---|
| **CO1** | - | 3 | - |
| **CO2** | - | 3 | 2 |
| **CO3** | - | 3 | - |
| **CO4** | - | 3 | - |
| **CO5** | - | 3 | 1 |

**COURSE CONTENTS:**

**MODULE I** **NUMBER SYSTEMS AND DIGITAL LOGIC FAMILIES** **9 Hours**

Number system; Error detection, corrections & codes conversions; Boolean algebra- De-Morgan's theorem; switching functions and Simplification using K-maps-3, 4 and 5 variables.Digital Logic Families - comparison of RTL, DTL, TTL, ECL and MOS families; Operation and characteristics of digital logic family.

| | | |
|---|---|---|
| **MODULE II** | **COMBINATIONAL LOGIC CIRCUIT** | **9 Hours** |
| Design of adders, subtractors, comparators, code converters, encoders, decoders, multiplexers and de-multiplexers. Function realization using multiplexers; Booth multiplier and Array Multiplier; Simulation of simple logic circuits. | | |
| **MODULE III** | **SYNCHRONOUS SEQUENTIAL LOGIC CIRCUITS** | **9 Hours** |
| Latches- Operation of SR and gated SR latch; Flip flops – Method of edge triggering, SR, JK, Master Slave JK, D and T flip flops; Important signals of FF. Design of Synchronous sequential circuits- Model Selection-State transition diagram- State synthesis table - Design equations-State reduction technique and Implementation; Binary counters-4 bit UP, DOWN and UP/DOWN counters; BCD counters, Ring counters, Johnson counters, shift registers. | | |
| **MODULE IV** | **ASYNCHRONOUS SEQUENTIAL LOGIC CIRCUITS** | **9 Hours** |
| Design of asynchronous sequential circuits-Design steps- State transition diagram- State table- FF transition table- K-map based Primitive table- State reduction techniques- State assignment and design equations; Races and hazards. | | |
| **MODULE V** | **MEMORY DEVICES, PROGRAMMABLE LOGIC DEVICES AND VHDL** | **9 Hours** |
| Programmable Logic Devices – PLA, PAL, PLD; Memories: ROM, PROM, EPROM; Introduction to V HDL-Digital design process flow using HDL- Basic VHDL Programming. | | |
| | | **TOTAL: 45 HOURS** |

**REFERENCES:**


1. *M. Morris Mano, ‑Digital Logic and Computer Design‖, Prentice Hall of India, 4th edition, 2013.*
2. *A.Anandkumar, ―Fundamentals of digital circuits‖, 3rd Edition, PHI Learnings Pvt. Ltd, 2014.*
3. *Malvino and Leach, Digital Principles and Applications, Tata McGraw Hill, New Delhi, 7th edition, 2011.*
4. *Floyd, Digital Fundamentals, Pearson Education, 10th edition, 2011.*
5. *John F.Wakerly, Digital Design Principles and Practice, Pearson Education, 4th edition, 2008.*
6. *http://nptel.ac.in/courses/117106086/*

| 2302EE304 | MEASUREMENTS AND INSTRUMENTATION | L | T | P | C |
|---|---|---|---|---|---|
| | | 3 | 0 | 2 | 4 |

**PREREQUISITE:**

1. Electric Circuit Analysis
2. Engineering Exploration

**COURSE OBJECTIVES:**

1. To learnt the measuring instrument characteristics and also to calculate different parameters of Instruments.
2. To empower students to understand the working of electrical equipment used in everyday life.
3. To describe the working principle, selection criteria and applications of various transducers used in measurement systems.

**COURSE OUTCOMES:**

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

| | |
|---|---|
| **CO1:** | Describe the basic functional elements of measuring instruments and the errors in the measurements systems. |
| **CO2:** | Discuss the operation and applications of measuring instrument under typical environment. |
| **CO3:** | Identify the unknown values of resistor, inductor and capacitor of given network using suitable bridge circuit. |
| **CO4:** | Explain the construction and working principle of various storage and display devices. |
| **CO5:** | Make use of sensor and transducers in measuring purpose using data acquisition system. |

**COs Vs POs MAPPING:**

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

**COs Vs PSOs MAPPING:**

| COs | PSO1 | PSO2 | PSO3 |
|---|---|---|---|
| **CO1** | 3 | 3 | - |
| **CO2** | 3 | 2 | - |
| **CO3** | 3 | 2 | 1 |
| **CO4** | 3 | 2 | - |
| **CO5** | 3 | 2 | - |

**COURSE CONTENTS:**

**MODULE I** **INTRODUCTIONS** **9 Hours**

Elements of a generalized measurement system- Primary sensing element, variable conversion element, variable manipulation element, data transmission and presentation element; Static and dynamic characteristics; Errors- Types, measurements, remedial methods; Statistical evaluation of measurement data; Calibration – Calibration methodology; Standards-National and International.

| **MODULE II** | **ELCTRICAL AND ELECTRONIC INSTRUMENTS** | **9 Hours** |
|---|---|---|

**Measuring instruments**- Classification of measuring instruments- Essential requirements of an instrument; Construction and Working Principle of PMMC, MI type instruments, Electro-dynamometer type Wattmeter, Energy Meter; Instrument transformers (CT & PT); Phase sequence indicators; Power factor meters.

**Digital meters**: Electronic multi-meter, Digital voltmeter, Vector Voltmeter.

| **MODULE III** | **DC AND AC BRIDGES** | **9 Hours** |
|---|---|---|

DC bridges –Wheatstone bridge, Kelvin bridge, and their merits and demerits, AC bridges-Maxwell bridge, Anderson bridge, Schering bridge and their merits and demerits; Transformer ratio bridge; Self balancing bridge.

| **MODULE IV** | **STORAGE AND DISPLAY DEVICES** | **9 Hours** |
|---|---|---|

**Display devices**- LED and LCD display, Comparison between LED and LCDs; Recorders- Strip chart recorders, Single point and Multi-point recorders, X-Y recorders, Magnetic tape recorders; Oscilloscope-CRO, Digital CRO and CRO measurements.

**Signal Analysis**: Wave Analyzer, Spectrum Analyzer& Application of Spectrum Analyzer

| **MODULE V** | **TRANSDUCERS AND DIGITAL DATA ACQUISITION** | **9 Hours** |
|---|---|---|

**Transducers-** Classification, Characteristics and Selection factors; Passive transducers-Strain cage, RTD and Thermistors transducers**;** Active transducers-Piezo electric, Hall effect and Thermo electric transducers; A/D and D/A converters; Smart sensors.

**Digital Data Acquisition System**: Interfacing transducers to Electronics Control and Measuring System. Instrumentation Amplifier, Isolation Amplifier.

**TOTAL: 45 HOURS**

**LIST OF EXPERIMENTS:**

1. Measure the given low resistance using Kelvin's Double Bridge.
2. Calibration of single Phase Energy Meter
3. Experiment on Temperature/Pressure/Displacement/flow sensors.
4. Perform signal conditioning by using ADC and DAC.
5. Study the displacement transducer using LVDT and obtain its characteristic
6. Simulation Experiment on
7. Measurement of self-inductance by Maxwell's bridge.

**TOTAL: (45+15) 60 HOURS**

**REFERENCES:**

1. *A.K. Sawhney and Puneet Sawhney, "A Course in Electrical, Electronic Measurements & Instrumentation",DhanpatRaiandCo.,2012*
2. *J.B.Gupta,"ACoursein Electronic and Electrical Measurements", S.K.Kataria & Sons, Delhi, Jan 2012.*
3. *H.S.Kalsi, "ElectronicInstrumentation",TataMcGrawHill,2nd Edition,2018.*
4. *Alan.S.Morris,"PrinciplesofMeasurementsandInstrumentation",2nd Edition,PrenticeHallofIndia, 4. 2003.*
5. *MurthyD.V.S.,"TransducersandInstrumentation",PrenticeHallofIndia,13th Printing,2018.*
6. *https://nptel.ac.in/courses/108/105/108105064//*

| 2301GEX07 | ENVIRONMENTAL SCIENCES AND SUSTAINABLITY | L | T | P | C |
|---|---|---|---|---|---|
| | | 1 | 0 | 2 | 2 |

**PREREQUISITE:**

1. Basic environmental studies

**COURSE OBJECTIVES:**

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

**COURSE OUTCOMES:**

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

| | |
|---|---|
| **CO1:** | Describe the importance of ecosystem. |
| **CO2:** | Describe the various environmental issues and its prevention. |
| **CO3:** | Organ12Oise various natural resources and the immediate need to conserve it. |
| **CO4:** | Select the various ways of conservation of biodiversity. |
| **CO5:** | Investigate the different types of pollution and its effects. |

**COs Vs POs MAPPING:**

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

**COs Vs PSOs MAPPING:**

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

**COURSE CONTENTS:**

| MODULE I | ECOSYSTEM | 8 Hours |
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Concept of an ecosystem – structure and function of an ecosystem – producers, consumers and decomposers. Introduction, types, characteristic features, structure and function of the (a) forest ecosystem (b) grassland ecosystem (c) desert ecosystem (d) aquatic ecosystems (ponds, rivers, oceans).

| MODULE II | ENVIRONMENTAL ISSUES AND SOLUTIONS | 7 Hours |
|---|---|---|

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

| MODULE III | BIODIVERSITY | 10 Hours |
|---|---|---|

Introduction to biodiversity -genetic, species and ecosystem diversity – value of biodiversity: consumptive use, productive use, social, ethical, aesthetic and option values – hot-spots of biodiversity – threats to biodiversity: habitat loss, poaching of wildlife, man-wildlife conflicts – conservation of biodiversity: In-situ and ex-situ

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| conservation of biodiversity. | | |
| **MODULE IV** | **NATURAL RESOURCES** | **10 Hours** |
| Forest resources: Use and over-exploitation, deforestation- timber extraction, mining, dams and their effects on forests and tribal people – Water resources: Use and over utilization of surface and ground water, dams-benefits and problems – Mineral resources: Use and exploitation, environmental effects of extracting and using mineral resources – Food resources: World food problems, changes caused by agriculture and overgrazing, effects of modern agriculture, fertilizer-pesticide problems, water logging, salinity– Energy resources: Growing energy needs, renewable and nonrenewable energy sources, use of alternate energy sources. Energy Conversion processes Biogas – production and uses, anaerobic digestion – Land resources: Land as a resource, land degradation, man induced landslides, soil erosion and desertification – role of an individual in conservation of natural resources – Equitable use of resources for sustainable lifestyles. | | |
| **MODULE V** | **ENVIRONMENTAL POLLUTION** | **10 Hours** |
| Definition – Source, causes, effects and control measures of: (a) Air pollution (b) Water pollution(c) Soil pollution - soil waste management: causes, effects and control measures of municipal solid wastes – (d) Marine pollution (e) Noise pollution –(f) Nuclear pollution (g) Thermal pollution role of an individual in prevention of pollution. | | |
| | | **TOTAL: 45 HOURS** |
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| **LIST OF EXPERIMENTS:** | | |
| **MINI PROJECT ADDITIONAL TOPICS** | | |
| **Soil Science** | | |
| 1. Effects of climate change on soil erosion. | | |
| 2. The role of land management in maintaining soil health. | | |
| 3. Effects of salinity in coastal region Agricultural activity. | | |
| 4. The effects of climate change on agriculture. | | |
| **Urban Ecology** | | |
| 1. How road construction impacts biodiversity and ecosystems. | | |
| 2. The effects of urbanization and city planning on water cycles. | | |
| 3. Impacts of noise pollution on human health. | | |
| **Pollution and Bio-remediation** | | |
| 1. The role of bio-remediation in removing “forever” chemicals from the environment. | | |
| 2. Impacts of air pollution on human health. | | |
| 3. How to improve plastic recycling processes? | | |
| 4. Individual measures to reduce consumption and creation of micro plastics. | | |
| **General Topics** | | |
| 1. Impact of Urbanization on Local Biodiversity | | |
| 2. Renewable Energy Options for Sustainable Living. | | |
| 3. Waste Management Strategies in Urban Areas | | |
| 4. Climate Change and Its Effects on Local Ecosystems | | |
| 5. Air Quality Monitoring in Urban centers | | |
| 6. Water Quality Assessment in Local Water Bodies | | |
| 7. Green Roof Technology and Its Environmental Benefits | | |
| 8. Impact of Plastic Pollution on Marine Life. | | |
| 9. Eco-friendly Practices in Agriculture: | | |
| 10. The Role of Community Gardens in Urban Sustainability | | |
| 11. Alternate energy sources for community Development. | | |
| 12. E-Waste Management. | | |
| 13. Energy Audit of a building. | | |
| 14. Rainwater harvesting system. | | |
| 15. Population growth variation among nations. | | |
| 16. Population explosion. | | |
| 17. Family welfare programme. | | |

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| 18. Women welfare programme. |
| 19. Child welfare programme. |
| 20. Environmental impact analysis. |
| 21. Role of information technology in environmental protection and human health. |
| **TOTAL: 15 HOURS** |
| |
| **REFERENCES:** |
| |
| *1. Trivedi.R.K., "Handbook of Environmental Laws, Rules, Guidelines, Compliances and Standards", Vol. I and II, Enviro Media, 3rd edition, BPB publications, 2010.* |
| *2. Cunningham, W.P. Cooper, T.H. Gorhani, "Environmental Encyclopedia", Jaico Publ., House, Mumbai, 2001.* |
| *3. Dharmendra S. Sengar, "Environmental law", Prentice hall of India PVT LTD, New Delhi, 2007.* |
| *4. Rajagopalan, R, "Environmental Studies-From Crisis to Cure", Oxford University Press, 2005.* |
| *5. Benny Joseph, "Environmental Science and Engineering", Tata McGraw-Hill, New Delhi, 2006* |
| *6. https://en.wikipedia.org/wiki/Carbon_capture_and_storage* |
| *7. Ravikrishnan "Environmental Science and Engineering" Sri Krishna Hi-tech Publishing Company Pvt .* |

| 2302EE351 | ELECTRICAL MACHINES –I LABORATORY | L | T | P | C |
|---|---|---|---|---|---|
| | | 0 | 0 | 2 | 1 |

**PREREQUISITE:**

1. NIL

**COURSE OBJECTIVES:**

1. Complete the circuit to test a given electrical machine.
2. Analyze the performance characteristics of various electrical machines.
3. Evaluate the performance of transformer.

**COURSE OUTCOMES:**

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

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| **CO1:** | Investigate the performance characteristics of a DC generator by conducting OCC and load test. |
| **CO2:** | Analyze the operating behavior of DC motors under various loading conditions. |
| **CO3:** | Obtain equivalent circuit parameters of single / three-phase transformer by conducting OC and SC test. |
| **CO4:** | Compute the current division of transformer by using parallel operation of two transformers. |
| **CO5:** | Report the usage of modern tools in DC motors. |

**COs Vs POs MAPPING:**

| COs | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **CO1** | 2 | 2 | 1 | 1 | - | - | - | - | 3 | 3 | 2 | - |
| **CO2** | 3 | 3 | 3 | 3 | 1 | - | - | - | 3 | 3 | 3 | - |
| **CO3** | 3 | 3 | 3 | 3 | 1 | - | - | - | 3 | 3 | 3 | - |
| **CO4** | 3 | 3 | 3 | 3 | - | - | - | - | 3 | 3 | 3 | - |
| **CO5** | 2 | 2 | 2 | 1 | - | - | - | - | 2 | 2 | 2 | 2 |
| **CO6** | 2 | 2 | 1 | 1 | - | - | - | - | 3 | 3 | 2 | - |

**COs Vs PSOs MAPPING:**

| COs | PSO1 | PSO2 | PSO3 |
|---|---|---|---|
| **CO1** | 3 | - | - |
| **CO2** | 3 | - | 1 |
| **CO3** | 3 | - | 1 |
| **CO4** | 3 | - | - |
| **CO5** | 2 | - | - |
| **CO6** | 3 | - | - |

**LIST OF EXPERIMENTS:**

1. Open circuit and Load characteristics of DC shunt generator.
2. Swinburne‘s and load test on DC shunt motor.
3. Load test on DC series motor.
4. Load test on DC compound motor.
5. Speed control of DC shunt motor (Field control &Armature control method).
6. Open circuit and Short circuit test on single-phase / three phase transformer.

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| 7. Load test on single-phase / three-phase transformer. |
| 8. Parallel operation of single-phase transformers. |
| 9. Simulation on Speed control of DC shunt motor (Field control &Armature control method). |
| 10. PLC based DC drives. |
| **TOTAL: 30 HOURS** |
| |
| **REFERENCES:** |
| |
| 1. *Kothari.D.P & Umre.B.S "Laboratory manual for electrical machines", I.K international Publishing House (P)Ltd. 2nd Edition, 2017* |

| 2302EE352 | ANALOG AND DIGITAL ELECTRONICS LABORATORY | L | T | P | C |
|---|---|---|---|---|---|
| | | 0 | 0 | 2 | 1 |

**PREREQUISITE:**

1. Analog Electronics
2. Digital Electronics

**COURSE OBJECTIVES:**

1. To implement and characterizing the circuit behavior with digital and analog IC's.
2. To design and testing of logic gates.
3. To analyze V-I Characteristics of conventional & special Diodes.
4. To Design a transistor based amplifier circuits.
5. To implement and characterizing the circuit behavior with digital and analog IC's.

**COURSE OUTCOMES:**

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

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| **CO1:** | Determine voltage gain from CE and CB configurations. |
| **CO2:** | Determine the frequency and gain value of various types of oscillators and amplifiers. |
| **CO3:** | Use simplification techniques to design a combinational hardware circuit. |
| **CO4:** | Design and implement combinational and sequential circuits. |
| **CO5:** | Apply various types of biasing and amplifier configuration. |

**COs Vs POs MAPPING:**

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

**COs Vs PSOs MAPPING:**

| COs | PSO1 | PSO2 | PSO3 |
|---|---|---|---|
| **CO1** | 1 | 3 | - |
| **CO2** | 1 | 3 | - |
| **CO3** | 1 | 3 | - |
| **CO4** | 1 | 3 | - |
| **CO5** | 1 | 3 | - |

**LIST OF EXPERIMENTS:**

1. Characteristics of PN junction diode and Zener diode.
2. Characteristics of CE and CB configurations.
3. Design and test a voltage regulator circuit using Zener diode.
4. Design of Hartley Oscillator & Colpitts Oscillator.
5. Design and verify the frequency response of single stage transistor amplifier.
6. Implementation of SISO, SIPO, PISO and PIPO shift registers using Flip-flops.
7. Implementation of Boolean functions, Adder/ Subtractor circuits
8. Design and implementation of Multiplexer and De-multiplexer using logic gates.

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| 9. Design and implementation of encoder and decoder using logic gates. |
| 10. Design and implementation of code converters using logic gates |
| **TOTAL: 30 HOURS** |
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| **REFERENCES:** |
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| *1. Mr.K.Nandakumar, and Mr.V.Yokeswaran "Analog and Digital Integrated Circuits Manual", 2022.* |
| *2. D Roy Choudhury and SheilB.Jani, "Linear Integrated Circuits" 4th Edition, New Age International, New Delhi, 2014.* |
| *3. RamakantA.Gayakward, "Op-amps and Linear Integrated Circuits", 4thEdition, PHI Learnings, 2003.* |
| *4. Mr.V. Yokeswaran, and Mr.K.Gokulraj ―Analog Electronics – Lab Manual‖ 2022.* |
| *5. Milman, Halkias and Satyabrata Jit, ―Electronic Devices and Circuits‖ 4th Edition, Mc Graw Hill Education (India) Private Ltd, 2015.* |
| *6. Integrated circuits: Solution manual: Analog digital circuits and systems manual by Jacob Millman* |