B.N.M. Institute of Technology

An Autonomous Institution under VTU

Department of Electrical and Electronics Engineering

III Semester Syllabus

B.N.M. Institute of Technology

An Autonomous Institution under VTU, Approved by AICTE

Department of Mathematics

Syllabus

Semester: III			
Course: Fourier Series, Transforms and Statistical Techniques **Course Code: 22MAC131 (Common to ECE, EEE & ME)**			
L:T:P:J	**2:1:1:0**	**CIA : 50**	
Credits:	**03**	**SEA : 50**	
Hours:	**40**	**SEA Duration : 03 Hours**	

Course Learning Objectives: The students will be able to

1	Develop knowledge of Statistical methods and curve fitting arising in engineering.
2	Have an insight into Laplace transform, Fourier series, Fourier transforms and Z-transforms.

Module-1: Curve fitting & Statistical methods	**RBT**	**Hrs.**
Examples from Engineering field that require curve fitting and statistical methods. **Curve Fitting:** Curve fitting by the method of least squares-fitting the curves of the form: $y = ax+b$, $y = ax^b$ *and* $y = ax^2 + bx + c$. **Statistical methods:** Introduction to Moments, Skewness, kurtosis and problems. Karl Pearson's coefficient of correlation and lines of regression. ***Lab Component:*** *Problems on curve fitting and statistical methods*	**Apply**	**8**
Module-2: Laplace Transform	**RBT**	**Hrs.**
Examples from Engineering field that require Laplace transforms **Laplace Transform**: Transformation for time domain to frequency domain. Definition and Laplace transforms of elementary functions (statements only). Laplace transform of $e^{at}f(t)$, $t^n f(t)$, $\frac{f(t)}{t}$, $\int_0^t f(t)dt$ and $f^n(t)$ (without proof). Laplace transforms of Periodic functions, unit-step function and unit impulse function. ***Lab Component:*** *Finding the Laplace transforms of function*	**Apply**	**8**
Module-3: Inverse Laplace Transform	**RBT**	**Hrs.**
Examples from Engineering field that require inverse Laplace transforms Definition and problems. Inverse Laplace transform using convolution theorem (without proof). Solution of linear differential equations and simultaneous differential equations. Applications to engineering problems. ***Lab Component:*** *Problems on convolution theorem*	**Apply**	**8**
Module-4: Fourier Series	**RBT**	**Hrs.**
Examples from Engineering field that require Fourier series Periodic functions, Introduction to Fourier Series, Dirichlet's condition. Fourier series of periodic functions with period 2π and arbitrary period. Half range Fourier sine and cosine series. Practical harmonic analysis over the interval *(0, 2l).* ***Lab Component:*** *Finding the Fourier series*	**Apply**	**8**
Module-5: Fourier Transforms & Z -Transforms	**RBT**	**Hrs.**
Examples from Engineering field that require Fourier Transforms & Z -Transforms **Fourier Transforms:** Fourier transform and properties-problems, Fourier sine and cosine transforms. Inverse Fourier transforms.	**Apply**	**8**

Z-Transforms: Introduction to Z-transform, Z-transform of standard functions and properties (without proof). Initial value and final value theorems, problems. ***Lab Component:*** *Finding the Fourier Transforms & Z –Transforms of a function*		

Course Outcomes: After completing the course, the students will be able to

CO 1: Make use of correlation and regression analysis to fit a suitable mathematical model for the statistical data.

CO 2: Use Laplace transform to find the Transformation for time domain to frequency domain

CO 3: Use inverse Laplace transform in solving differential equations arising in network analysis , control system and other fields of engineering

CO 4: Demonstrate Fourier series to study the behavior of periodic functions and their applications in system communications, digital signal processing and field theory.

CO 5: Make use of Fourier transform and Z-transform to illustrate discrete / continuous function arising in wave and heat propagation, signals and systems

Reference Books:

1. E. Kreyszig: "Advanced Engineering Mathematics", John Wiley & Sons, 10"Ed.(Reprint), 2016.
2. B.S. Grewal: "Higher Engineering Mathematics", Khanna Publishers, 44th Ed., 2017.
3. H. K. Dass, " Advanced Engineering Mathematics" S. Chand publication.
4. C.Ray Wylie, Louis C. Barrett : "Advanced Engineering Mathematics", 6" Edition, 2. McGraw-Hill Book Co., New York, 1995.
5. James Stewart : "Calculus —Early Transcendentals", Cengage Learning India Private Ltd., 2017.
6. B.V. Ramana: "Higher Engineering Mathematics" 11th Edition, Tata McGraw-Hill, 2010.
7. Srimanta Pal & Subobh C Bhunia: "Engineering Mathematics", Oxford University Press, 3 Reprint, 2016.
8. Gupta C. B., Singh S. R. and Mukesh Kumar: "Engineering Mathematics for Semester I & II", Mc-Graw Hill Education (India) Pvt. Ltd., 2015.

Web links and Video Lectures:

1. https://archive.nptel.ac.in/courses/111/106/111106111/
2. https://youtu.be/d7NF-_8vVv4
3. https://youtu.be/d7NF-_8vVv4
4. https://youtu.be/LGxE_yZYigI
5. https://youtu.be/GWDyEf0LC0o
6. https://youtu.be/sMYtHaSIXbU

Department of Electrical and Electronics Engineering

Semester: III	
Course Name: Generation, Transmission and Distribution (PCC) **Course Code: 22EEE132**	
Teaching Hours/Week (L:T:P:J): (2:2:0:0)	**CIA Marks:50**
Credits:3	**SEA Marks:50**
Hours:40	**SEA Duration: 03 hours**

Course Learning Objectives:

- To understand the concepts of various methods of generation of power
- To understand the merits and demerits of hydroelectric power plant, thermal power plant and nuclear power plant
- To understand the conductor and insulator selection
- To calculate the parameters of the transmission line for different configurations and assess the performance of the line
- To understand the basics of the AC distribution system

Pre-Requisites: Basic Electrical Engineering, Transmission and Distribution

Course Outcomes: After the completion of the course the students will be able to:

- Explain the generation of electrical energy, its sources, conventional and non-conventional generation of power
- Explain the structure of power system & selection of conductors and string efficiency
- Calculate the line parameters for a single phase, three phase–symmetrical and unsymmetrical systems.
- Calculate the performance and efficiency of short and medium transmission lines
- Explain primary & secondary distribution system
- Explain the impact of high-power transmission and distribution systems on society

Module-1: Power Generation	RBT	Hrs.
Introduction: Importance of electricity, Generation of electrical energy, Sources of energy, Comparison of energy sources. **Hydro-electric power station:** Introduction, Advantages and disadvantages, Schematic arrangement, Selection of site, Constituents of plant – Hydraulic structures, Water turbine, Electrical equipment **Steam power station:** Introduction, Advantages and disadvantages, Schematic arrangement, Choice of site, Equipment of steam power station **Nuclear power station:** Introduction, Advantages and disadvantages, Schematic arrangement - Nuclear reactor, Heat exchanger, Steam turbine, Alternator, Selection of site **Reference Book 1 : Chapters 1, 2**	**Understand**	**8**
Module-2: Electrical Supply System	**RBT**	**Hrs.**
Electrical Supply System: Layout, Advantages of HV transmission, Elements of a transmission line, Conductors –Aluminium Conductor steel reinforced (ACSR), Gap type thermal resistant aluminium alloy conductor steel reinforced (GTACSR), High Tension Low Sag (HTLS) conductor, Bundle conductor and its advantages. Importance of sag, Sag calculation – supports at same and different levels, **Overhead line Insulators:** A brief introduction to types of insulators, material used- porcelain, toughened glass and polymer (composite). Potential distribution over suspension insulator string, String efficiency, Methods of increasing string efficiency (Description only). **Reference Book 1 : Chapters 8**	**Apply**	**8**

Module-3: Transmission Line Parameters	RBT	Hrs.
Introduction to line parameters- resistance, inductance and capacitance. Calculation of inductance of single phase and three phase lines with equilateral spacing, unsymmetrical spacing, double circuit and transposed lines. Inductance of composite – conductors, geometric mean radius (GMR) and geometric mean distance (GMD). Calculation of capacitance of single phase and three phase lines with equilateral spacing, unsymmetrical spacing, double circuit and transposed lines, geometric mean radius (GMR) and geometric mean distance (GMD). Advantages of single circuit and double circuit lines. **Reference Book 2 : Part 2 Chapter 2**	**Apply**	**8**
Module-4: Performance of Transmission Lines and Underground Cables	**RBT**	**Hrs.**
Performance of Lines: Classification of lines – short, medium and long. Current & voltage relations, line regulation, transmission efficiency, and ABCD constants in short and medium-length lines, Ferranti effect on long-length lines**.** **Underground Cables:** Introduction, construction features, insulating materials for cables, classification of cables – belted cables, screened cables and pressure cables, comparison between AC and DC cables and limitations of cable. **Reference Book 1: Chapters 10, 11**	**Apply**	**8**
Module-5: Distribution Systems	**RBT**	**Hrs.**
Distribution: Primary AC distribution systems – Radial feeders, parallel feeders, loop feeders and interconnected network system, Methods of solving AC distribution problems, Secondary AC distribution systems – Three phase 4 wire system, Effect of disconnection of neutral in a 3 phase four wire system. **Reference Book 1: Chapters 12, 14**	**Understand**	**8**

Reference Books:

1. Principles of Power System,V.K. Mehta & Rohit Mehta, S. Chand Technical Publications.
2. A Course in Electrical Power, Soni Gupta & Bhatnagar Dhanpat Rai & Sons. 1st Edition, 2013

Department of Electrical and Electronics Engineering

Semester: III

Course Name: Network Analysis (PCC)
Course Code: 22EEE133

Teaching Hours/Week (L:T:P:J): 2:2:0:0	**CIA: 50**
Credits: 3	**SEA: 50**
Hours: 40 Hrs	**SEA Duration: 03 Hours**

Course Objectives:

- To explain about the various elements used in electrical circuits.
- To explain the use of network reduction and network solution methods for the analysis of electric circuits.
- To apply the concept of network theorems for the solution of electric circuits.
- To explain the concept of the time domain approach to analyze the initial and final behaviour of electric circuit elements.
- To explain the simplified Laplace transformation approach to analyze the behaviour of electric circuits.

Pre-requisites: KVL, KCL, series-parallel reduction of circuits with R, L, and C elements, complex variable operations, linear algebra, solution of differential equations, Laplace transforms and inverse Laplace transforms

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

- Analyse the given circuit (both single phase and three phases) using network reduction & other network solution methods.
- Solve the given electric circuit by applying the concept of network theorems.
- Analyse the behaviour of electrical network under initial, steady state condition and variation of parameters.
- Analyse electric circuits using Laplace transformations.
- Model the given two port networks in terms of network parameters (Z, Y, h and T)

Module-1: Fundamentals of Network Theory	**RBT**	**Hrs**
Basic network elements, classification, representation. Network reduction using Source transformation, and source shifting. Star-delta transformations, network reduction using star-delta transformations. Applications of KVL and KCL for Mesh current and node voltage analysis of AC and DC electric circuits with and without control sources. Super loop and super node methods. Illustrative examples	**Apply**	**8**
Module–2: Network Theorems	**RBT**	**Hrs**
Integro-differential equations on loop and node basis of circuits with R, L and C. Duality in electric networks. Superposition theorem, Thevenin's and Norton's theorems, Millman's theorem, and Maximum power transfer theorem. Illustrative examples (dependent sources excluded).	**Apply**	**8**
Module–3: Initial conditions and Resonance in networks.	**RBT**	**Hrs**
Initial conditions Initial conditions, definition and its importance in networks, evaluation of initial conditions in R-L, R-C, and R-L-C series and parallel circuits excited by DC sources. Interpretation of derivatives and waveform prediction, illustrative examples. **Resonance-** Meaning, importance, definitions of terminologies, series resonance, resonant frequency, Quality factor, half power frequencies, bandwidth of series and parallel resonant circuits, illustrative examples.	**Apply**	**8**
Module–4: Laplace transform	**RBT**	**Hrs**
Definition, importance, and applications. Laplace transforms of various parameters, Standard input signals (impulse, step, ramp, and parabolic). Inverse Laplace transformations, Partial fraction expansions. Applications of Laplace transformations for Analysis of simple R-L, R-C,	**Apply**	**8**

and R-L-C series parallel circuits excited by DC sources. Initial value and final value theorems, illustrative examples.		
Module-5: Two port Network parameters and Three phase circuits.	**RBT**	**Hrs**
Two port Network parameters Two-port network modeling through Z, Y, h and T-parameters. Relationship between the network parameters. Illustrative examples of evaluating the parameters of two-port networks containing independent and controlled sources. **Three-phase circuits:** Three-phase systems - three-phase 3-wire and 4-wire systems, unbalanced star and delta connected loads, evaluation of current, powers in unbalanced star and delta connected loads excited by balanced three-phase supply, illustrative examples.	**Apply**	**8**

Reference Books:

1. Network Analysis. Prof.K.Chennavenkatesh, Dr. Ganesh Rao, Publisher-Sanguine Technical Publishers.
2. Circuit Theory (Analysis and synthesis), A. Chakrabharathi, Dhanpat rai @co.(pvt.) Ltd, 6th ed. 2010.
3. Electric Circuits, Joseph A Edminister & Mahmood Nahavi, 5th ed. Schaum's outlines, McGraw Hill.

Department of Electrical and Electronics Engineering

Semester: III

Transformers and Induction Motors (PCI)

Course Code: 22EEE134

Teaching Hours/Week (L:T:P:J): (3:0:2:0)	**CIE Marks:** 50
Credits: 4	**SEE Marks:** 50
Hours: 40 Hours Theory+ 10 Lab Sessions	**SEE Duration:** 03 Hours

Course Learning Objectives:

- To understand the working of transformer, auto-transformer, and IM
- To understand the performance of single-phase & three phase transformer
- To understand the characteristics, starting methods, speed control of three phase IMs
- To understand the performance of three phase IMs and single-phase IM

-Requisites: Electromagnetic Induction, Single phase and three phase AC circuits, KCL & KVL

Course Outcomes: After the completion of the course the students will be able to:

- Explain the construction and working of single-phase & 3-phase transformer, auto-transformer.
- Determine the performance parameters of single-phase transformers and three-phase transformers through load and no-load tests
- Explain the construction, working, and types of 3-phase & single-phase Induction motor
- Explain the performance characteristics, starting methods and speed control of three phase IMs
- Determine the performance parameters and characteristics of Induction Motor through load and no-load test.

Module-1: Single-Phase Transformers	RBT	Hrs
Single-Phase Transformers: Necessity of transformer, principle of operation, Types and construction, EMF equation, Operation of practical transformer under no-load and on-load with phasor diagrams, equivalent circuit, Transformer losses, efficiency, and condition for maximum efficiency, voltage regulation, all day efficiency. Illustrative examples	**Apply**	**8**
Module-2: Testing and Parallel operation of Single-phase transformers	**RBT**	**Hrs**
Testing: Open circuit and short circuit tests, polarity test, Sumpner's test, and separation of hysteresis and eddy current losses, Illustrative examples **Parallel operation -** need, conditions to be satisfied for parallel operation– Single phase and three phase, Load sharing in case of similar and dissimilar transformers, Illustrative examples	**Apply**	**8 hours**
Module-3: Three phase transformers and Auto Transformers	**RBT**	**Hrs**
Three-phase Transformers: Introduction, Constructional features of three-phase transformers. Choice between single unit three-phase transformer and a bank of three single-phase transformers, Transformer connections for three phase operation - delta/star, delta/delta, star/delta, and vee/vee, choice of connections. Tertiary winding, Scott connection for three-phase to two-phase conversion, Illustrative examples **Autotransformers:** Single phase and three phase auto transformer, saving of conductor material, comparison of auto transformer and two winding transformer, Illustrative examples	**Apply**	**8 hours**
Module-4: Three phase Induction Motor	**RBT**	**Hrs**
Three phase Induction Motor: Concept and generation of rotating magnetic field, Principle of operation, construction, classification, and types; squirrel-cage, slip-ring. Slip and its significance, Torque equation, torque-slip characteristics Starting torque and Maximum torque, Equivalent circuit, Losses and efficiency, power flow diagram, Phasor	**Apply**	**8 hours**

diagram of induction motor on no load and loaded conditions. (numerical as applicable), Applications		
Module-5: Testing, Starters and Speed Control of 3-phase IM & Single-Phase IM	**RBT**	**Hrs**
Tests on three phase Induction Motor: Brake test, No-load and blocked rotor tests, circle diagram, Performance of the motor from the equivalent circuit. Illustrative examples **Starters and Speed control for 3-phase IMs:** Need for starter. Direct on line (DOL), Star-Delta and autotransformer starting, Rotor resistance starting. Speed control by V/f control (qualitative) and rotor resistance control **Single-Phase Induction Motor:** Double field revolving theory and principle of operation. Construction and operation of split-phase, capacitor start and capacitor run and shaded pole motors, and applications. (Excluding Numerical)	**Apply**	**8 hours**

Laboratory Experiments:

1. Open Circuit and Short circuit tests on single phase transformer and predetermination of (i) Efficiency and regulation (ii) Calculation of parameters of equivalent circuit.
2. Sumpner's test on transformers and determination of individual transformer efficiency
3. Polarity test and Parallel operation of two dissimilar single-phase transformers and determination of load sharing and analytical verification using the short circuit test data.
4. Scott connection with balanced and unbalanced loads
5. Separation of hysteresis and eddy current losses in single phase transformer.
6. Connection of 3 single-phase transformers in (a) star – delta, (b) delta – delta and (c) V – V (open delta) and determination of efficiency and regulation under balanced resistive load.
7. Load test on three phase induction motor.
8. No load and Blocked rotor tests on three phase induction motor to draw the circle diagram and hence to determine (i) the performance parameters at different load conditions and (ii) obtain the equivalent circuit.
9. Load test on single-phase induction motor
10. Performance characteristics of Induction Generator

Reference Books

1. Electrical Machinery, J.B. Gupta, S K Kataria & Sons
2. Electric Machines, D P Kothari, I J Nagrath, TMH
3. Electrical Machines, Ashfaq Hussain, Dhanpat Rai & Co. Publications
4. Electrical Technology, B L Theraja and A K Theraja

Web links and Video Lectures:

NPTEL Courses

https://nptel.ac.in/courses/108106071
https://archive.nptel.ac.in/courses/108/105/108105155/
https://nptel.ac.in/courses/108106072
https://archive.nptel.ac.in/courses/108/105/108105131/
https://archive.nptel.ac.in/courses/108/102/108102146/

Department of Electrical and Electronics Engineering

Semester: III	
Analog and Digital Electronic Circuits (PCI) **Course Code: 22EEE135**	
Teaching Hours/Week (L:T:P:J): (3:0:2:0)	**CIE Marks:** 50
Credits: 4	**SEE Marks:** 50
Hours: 40 hours Theory+ 10 lab sessions	**SEE Duration: 0**3 Hours

Course Learning Objectives: The students will be able to

- ❖ Understand non-linear application of op-amp and realize function generator using op-amp.
- ❖ Design and analyse Butterworth filter circuit
- ❖ Use D/A and A/D convertors, Linear ICs 555, Voltage regulators for Analog circuit applications
- ❖ Implement Boolean switching functions after using K-map to simplify equations
- ❖ Use combinational circuits like Code converters, multiplexers, decoders
- ❖ Use flip flops to realize registers, and counters

Pre-Requisites: Course on Basic Electronics

Course outcomes: At the end of the course the student will be able to
CO1: Implement filters, waveform generators and non-linear applications of Op-Amp for a given requirement
CO2: Use Timer IC, Regulators, D/A and A/D converters for a given application
CO3: Simplify given Boolean expression using k-map
CO4: Build combinational circuits for code conversion, multiplexer, decoder, and encoder.
CO5: Build sequential circuits using flip flops for registers and counter operations

Module-1: Introduction to Digital Circuits and Combinational circuits	RBT	Hrs
Review of Digital basics and logic gates, Switching equations, Canonical form of SOP and POS, Simplification and realization of Digital switching equations using K-map [3 and 4 variables], Design Code convertors [BCD to Excess-3, BCD to 7-segment code]	**Apply**	**8**
Module-2: Combinational circuits and Introduction to sequential circuits	**RBT**	**Hrs**
Multiplexers (Mux): Implementation of 4:1, 8:1 Mux, Realization of Boolean expression using Mux. **Decoders:** Implementation of 2:4, 3:8 decoders, Realizing higher order decoder using lower order decoders, realization of Boolean expression using Decoders. **Encoders:** Implementation of 4:2, 8:3 encoders **Flip Flops:** Basic bistable element, Gated SR Latch, Need for Edge triggered flip flops, Edge triggered D-flip flop, JK-flip flops and T-flip flops [Block diagram and Functional truth table only], Characteristic equation of flip flops, Excitation table of flip flops, Interconversion of flip flops.	**Apply**	**8**
Module-3: Sequential circuits	**RBT**	**Hrs**
Registers: Types of registers, Shift registers, 4-bit PIPO, PISO, SISO, SIPO registers, Universal shift registers, **Counters:** Binary ripple counters, Synchronous Binary counters, Counters based on Registers, Design of Synchronous counters	**Apply**	**8**
Module-4: Operational Amplifier Applications		
Review of op-amp parameters **Op-Amp Non-Linear Applications:** ZCD, Schmitt Trigger [Analysis and Design] **Waveform generation:** Generation of Square wave using Astable circuit [Analysis and Design], Phase shift oscillator, Triangular wave generation **Filters:** Advantage of active filter, First order Butterworth Low pass, High pass, [Analysis and Design]	**Apply**	**8**
Module-5: Linear IC applications	**RBT**	**Hrs**

D/A and A/D convertors: Introduction to D/A and A/D convertors, R-2R D/A convertor, Successive approximation A/D convertors **555 Timer IC:** Internal Block diagram of 555, working of 555 as astable and monostable circuit. Applications of monostable and astable circuits[Analysis and Design] **Voltage regulators:** Fixed voltage regulators using 78XX and 79XX IC, Adjustable voltage regulators using LM317	**Apply**	**8**

Reference Books

1. Op-Amps and Linear Integrated Circuits, by Ramakant A.Gayakwad, 4th edition, PHI, 2012.
2. Digital Design, by M.Morris Mano, Michael D.Ciletti, 5th edition, Pearson Education Inc.
3. Digital Principles and Design, Donald D. Givone, TMH Edition 2002
4. Charles H Roth JR, Larry L Kimney, "Fundamentals of Logic Design", Cengage Learning, 5th edn.
5. S. Shalivahanan et.al., "Linear Integrated Circuits", McH, 2nd edn, 2014

Lab Experiments (10 Lab sessions)	
Sl. No.	**Experiments**
1	Design and realization of 1st order Butterworth High pass and low pass filter
2	Design and realization of Schmitt trigger circuit of a given UTP and LTP
3	Design and realization of square wave generation using 555 Timer IC
4	Realization of R-2R ladder D/A convertor
5	Realization of op-amp based function generator for Square and Triangular wave generation.
6	Design and realization of Op-Amp based Sine wave generator.
7	Simplification and realization of a given Boolean expression using logic gates
8	Realization of 4-bit adder/subtractor using Adder IC
9	Realization of 3-bit mod-N counter using counter IC
10	Realization of Johnson and Ring counter

Department of Electrical and Electronics Engineering

Semester: III	
Course Name: Python Programming for Electrical Engineers (PBL) **Course Code: 22EEE136**	
Teaching Hours/Week (L:T:P:J): (0:0:2:2)	**CIE Marks:** 50
Credits: 2	**SEE Marks:** 50
Hours: 30	**SEE Duration: 0**3 Hours

Course objectives: The students will be able to

- To know the basics of algorithmic problem solving using python.
- To develop Python programs with conditionals, loops, and functions.
- To use Python data structures –- lists, tuples, dictionaries.
- To write Python programs for problem solving and analysis in the field of Electrical Engineering.
- To develop programs using Python for embedded applications

Pre-requisites:

Fundamental knowledge of computer systems, Basic knowledge of C Programming, Basic Electrical Engineering, Electrical Circuit Analysis, Analog and Digital Circuits

Lab Course outcomes: At the end of the course the student will be able to:

- Develop applications using Python Programming
- Develop programs with different data types utilizing loops, decision-making statements, and functions.
- Evaluate the characteristics of the machines and transformer parameters using Python.
- Develop a python program for linear circuits and digital circuits.
- Develop a Python program to interface sensors, actuators with a Python supported microcontroller board.
- Communicate effectively about the chosen problem
- Write technical report for the chosen problem

Sl. No.	Experiments
1	**Installation Guide, Operators, Datatypes, and Basic I/P and O/P operations.** 1. Write a python program to convert temperature to and from Celsius to Fahrenheit. 2. Write a Python program to compute the distance between two points taking input from the user.
2	**Decision Making and Loop Statements, strings** 1. Write a program to create, concatenate and print a string and access substring from a given string. 2. Write a python program to print prime numbers less than 50. 3. Develop a python code to design and realize Combinational/Sequential logic circuits.
3	**Lists, Tuples, Dictionaries.** 1. Write a python program to create a list and perform the following methods 1) insert() 2) remove() 3) append() 4) len() 5) pop() 6) clear() 2. Write a program to Create a tuple and perform the following methods 1) Add items 2) len() 3)check for item in tuple 4)Access items 3. Write a program to create a dictionary and apply the following methods 1) Print the dictionary items 2) access items 3) use get() 4)change values 5) use len()
4	**Functions, Modules** 1. Write a function to compute GCD, LCM of two numbers. Each function shouldn't exceed one line. **2.** Write a Python program to define a module to find Fibonacci Numbers and import the module to another program.
5	**Error Handling, Numpy and Matplotlib modules** 1. Write a program in Python to handle user-defined exception for given problem. 2. Write a python program to perform AC Analysis.

6	**Introduction to PySpice (Python, Installation Guide)** Write a program to perform DC Nodal Analysis using Pyspice(Python)
7	Write a program to plot the Characteristics of the Induction Motor
8	Write a python code plot the efficiency of Transformer at different loads.
9	**Introduction to RaspberryPi, Installation Guide** Write a program in Python to send digital data on Raspberry pi GPIO pins to blink LED, Fade an LED and develop a simple traffic light system.
10	Connect the Digital/Analog I/O module and write a program in python to interface the various Analog Sensors such as temperature sensors, Motion sensors.
11	Write a python script to control the speed of Servomotor.
12	Speed control of DC motor using Raspberry-pi and python

Sl. No.	List of indicative Projects
1	Electricity Bill Management System using python
2	Smart Surveillance Monitoring System Using Raspberry PI and PIR Sensor:
3	Temperature based DC Fan Control
4	Autonomous Lane Detection Car Using Raspberry Pi and python
5	Raspberry Pi-based Automated Street Lighting System
6	Raspberry Pi based Battery monitoring system
7	Smart Energy meter using Raspberry pi and IoT
8	Text to Speech Converter using Python
9	Create an analog clock using python.
10	Power theft identification and alerting system using Raspberry Pi

Reference Book

1.	Think Python: How to ThinkLike a Computer Scientist	Allen B. Downey	Green Tea Press	2nd Edition, 2015
2.	"Automate the Boring Stuff with Python"	Al Sweigart	Starch Press	1st Edition, 2015
3	"Python programming using problem solving approach"	Reema Thareja	Oxford university press	1st Edition, 2018
5	Introduction to programming using Python,	Y. Daniel Liang	Pearson Publications	1st Edition,2017.
6	Python for Science and Engineering	Hans-etter Halvorsen	https://www.halvorsen.blog/documents/programming/python/	August,2020
7	Programming the Raspberry Pi, Getting Started with Python	Simon Monk	McGraw Hill	Third Edition

Web links and Video Lectures:

https://www.learnbyexample.org/python/
https://www.learnpython.org/
https://pythontutor.com/visualize.html#mode=edit
https://pyspice.fabrice-salvaire.fr/releases/v1.3/examples/index.html
https://nptel.ac.in/courses/106106145
https://www.w3schools.com/python/

Semester: III		
COURSE: CONSTITUTION OF INDIA AND PROFESSIONAL ETHICS		
Course Code: 22CIP137	**L:T:P:J: 0:2:0:0**	**CIE Marks:** 100
Credits:	**1**	**SEE Marks:- -**
Hours:	**15 hrs**	**SEE Duration:--**

Course Learning Objectives: The students will be able to

1	know the fundamental political codes, structure, procedures, powers, and duties of Indian government institutions, fundamental rights, directive principles, and the duties of citizens
2	know the Indian top civil service positions and the exams conducted by UPSC and SPSC for the same
3	Understand engineering ethics and their responsibilities; identify their individual roles and ethical responsibilities towards society.

MODULE 1: Introduction to Indian Constitution	RBT	Hrs
The Necessity of the Constitution, Introduction to Indian Constitution, The Making of the Constitution, Role of Constituent Assembly, Preamble and Salient features of the Constitution of India, Fundamental Rights and its Restriction and limitations in different complex situations, Directive Principles of State Policy, Fundamental Duties.	**1,2,3**	**3**
MODULE 2: System of Government, Central Government, State Government	**RBT**	**Hrs**
System of Government-Parliamentary System, Federal System. Central Government-Basic details, Powers and Functions of Union Executive. Parliament- LS and RS (Composition, Duration, Membership and Presiding officers of Parliament and their functions). Leaders in Parliament (Leader of the House and Leader of the Opposition). Sessions of Parliament (Summoning, Adjournment, Adjournment Sine Die, Prorogation, Dissolution). Quorum of House, Language in Parliament, Joint sitting of two Houses. State Government- Basic details, Powers and Functions of State Executive. State Legislature (Composition, Duration, Membership and Presiding officers of Parliament and their functions).	**1,2,3**	**3**
MODULE 3: Judiciary, Amendments and Emergency Provisions	**RBT**	**Hrs**
Supreme Court, High Court, Judicial Review, Judicial Activism. Methods in Constitutional Amendments (How and Why). Types of Emergencies and its Consequences, Recent Amendments to the Constitution.	**1,2,3**	**3**
MODULE 4: Elections, Constitutional and Non Constitutional Bodies	**RBT**	**Hrs**
Elections- Election Commission of India, Electoral Process. Constitutional Bodies- Election Commission, Union Public Service Commission, State Public Service Commission, Goods and Service Tax Council. Non Constitutional Bodies- Central Information Commission, State Information Commission.	**1,2,3**	**3**
MODULE 5: Professional Ethics	**RBT**	**Hrs**
Scope & Aims of Engineering & Professional Ethics, Positive and Negative Faces of Engineering Ethics, Responsibilities in Engineering, the impediments to Responsibility. Trust and Reliability in Engineering, Risks, Safety and liability in Engineering, Clash of Ethics, IPRs (Intellectual Property Rights)	**1,2,3**	**3**

Course outcome: On completion of this course, students will be able to,
CO1: Have constitutional knowledge and legal literacy.
CO2: Have knowledge on All India Services and State Civil Services.
CO3: Understand Engineering and Professional Ethics and responsibilities of Engineers.

Reference Books

Suggested Learning Resources:

1.**Title of the Book - Indian Polity**
Name of the Author - M Lakshmikanth
Name of the Publisher-Mc Graw Hill Education
Edition and Year- 2019

2.**Title of the Book - Engineering Ethics**
Name of the Authors - M. Govindarajan, S.Natarajan, V.S. Senthilkumar
Name of the Publisher- Prentice-Hall
Edition and Year-2004

3. Durga Das Basu (DD Basu): "Introduction to the Constitution on India", (Students Edition.)Prentice –Hall EEE, 19th / 20th Edn., (Latest Edition) or 2008.

4. Shubham Singles, Charles E. Haries, and Et al : "Constitution of India and Professional Ethics" byCengage Learning India Private Limited, Latest Edition – 2018.

5. M.Govindarajan, S.Natarajan, V.S.Senthilkumar, "Engineering Ethics", Prentice –Hall of IndiaPvt. Ltd. New Delhi, 2004

6. M.V.Pylee, "An Introduction to Constitution of India", Vikas Publishing, 2002.

7. Latest Publications of **NHRC - Indian Institute of Human Rights**, New Delhi.

Web Links and Video Lectures www.unacademy.com/lesson/future-perfect-tense/YQ9NSNQZ https://successesacademy

Semester: III		
COURSE: Soft Skill-1		
Course Code: 22SFT138	**L:T:P:J: 0:2:0:0**	**CIA Marks:** 100
Credits:	**1**	**SEA Marks:- -**
Hours:	**15 hrs**	**SEE Duration: --**

Course Learning Objectives: The students will be able

1	To help students understand their strengths and weakness.
2	To develop analytical and creative ability to solve problems individually or as a team.
3	To make students industry ready through practice of corporate etiquettes.
4	To enhance public speaking and presentation skills.

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

CO1	Understand their strength and weaknesses.
CO2	Develop analytical and creative ability to solve problems.
CO3	Identify themselves as industry ready through the practice of corporate etiquettes.
CO4	Enhance public speaking and presentation skills.
CO5	Build team collaboration by working towards shared goals.

Module No.	Contents of the Module	Hours	Cos
1	**Module-1 Understanding and Managing Self** Self-Awareness, Self-Management, Anger Management, Time management, Change management. Vision and goal setting - Diff between vision and goal, smart, stretched goal concept, case studies Knowledge, Skill, Attitude Personality analysis using Big 5 personality test Critical Thinking, Problem solving, Creativity and innovation Integrity, ethics, values	8	**1 &2**
2	**Module -2 Corporate etiquettes and Mannerism** Introduction to Etiquette and Mannerism, Personal Etiquette, Grooming etiquettes- professional styling, Body & personality styling, Video Interview Etiquettes, Personal Interview Etiquettes Effective meeting skills. Workplace behaviour, Personal interview	6	**3**
3	**Module -3 Public Speaking and presentation skills** Introduction to public speaking, making ideas, illustrating and delivering ideas, overcoming fear of public speaking and developing great delivery. Advanced Business presentation skills, PowerPoint presentation, Group discussion	**6**	**4**
4	**Module -4 Team Work** Interpersonal skills, group work vs team work	**4**	**5**

Mapping of Course Outcomes with Programme Outcomes:

CO1	PO8	PO9	PO10	PO11
CO1	3	3		
CO2		3		3
CO3	3	3		3
CO4		3	3	
CO5			3	3

MOOC Course:

Communicate with impact - https://www.coursera.org/learn/communicate-with-impact
Leading Diverse Teams - https://www.coursera.org/learn/leading-diverse-teams

Practical component:

1. Mock GD and interview may be conducted at the end of the course to check their confidence. Students can prepare their SWOT analysis and present the same.
2. The students are to be involved in various activities and games such as Just a Minute or Pick and speak to demonstrate each topic.

Semester: III	
Course Name: Innovative Project Lab **Course Code: 22EEE139**	
Teaching Hours/Week (L:T:P:J): (0:0:0:2)	**CIA: 100**
Credits: 1	**SEA: -**
Hours: 15 hrs.	**SEA Duration: -**

Course Objectives:

- To encourage independent learning and innovative attitude of the students
- To inspire team working
- To expand Intellectual capacity, Credibility and Judgement.
- To develop Interactive attitude, Communication skills, Time management & Presentation skills.

All the students registered to II year of BE shall have to take up Innovative during III semester. Semester End Assessment will be conducted and the prescribed credit will be included.

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

- Demonstrate a sound technical knowledge of their selected project topic.
- Undertake problem identification, formulation and solution.
- Design engineering solutions to complex problems utilizing a systems approach.
- Communicate with engineers and the community at large in written or oral forms.

B.N.M. Institute of Technology

An Autonomous Institution under VTU

Department of Electrical and Electronics Engineering

IV Semester Syllabus

Department of Mathematics

Semester: IV	
Course: Complex Analysis, Probability and Random Process **Course Code: 22MAC141 (Common to ECE, EEE & ME)**	
Teaching Hours/Week (L:T:P:J): (3:0:0:0)	**CIA: 50**
Credits: 03	**SEA: 50**
Hours: 40	**SEA Duration: 03 Hours**

Course Learning Objectives: The students will be able to

1 Provide an insight into applications of complex variables and conformal mapping arising in potential theory, quantum mechanics, heat conduction and field theory.

2 Develop the knowledge of probability, joint probability distribution and Random process occurring in digital signal processing, design engineering and microwave engineering.

Module-1: Complex Analysis	RBT	Hrs
Examples from Engineering field that require complex analysis. Review of function of a complex variable, limits, continuity and differentiability. Analytic functions. Cauchy-Riemann equations in Cartesian and polar forms. Consequences of Cauchy-Riemann equations (only statement), construction of analytic function using Milne-Thomson method. **Lab Component:** problems on construction of analytic functions	**Apply**	**8**
Module-2: Conformal Mapping & Complex Integration	**RBT**	**Hrs**
Examples from Engineering field that require Conformal Mapping & Complex Integration. **Conformal mapping:** Introduction, discussion of transformations: $w = e^z$, $w = z^2$, $w = z + \frac{1}{z}$ $(z \neq 0)$ and bilinear transformations. **Complex integration:** Introduction to complex integration, Cauchy's theorem and Cauchy's integral formula. **Lab Component:** problems on Cauchy's integral formula	**Apply**	**8**
Module-3: Probability Distributions & Joint probability distribution	**RBT**	**Hrs**
Examples from Engineering field that require Probability and Joint probability distribution **Probability Distributions:** Review of basic probability theory. Discrete and continuous Random variables, probability mass/density functions (definitions only). Binomial, Poisson, exponential and normal distributions (without proof). **Joint probability distribution:** Joint Probability distribution for two discrete random variables, expectation, covariance and correlation. **Lab Component:** Problems on binomial, Poisson, exponential and normal distributions	**Apply**	**8**
Module-4:Markov Chain & Sampling Theory	**RBT**	**Hrs**
Examples from Engineering field that require Markov Chain and Sampling Theory **Markov Chain**: Introduction to Stochastic process, Probability vectors, Stochastic matrices, Regular stochastic matrices, Markov Chains, Higher transition probabilities, Stationary distribution of Regular Markov chains and absorbing states, Markovian processes. **Sampling Theory**: Introduction to sampling theory, Testing of hypothesis, level of significance, confidence limits, test of significance of mean and difference of means for large samples-z-test, test of significance of small samples-Student's t- distribution, Goodness of fit-Chi-square test. **Lab Component:** Problems on Markovian processes and, Sampling Theory	**Apply**	**8**

Module-5: Random Process	RBT	Hrs
Examples from Engineering field that require random process Introduction, classification of random process, methods of description of a random process, stationary, auto-correlation function, Ergodicity, Spectral representation, Weiner-Kinchine theorem, Poisson process, pure birth process, birth and death process with a constant rate, death process with a linear rate. **Lab Component:** Problems on Poisson process, pure birth process, birth and death process	**Apply**	**8**

Course Outcomes: After completing the course, the students will be able to

CO1: Use the concepts of analytic function and complex potentials to solve the problems arising in electromagnetic field theory.

CO2: Utilize conformal mapping and complex integral arising in aerofoil theory, fluid flow visualization and image processing.

CO3: Apply discrete and continuous probability and joint probability distributions in analyzing the probability models arising in engineering field.

CO4: Use Markov chain in prediction of future events and demonstrate the validity of testing the hypothesis.

CO5: Use the concepts of random process in dealing with signals in engineering problems.

Reference Books:

1. E. Kreyszig: "Advanced Engineering Mathematics", John Wiley & Sons, 10th Edition(Reprint), 2016.
2. B. S. Grewal: Higher Engineering Mathematics, Khanna Publishers, 44th Edition, 2017.
3. S. D. Sharma : "Operations Research", KedarNath Ram Nath & Co. Meerut, 2014.
4. T. Veerarajan : "Probability, Statistics and Random processes", McGraw Hill Education (India) Private Limited, Third edition, Nineteenth reprint 2017.
5. C. Ray Wylie, Louis C. Barrett : "Advanced Engineering Mathematics", 6th Edition, 2. McGraw-Hill Book Co., New York, 1995.
6. James Stewart : Calculus —Early Transcendental, Cengage Learning India Private Ltd., 2017.
7. B. V. Ramana: "Higher Engineering Mathematics" 11th Edition, Tata McGraw-Hill, 2010.
8. Srimanta Pal & Subobh C. Bhunia: "Engineering Mathematics", Oxford University Press, 3rd Reprint, 2016.

Web links and Video Lectures:

1. https://nptel.ac.in/courses/111106141
2. https://www.digimat.in/nptel/courses/video/111107119/L29.html
3. https://archive.nptel.ac.in/courses/122/107/122107036/
4. https://archive.nptel.ac.in/courses/105/105/105105045/
5. https://archive.nptel.ac.in/courses/111/102/111102014/
6. https://archive.nptel.ac.in/courses/111/103/111103159/

Department of Electrical and Electronics Engineering

Semester: IV	
Course Name: Linear Control Systems (PCC) **Course Code: 22EEE142**	
Teaching Hours/Week (L:T:P:J): (2:2:0:0)	**CIA Marks:** 50
Credits: 3	**SEA Marks:** 50
Hours: 40	**SEA Duration:** 03 Hours

Course Learning Objectives:

- To understand modelling of physical systems and obtain the transfer function through block diagrams and signal flow graphs.
- To understand time domain response and estimate transient parameters and errors in steady state conditions.
- To use Routh-Hurwitz and Root locus techniques to determine stability of linear systems.
- To understand the difference between time domain and frequency domain specifications, analysis of systems in frequency domain.
- To use the Bode technique to determine the stability of linear systems.

Pre-Requisites: Knowledge of network duality, Laplace transformations theory and applications. Differential equations. Matrix algebra

Course Outcomes: After the completion of the course the students will be able to:

- Develop electrical analogous circuits for mechanical systems and transfer function for servomotors.
- Develop transfer function using block diagram reduction and signal flow graph techniques.
- Obtain the transient and steady state parameters for a 2nd order system subjected to step input.
- Determine stability of a given system using Routh Hurwitz, Root locus, Bode analysis.

Module-1: Modeling of control systems	RBT	Hrs
Introduction to Control systems, types, and Classification of control systems. **Mathematical modeling:** Modeling of mechanical systems, electrical systems, and Analogous systems. DC Servomotors: modelling of armature-controlled and field-controlled servomotors. Transfer functions. Illustrative examples.	**Apply**	**8**
Module-2: Block Diagrams and Signal flow graphs	**RBT**	**Hrs**
Block diagrams: Block diagram of a closed loop system, construction of block diagram of electrical networks, block diagram reduction algebra to find the overall transfer function. Illustrative examples. **Signal flow graphs:** Definitions, construction of signal flow graph for electrical networks, Block diagrams Masons gain formula to find the overall transfer function. Illustrative examples.	**Apply**	**8**
Module-3: Time Domain Analysis	**RBT**	**Hrs**
Standard test signals, time response of second order systems, Time domain specifications, steady state errors and static error constants. Dynamic error constants, their importance. Illustrative examples	**Apply**	**8**
Module-4: Stability analysis using Root locus and Routh Hurwitz techniques	**RBT**	**Hrs**
Routh Stability criterion: Definitions of stability terms. BIBO stability, Necessary conditions for stability, Routh stability criterion difficulties in formulation of Routh table, applications of Routh stability criterion. **Root locus technique:** Introduction, root locus concepts, construction of root loci, rules for the construction of root locus. Stability analysis using Root locus techniques	**Apply**	**8**

Module-5: Stability analysis in the Frequency domain.	RBT	Hrs
Frequency domain specifications. Co-relation between time and frequency response – 2nd order systems. Illustrative examples. ***Bode plots***: Definitions of gain margin, phase margin. General procedure for constructing bode plots, computation of gain margin and phase margin, reverse bode plots. Illustrative examples.	**Apply**	**8**

Reference Books

1. A Anand Kumar, **"**Control systems", PHI learning private limited, New Delhi
2. Benjamin C Kuo, Farid Golnaraghi, "Automatic Control System", Wiley, 9th edn, 2010
3. Ashfaq Husain, Haroon Ashfaq, "Control Systems", Dhanpat Rai & Co.,1st edn, reprint 2017
4. M. Gopal, "Control Systems: Principles and Design", McH, 4th Edn, 2012
5. S. Salivahanan et.al, "Control System Engineering", Pearson, 1st Edn, 2015.
6. D.Ganesh Rao and K.Channavenkatesh. "Control Engineering'", Publisher-Sanguine Technical Publishers,2008.

Semester: IV	
Electrical Motors and Synchronous Machines (PCI) **Course Code: 22EEE143**	
Teaching Hours/Week (L:T:P:J): (3:0:2:0)	**CIE Marks:** 50
Credits: 4	**SEE Marks:** 50
Hours: 40 Hours Theory+ 10 Lab Sessions	**SEE Duration:** 03 Hours

Course Learning Objectives:

- To understand the working of DC Motors, Stepper motor, and synchronous machines
- To understand the performance of DC motors and synchronous machines
- To understand the characteristics, starting methods, speed control of DC Motors and synchronous motors
- To understand the concept of parallel operation and voltage regulation of alternators

Pre-Requisites:

- Knowledge of Electromagnetic Induction
- Knowledge of three phase AC circuits
- KCL & KVL

Course Outcomes: After the completion of the course the students will be able to:

- Explain the construction and working of DC Motors, Stepper motor, and synchronous machine
- Determine the performance parameters and characteristics of DC Motors and synchronous motor through load and no-load tests
- Explain the performance, starting methods and speed control of DC Motors and synchronous motors
- Predetermine the voltage regulation of alternators by EMF, MMF, ZPF and slip test
- Explain the concept of parallel operation of alternators

Module-1: DC Motors	RBT	Hrs
DC Motors: Construction and working principle, Back E.M.F and its significance, Torque equation, Classification, Characteristics of shunt, series & compound motor, Losses in DC motors, power flow diagram, efficiency, condition for maximum efficiency. Speed control of shunt motor and series motor by armature and field control, Applications of motors. Illustrative examples	**Apply**	**8**
Module-2: Starters and Testing of DC Motors	**RBT**	**Hrs**
Starters: need for starters, 3-point starter, starters for Series motors, **Testing of DC Motors:** performance curves of shunt and series DC motor Direct load test, Swinburne's test, Hopkinson's test, Fields Test on dc series machines, merits, and demerits of tests. Illustrative examples,	**Apply**	**8**
Module-3: Stepper motor and Synchronous Generators	**RBT**	**Hrs**
Stepper motor - Construction, Principle of operation of Variable Reluctance (VR), permanent magnet and hybrid stepper motors, applications. **Synchronous Generators:** Types of Construction, principle of operation, frequency of induced emf, winding factors, EMF equation, Armature reaction, Synchronous reactance, Equivalent circuit. Phasor diagram of non-salient type alternator, Illustrative examples	**Apply**	**8**
Module-4: Voltage Regulation of Non-salient & Salient pole alternators	**RBT**	**Hrs**

Voltage Regulation of Non-salient pole alternators: EMF, MMF, ZPF methods. Illustrative examples **Salient pole alternators:** Two reaction analysis, experimental determination of X_d and X_q by slip test**,** voltage regulation, phasor diagrams on load, Illustrative examples	**Apply**	**8**
Module-5: Parallel operation of alternators & Synchronous Motors	**RBT**	**Hrs**
Parallel operation of alternators – Need, requirements for parallel operation, Methods of synchronization of 3-phase alternators, synchronizing current, power & torque, effect of increasing excitation, load sharing between two alternators, illustrative examples (on synchronizing power, torque & load sharing only) **Synchronous Motor:** Principle of operation, effect of load, effect of change in excitation on armature current and power factor (V and inverted V curves), equivalent circuit, phasor diagrams, power developed, power flow, hunting and its suppression, Methods of starting, Illustrative examples	**Apply**	**8**

Laboratory Experiments:

1. Swinburne's Test and Speed control of DC shunt motor
2. Load test on dc shunt motor to draw speed – torque and horse power – efficiency characteristics
3. Fields Test on dc series machines.
4. Retardation test on dc shunt motor.
5. Regenerative test on dc shunt machines.
6. Voltage regulation of an alternator by EMF, MMF and ZPF methods.
7. Slip test – Measurement of direct and quadrature axis reactance and predetermination of regulation of salient pole synchronous machines.
8. V & inverted V curves of synchronous motor
9. Synchronization of alternator by dark lamp method
10. OCC Characteristics of DC Shunt Generator and determination of its critical resistance

Reference Books

Electrical Machinery, J.B.Gupta, S K Kataria & Sons
Electric Machines, D P Kothari, I J Nagrath, TMH
Electrical Machines, Ashfaq Hussain, Dhanpat Rai & Co. Publications
Electrical Technology, B L Theraja and A K Theraja

Web links and Video Lectures:

https://nptel.ac.in/courses/108106071
https://archive.nptel.ac.in/courses/108/105/108105155/
https://nptel.ac.in/courses/108106072
https://archive.nptel.ac.in/courses/108/105/108105131/
https://archive.nptel.ac.in/courses/108/102/108102146/

Semester: IV	
Course Name: Power Electronic Devices and Circuits [PCI] **Course Code: 22EEE144**	
Teaching Hours/Week (L:T:P:J): (3:0:2:0)	**CIA Marks: 50**
Credits: 4	**SEA Marks: 50**
Hours: 40 hours Theory + 10 Lab sessions	**SEA Duration: 03 Hours**

Course Learning Objectives:

- To study the operation, steady state and switching characteristics of solid state switches and their ratings.
- To give an overview of applications power electronics, different types of power semiconductor devices, their switching characteristics.
- To analyze different types of Thyristors, their gate characteristics and gate control requirements.
- To understand the design, analysis techniques, performance parameters and characteristics of controlled rectifiers, DC-DC, DC -AC converters and Voltage controllers.
- To analyze the block diagrams of Power electronic converters used in UPS, Laptop and Electric Traction systems

Pre-requisite:

- Working principle of Semiconductors devices
- Electrical & Electronic Circuit analysis

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

- Demonstrate the steady state, switching characteristics, ratings, and operation of ideal and practical solid state switches
- Analyze the speed control of DC Motor and stepper motor
- Interpret the significance of gate drive, protection and isolation circuits
- Demonstrate the operation of single phase and three phase rectifiers and AC Voltage controllers feeding R and RL loads
- Design Buck, Boost and Buck-boost switched mode regulators
- Analyze the waveforms of single phase and three phase inverters using step mode and SPWM techniques and their applications in home and Industrial appliances.

Module-1: Introduction & Applications of Power Electronics	RBT	Hrs
Introduction: Ideal and real switches, static performance and dynamic performance, Temperature rise-use of heat sink, **Power Diodes:** available rating, types of diode, Junction structure, packing, reverse recovery characteristics, effect of reverse recovery transient, Schottky diodes andsnubber circuits **Applications of Power Electronics:** Types of Power Electronic Converter Circuits and their applications, Peripheral Effects of Power Electronic Converters	**Understand**	**8**
Module–2: BJT Family	**RBT**	**Hrs**
Power Bipolar Junction Transistors: Types, ratings, Junction structure, static characteristics, proportional drive, safe operating area, switching times, base drive circuit for power transistors, switching aid circuits **Power MOSFET and IGBT:** types, comparison with BJT, Junction structure, Principleof operation, output characteristics, safe operating area, Gate electrode capacitance, Power MOSFET switching times, switching aid circuits, Gate drive circuits for power MOSFET, IGBT Comparison with BJT and MOSFET, Junction Structure, Principle ofworking, Switching times, Gallium Nitride and Silicon Carbide power semiconductor switches.	**Understand**	**8**
Module–3: Thyristors	**RBT**	**Hrs**
Thyristors: Junction structure, Packaging, circuit symbol, operating states of Thyristor, turn	**Understand**	**8**

on switching, two transistor Analogy **(derivation for relationship between gate current and anode current)**, problem in Turn-off by reverse gate pulse,rate of rise of forward voltage, switching characteristics, Thyristor classification according to Switching times and Thyristor selection according to Converter types, **Gate circuit requirement for Thyristor:** Timing control and firing of Thyristors, Thyristor ratings and protection, Gate Turnoff Thyristors, Gate control circuit of GTO, TRIAC, Thyristor Firing Circuits, Unijunction Transistor.		
Module–4: Controlled Rectifiers & AC Voltage Controllers	**RBT**	**Hrs**
Controlled Rectifiers: Introduction, Single-Phase Full Converters feeding R and RL Load (Highly Inductive load), Three- Phase Full Converters feeding R load, Illustrative Examples. **AC Voltage Controllers:** Introduction, Single-Phase Full-Wave Controllers with Resistive Loads, Single-Phase Full-Wave Controllers with Inductive Loads, Illustrative Examples.	**Apply**	**8**
Module–5: Switched mode regulators & Inverters	**RBT**	**Hrs**
Switched mode regulators: **Elements of switching mode regulators,** Buck Regulator, Boost Regulators, Buck-Boost Regulators (derivations for voltage gain, peakripple currents, peak ripple voltages, and problems) **DC-AC converters**: Introduction, principle of operation single phase full bridge Inverters feeding R load, Single phase inverter using SPWM technique, Three-phase bridge inverters for 180° conduction	**Apply**	**8**

Sl.No	Experiments
1	Static Characteristics of SCR
2	Static Characteristics of MOSFET and IGBT
3	Characteristic of TRIAC
4	SCR turn on circuit using synchronized UJT relaxation oscillator
5	SCR digital triggering circuit for a single-phase controlled rectifier and ac voltage regulator
6	Single phase controlled full wave rectifier with R load and R –L load
7	AC voltage controller using TRIAC and DIAC combination connected to R and RL loads
8	Speed control of stepper motor
9	Speed control of a separately excited D.C. Motor using an IGBT or MOSFET chopper
10	Single-phase MOSFET/IGBT-based PWM inverter

Reference Books			
Power Electronics, Principles and applications	Joseph Vithayathil	Tata Mc Graw Hill Edition	Third reprint-2011 ISBN-13: 978-0-07-070239-4
Power Electronics: Circuits Devices and Applications	Mohammad H Rashid,	Pearson	4th Edition, 2014
Power Electronics: Converters, Applications and Design	Ned Mohan et al	Wiley	3rd Edition, 2014
Power Electronics	Daniel W Hart	McGraw Hill	1st Edition, 2011
Power Electronics	M.S. Jamil Asghar	PHI	Fifth print ISBN-978-81-203-2396-4

Semester: IV	
Course Name: Simulation of Electrical & Electronic Circuits [PBL] **Course Code: 22EEE145**	
Teaching Hours/Week (L:T:P:J): (0:0:2:2)	**CIA: 50**
Credits: 2	**SEA: 50**
Hours: 30	**SEA Duration: 03 Hours**

Course objectives:

- To use software package to simulate and understand the working of Electrical & Electronics circuits.
- To simulate and verify circuit theorems for AC and DC circuits.
- To simulate and explore the behavior of the RLC circuit when excited by Sinusoidal signal and Step input.
- To simulate and explore the Op-Amp linear applications.
- To simulate and explore the Op-Amp non-linear applications.
- To design and build an application for a given requirement.

Pre-requisites: Concept of Electrical Circuit Analysis & Analog Electronic Circuits using Op-Amp.

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

- Use software package for simulation of Electrical & Electronic Circuits.
- Simulate DC & AC Circuits to verify circuit theorems.
- Explore the behavior of RLC circuit excited by sinusoidal and step input.
- Design and simulate Op-Amp-based non-linear applications.
- Design and simulate Op-Amp-based linear applications.
- Design and build a circuit for a given application

Sl. No.	Experiments
1	Verification of KCL & KVL for DC and AC Circuits
2	Verification of Thevenin's theorem and Maximum Power Transfer Theorem
3	Study the characteristics of series and parallel resonance for (i) Variable frequency (ii) Variableinductance and (iii) Variable capacitance.
4	Obtain time response of an RLC circuit due to step excitation
5	Testing of (i) Diode clipping (Single/Double ended) circuits for peak clipping, peak detection (ii) Clamping circuits: positive clamping /negative clamping
6	Design & Verification of inverting and non-inverting amplifiers using Op-Amp for (i) Time Response (ii) Frequency Response
7	Design and verification of (i) Inverting Comparator (ii) Non-inverting Comparator & (iii) Window detector using Op-Amp
8	Design and verification of (i) Inverting Schmit Trigger (ii) Non-inverting Schmit Trigger using Op-Amp
9	Design & Verification of Square/Rectangular waveform Generation using Op-Amp Astable Multi-vibrator
10	Generate Pulse Width Modulation (PWM) Signal using 555 Timer IC

Sl. No.	List of indicative Projects
1	Design, Simulation and Implementation of Variable Regulated power supply
2	Design, Simulation and Implementation of Overvoltage and undervoltage protection circuit
3	Design, Simulation and Implementation Solar Battery Charger Circuit
4	Simulation and Implementation LED Dimmer using PWM Technique
5	Simulation and Implementation of DC Motor Speed Controller Circuit Using PWM Technique
6	Design, Simulation and Implementation of PID controller for an application
7	Dark Activated 220V Automatic Evening Lamp using LDR & IC 555
8	Temperature Deviation Indicator Using OP-AMP 741
9	Over Heat Detector with Auto Cut-Off System using Op-Amp
10	Automatic Water Pump Switch ON-OFF Circuit with 555
Reference Books	
"Engineering Circuit Analysis," William H. Hayt, Jr. et all, McGraw Hill,8th Edition	
Op-amp and Linear Integrated Circuits, Ramakant A Gayakwad, PHI Learning Pvt. Ltd. New Delhi, 4th Edition	

Semester: IV	
Course Name: Electronic Instrumentation and Measurements **Course Code: 22EEE146**	
Teaching Hours/Week (L:T:P:J): (2:0:0:0)	**CIA Marks: 50**
Credits: 2	**SEA Marks: 50**
Hours: 25	**SEA Duration: 03 Hours**

Course Learning Objectives:

- To know the necessity of different measuring instruments and their design principle
- To understand the working principle of different measuring instruments and technical solutions to handle different errors.
- To understand the functional elements of instrumentation/measurement systems.
- To impart the basic concepts of digital instruments, oscilloscope and signal generators.
- To illustrate the principle, design and working of transducers for the measurement of displacement, strain and temperature.

Pre-requisite: Basic Principles of Electrical Engineering (Circuit Theory), Basic Digital and Analog Electronics

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

- Apply their knowledge to measure electrical quantities using standard Electronic measuring instruments.
- Explain the principle and working of digital instruments, Recorders function generators and Analyzers
- Discuss the principle, construction and working of transducers for the measurement of displacement, strain and temperature.
- Explain the principle and working of Bio-Medical Instruments

Module–1: Digital Voltmeters, Digital Multimeters and Frequency Meters	**RBT**	**Hrs**
Introduction, Ramp technique & ramp type DVM, Dual slope integrating type DVM, Successive approximation DVM, Resolution and sensitivity of digital meters. Digital multimeters, Digital frequency meter-Block Diagram and principle of operation	**Understand**	**5**
Module–2: Recorders	**RBT**	**Hrs**
Strip Chart Recorders and its applications, XY recorders, Magnetic Recorders, Frequency Modulation Recording, Digital data Recording	**Understand**	**5**
Module–4: Signal Generation and Analysis	**RBT**	**Hrs**
Pulse and Square wave generation, Function Generation, Wave Analyzers, Harmonic Distortion Analyzers, Spectrum Analyzers.	**Understand**	**5**
Module-5: Transducers	**RBT**	**Hrs**
Introduction to sensors & Transducers, Strain gauge, LVDT, Hall-effect transducers, Proximity sensor.	**Understand**	**5**
Module-5: Bio-Medical Instrumentation	**RBT**	**Hrs**
Biometrics, Bio-potential, Principle of operation of Electrocardiogram (ECG), electroencephalogram (EEG), Blood pressure and Blood flow measurement, Magnetic resonance Imaging (MRI), Computed Tomography Imaging (CT SCAN)	**Understand**	**5**

Reference Books

1. Electronic Instruments and Measurement Techniques, Cooper, W.D. Halfrick, A.B. PHI Learning, New Delhi, latest edition
2. Electronic Instruments, H.S. Kalsi, Tata Mc-Graw hill.
3. Electrical and Electronic Measurements, Sawhney, A.K. Dhanpat Rai, New Delhi, latest edition
4. Electronic Instrumentation and Measurements, David, Bell, PHI New Delhi, latest edition

Web links and Video Lectures:

1. https://nptel.ac.in/courses/108105153
2. https://nptel.ac.in/courses/108105064
3. https://www.youtube.com/watch?v=As5kzxkyT24

BNM Institute of Technology

Syllabus for Softskills-2

SEMESTER – IV

Subject Name	Softskills-2 (Aptitude Quantitative & Logical)	**Weekly Assessment Marks**	10
Subject Code	22SFT147	**Internal Assessment Marks**	60
Number of Contact Hours/Week	3	**Company Simulation Tests Marks**	30
Total Number of Contact Hours	36	**Credits**	1

Module 1 (Quantitative Aptitude - 1)	**Number System** - Classification of Numbers, Multiple and factors, Divisibility Rules
	HCF & LCM, Squares and Cubes.
	Profit & Loss - Concepts of SP, CP, Profit, Loss, Gain or Loss %.
	Profit & Loss - Marked Price & Discount problems, Successive Discount.
	Percentages – Percent To Decimal Or Fraction Conversion, Inverse Case – Value From Percentage, relative Percentage
	Averages - Understanding Averages & solving problems.
Module 2 (Quantitative Aptitude - 2)	**Ratios -** Duplicate and Triplicate Ratio, Direct and Indirect variation
	Proportion - Direct Indirect proportion and relation.
	Simple Interest - Simple Interest, Basic Difference b/w both the Interests
	Compound Interest - CI with a Fractional Rate, to find Instalments.

	Speed Time & Distance - Important formulas, Relative Speed.
	Speed Time & Distance - Understanding Units & Conversion of units
Module 3 (Quantitative Aptitude - 3)	**Time & Work -** Introduction and Concept, Important Time and Work Formula, Work Done
	Time & Work - Rate of Work, Time Taken, If a piece of work is done in x number of days
	Data Interpretation - Bar Graph, Tabular Form, Line Chart, case let Form
	Data Interpretation - Pie Chart, Radar/Web, and Missing Data Interpretation.
	Probability – Understanding concepts and important formulas.
	Probability – Understanding types of problems on probability
Module 4 (Logical - 1)	Problems on Syllogisms
	Problems on Assumptions
	Logical Puzzles - K-level thinking
	Logical Puzzles - Arithmetic Puzzles
	Stick Puzzles
	Series Completion - Basics of Next no, Missing no and Wrong no and problems on that.
	Solving various types of Letter series and understanding different types.
Module 5 (Logical - 2)	**Problem on Ages -** Understanding concepts and basic formula along with solving different types of problems.
	Problem on Ages - Tips and Tricks to Solve Problems on Ages

	Blood Relation - Generation Tree, Family Tree Problems.
	Blood Relation - Statement Based Questions, Coded Blood Relation Question.
	Coding & Decoding - Concept of EJOTY, Opposite Letter, Reversing thealphabets.
	Coding & Decoding - Jumbling of Letter, Finding Codes of Derivatives.
Module 6 (Logical - 3)	**Clocks –** Understanding concepts and basic formula along with solving differenttypes of problems.
	Calendar - Understanding concepts and basic formula along with solvingdifferent types of problems.
	Image Analysis - Paper cutting & Folding, Mirror & Water Image, Cubes andDice, Analogy, Find the odd one out, Rule Detection
	Odd Man Out - Following certain patterns and groups.
	Identifying the errors/odd one in the group.
	Seating Arrangement - Linear and Circular seating Arrangements as well as problems of sitting around Square and Rectangular.
	Distance & Direction - Distance and Displacement between any two points aswell as puzzles based on that, Concept of Shadows.

Semester : IV	
Course Name: Internship-1/Innovative Project Lab **Course Code: 22EEE148**	
Teaching Hours/Week (L:T:P:J): (0:0:2:2)	**CIA: 100**
Credits: 1	**SEA: -**
Hours: 15	**SEA Duration: -**

Course Objectives:

- To encourage independent learning and innovative attitude of the students
- To inspire team working
- To expand Intellectual capacity, Credibility and Judgement.
- To develop Interactive attitude, Communication skills, Time management & Presentation skills.

All the students registered to II year of BE shall have to undergo mandatory internship of 4 weeks during II semester or III semester vacation. Semester End Assessment will be conducted in IV semester and the prescribed credit will be included. Internship shall be considered as a head of passing and shall be considered for the award of degree.

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

- Acquire practical experience in the field of the internship.
- Apply skills learned during the internship to implement in future work.
- Execute the project in the field of internship.
- Develop oral and written communication skills.
- work as an individual and team member with time constraints.