COURSE STRUCTURE(R19)
AND
DETAILED SYLLABUS
(III YEAR)

ELECTRICAL & ELCTRONICS ENGINEERING

For
B.Tech., Four Year Degree Course
(Applicable for the batches admitted from 2019-20)

LENDI INSTITUTE OF ENGINEERING AND TECHNOLOGY
An Autonomous Institution
Approved by AICTE & Permanently Affiliated to JNTUK, Kakinada
Accredited by NAAC with "A" Grade and NBA (CSE, ECE, EEE & ME)
Jonnada (Village), Denkada (Mandal), Vizianagaram Dist – 535 005
Phone No. 08922-241111, 241112
E-Mail: lendi_2008@yahoo.com
Website: www.lendi.org

DEPARTMENT OF ELECTRICAL AND ELECTRONICS ENGINEERING

B. Tech III-Year Course Structure and Syllabus –R19

III Year – I SEMESTER							
S. No.	**Course code**	**Subjects**	**Category**	**L**	**T**	**P**	**Credits**
1	R19EEE-PC3101	Power Systems-II	PC	3	0	0	3
2	R19EEE-PC3102	Power Electronics	PC	3	0	0	3
3	R19ECE-OE3101 R19CSE-OE3101 R19CSE-OE3102 R19CSE-OE3103	**Open Elective-I** 1. Linear and Digital IC Applications **2.** Big Data Analysis **3.** Internet of Things **4.** Python Programming	OE	3	0	0	3
4	R19EEE-PE3101.1 R19EEE-PE3101.2 R19EEE-PE3101.3	**Professional Elective – I** **1.** Digital Control Systems **2.** Electrical Machine Design **3.** Embedded Systems	PE	3	0	0	3
5	R19CSE-ES3101	Data Structures	ES	3	0	0	3
6	R19EEE-PC3103	Electrical Machines-II Lab	PC	0	0	3	1.5
7	R19EEE-PC3104	Control Systems Lab	PC	0	0	3	1.5
8	R19EEE-PC3105	Electrical Measurements and Instrumentation Lab	PC	0	0	3	1.5
9	R19CSE-SD3101	Data Structures Lab	SD	0	0	2	0
10	R19BSH-MC3102	Entrepreneurship and Incubation	MC	2	0	0	0
11	R19EEE-PJ3101	Engineering Exploration Project Design Thinking	PJ	0	0	1	0.5
12	R19EEE-MC3101	MOOCS-2	MC	0	0	0	0
13	R19EEE-SI3101	Summer Internship-1 (Evaluation)	SI	0	0	0	0
Total				**17**	**0**	**12**	**20**
Honors Course -2/Minor Course-2							

III Year – II SEMESTER							
S. No.	**Course code**	**Subjects**	**Category**	**L**	**T**	**P**	**Credits**
1	R19EEE-PC3201	Electric Drives	PC	3	0	0	3
2	R19EEE-PC3202	Power System Analysis	PC	3	0	0	3
3	R19ECE-PC3207	Microprocessors and Microcontrollers	PC	3	0	0	3
4	R19EEE-PC3203	Switchgear and Protection	PC	3	0	0	3
5	R19EEE-PE3201.1 R19EEE-PE3201.2 R19EEE-PE3201.3 R19EEE-PE3201.4	**Professional Elective – II** 1. Advanced Control Systems 2. HVAC Transmission 3. Special Electrical Machines 4. Wavelet Transforms	PE	3	0	0	3
6	R19ECE-OE3201 R19CSE-OE3203 R19CSE-OE3201 R19MEC-OE3201	**Open Elective-II** 1. Communication Systems 2. Data Base Management System 3. OOPS Through JAVA 4. Robotics	OE	3	0	0	3
7	R19EEE-PC3204	Power Electronics Lab	PC	0	0	3	1.5
8	R19ECE-PC3208	Microprocessors & Microcontrollers Lab	PC	0	0	3	1.5
9	R19EEE-SD3201	Electrical Engineering Virtual Lab	SD	0	0	3	0
10	R19EEE-SD3202	Introduction to MATLAB	SD	1	0	2	0
Total				**19**	**0**	**11**	**21**
***Honors Course -3/Minor Course-3**							
Summer Internship-2(After Third Year & Evaluated in IV-I Semester)							

**The Eligible students who opted the courses for B.Tech with Honors/Minor only*
Note:L-Lecture, T-Tutorial, P-Practical, C-Credits

III Year – I Semester

Course Code	Course Title	Hrs./Week L: T: P	Credits
R19EEE-PC3101	Power Systems – II	3:0:0	3

Course Objectives:

- To introduce Mechanical design calculations of transmission lines
- To discuss the concepts of neutral grounding
- To discuss the Travelling wave phenomenon on transmission lines
- To teach Underground cables: construction, types, and grading
- To classify of distribution systems and To teach Concepts of DC and AC distribution systems and their comparison

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

1. Distinguish different types of insulators and analyze the phenomenon of corona(L2)
2. Calculate sag of transmission line or equal and unequal heights of towers (L3)
3. Analyze different types of transients in power systems (L4)
4. Analyze the construction, types and grading of underground cables (L4)
5. Analyze the various factors associated with power distribution (L4)

UNIT-I

Overhead Line Insulators and Corona: Types of Insulators- String efficiency and Methods for improvement– Voltage Distribution, Calculation of string efficiency- Capacitance grading and Static shielding, Numerical Problems

Corona - Description of the phenomenon, factors affecting corona, critical voltages and power loss, Radio Interference.

Learning outcomes: The students are able to

- Understand the need of line insulators and conductors(L2)
- Analyze the factors affecting corona(L4)

UNIT-II

Mechanical Design of Transmission lines and Neutral Grounding: Sag and Tension Calculations with equal and unequal heights of towers, Effect of Wind and Ice on weight of Conductor - Stringing chart and sag template and its applications-Numerical Problems. Effectively grounded system, ungrounded system, Resonant Grounding, methods of neutral grounding, Generator neutral breaker, grounding Practice

Learning outcomes: The students are able to

- Analyse the importance of sag/tension in transmission lines (L4)
- Understand the importance and methods of neutral grounding(L2)

UNIT – III

Power System Transients: Types of System Transients - Travelling or Propagation of Surges - Attenuation, Distortion, Reflection and Refraction Coefficients - Termination of lines with different types of conditions - Open Circuited Line - Short Circuited Line, T-Junction -Bewley's Lattice Diagram-Numerical Problems

Learning outcomes: The students are able to

- Classify the types of system transients (L2)
- Explain various factors related to charged transmission lines (L2)

UNIT-IV

Underground Cables: Types of Cables, Construction, Types of Insulating materials, Calculations of Insulation resistance and stress- Capacitance of Single and 3-Core belted cables, Grading of Cables - Capacitance grading, Description of Inter-sheath grading – Numerical Problems– Applications.

Learning outcomes: The students are able to

- Classify the types of cables (L2)
- Identify single core and multi core cables with different insulating materials (L3)
- Understand the importance of capacitance in single and multi-core belted cables (L2)

UNIT-V

General Aspects of Distribution Systems: Classification of distribution systems, design features of distribution systems, radial distribution, ring main distribution -AC distributors fed at one end and at both ends, comparison of DC and AC distribution -Kelvin's law- Limitations of Kelvin's law- Choice of scheme-Size of feeders, voltage & power factor correcting methods, load modeling and characteristics-Numerical Problems-Applications.

Learning outcomes: The students are able to

- Classify the types of distribution system (L2)
- Analyse the load modelling and characteristics (L4)

Textbooks

1. Electrical power systems, C.L.Wadhwa, New Age International (P) Limited, 6th Edition, 2010, Reprint 2014.
2. Power System Engineering, M.L.Soni, P.V.Gupta, U.S.Bhatnagar and A.Chakrabarti, DhanpatRai& Co. Pvt. Ltd., 1999.
3. Power system analysis and design by J.Duncan Glover,Mulukutla S.Sarma ,Thomas J. Overbye Cengage Learning publicationss

Reference Books

1. Power system Analysis 4th edition, John J Grainger and William D Stevenson, JR, McGraw Hill Education, 2003, Reprint 2015.
2. Power System Engineering, D. P. Kothari and I. J. Nagrath, McGraw Hill Education (India) Pvt. Ltd., 2nd Edition, 2008, 23rd Reprint 2015.
3. Electric Power Transmission System Engineering: Analysis and Design, Turan Gonen, 2nd Edition, CRC Press, Taylor & Francis group, 2009, 1st Indian Reprint 2010.

Web Links:

1. https://nptel.ac.in/courses/108/102/108102047
2. https://onlinecourses.nptel.ac.in/noc20_ee39/preview
3. https://www.electricaleasy.com/p/power-system.html
4. https://nptel.ac.in/courses/108/108/108108034/

Course Code	Course Title	Hrs./Week L: T: P	Credits
R19EEE-PC3102	Power Electronics	3:0:0	3

Course Objectives:

- To study the characteristics of power semiconductor devices and the TURN ON and TURN OFF process of the switches.
- To study the process of converting fixed AC to variable DC using thyristor as a switch.
- To analyze the process for step down and step up the DC voltage.
- To study and analyze the operation of 1-Φ and 3-Φ voltage source inverter.
- To analyze the operation of AC-AC converters.

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

1. Explain the characteristics of power semiconductor devices and the process of Turn-on and Turn-off semiconductor switches. (L2)
2. Design the controlled rectifier circuits with R and RL-Loads. (L5)
3. Design the DC to DC choppers. (L5)
4. Analyze the operation of AC-AC converters. (L4)
5. Demonstrate the operation of single and their phase voltage source inverters. (L2)

UNIT-I

Power Semiconductor Switching Devices: Thyristor family: Silicon controlled rectifiers (SCR), GTO, TRIAC-Static, Dynamic and Gate characteristics of SCR; Turn-on and Turn-off methods of Thyristor-Snubber Circuit-Transistor Family: Power MOSFET, Power IGBT.

Learning outcomes: The students are able to

- Explain the characteristics of power semiconductor switching devices. (L2)
- Design the snubber circuit for thyristors. (L5)

UNIT-II

AC-DC Controlled rectifiers: Single-phase half-wave controlled Rectifier with R and RL load-with and without freewheeling diode-single phase full-wave controlled rectifiers: center tapped and Bridge configurations with R load, RL load and RLE load -with and without freewheeling diode; Single phase semi controlled rectifier with R load, RL load and RLE load - Effect of source inductance in single phase fully controlled bridge rectifier with continuous conduction only.

Three-phase controller rectifiers-Three phase half wave, Semi and full wave-controlled rectifiers with R and RL loads-performance analysis of controlled rectifiers-Dual converters-Numerical Problems.

Learning outcomes: The students are able to

- Analyse the operation of single-phase controlled rectifiers. (L4)
- Understand the operation of three phase-controlled rectifiers. (L2)

UNIT-III

DC-DC Choppers: Elementary chopper-Duty ratio-control strategies: time ratio control and current limit control-Analysis of Buck, Boost, and Buck-Boost converters in continuous and discontinuous conduction modes of operation-output voltage equations-inductor current and output voltage ripples-Expressions for Critical inductance and capacitance-Numerical Problems- Applications.

Learning outcomes: The students are able to

- Understand the operation of different types of DC-DC converters (L2)
- Analyze the operation of buck, boost and Buck-Boost converters. (L4)

UNIT-IV

AC Voltage Controllers and Cycle Converters: Single-phase AC-AC regulator- phase angle control and integrated cycle control with R and RL load – For continuous and discontinuous conduction- 3-Phase AC-AC regulators with R load only-single phase cyclo-converter with R and RL load-Numerical problems.

Learning outcomes: The students are able to

- Analyze the operation of the voltage regulator (L4).
- Understand the concept of cyclo-converter (L2).

UNIT-V

Inverters: Single-phase voltage source inverter-single phase half bridge and full bridge inverters with R and RL load-Fourier Analysis of single-phase inverter output voltage-Current source inverter-Three phase square wave inverters -120^0 conduction and 180^0 conduction modes of operation-PWM inverters-modulation index-Total harmonic distortion analysis-Introduction to Multilevel Inverters-Numerical Problems.

Learning outcomes: The students are able to

- Analyze the operation of single-phase inverter with square wave modulation. (L4)
- Evaluate the operation of voltage source inverter with sinusoidal modulation. (L2)
- Design the power circuit of a three-phase voltage source inverter. (L5)
- Analyze the voltage waveforms at different switching states of the VSI inverter. (L2)

Textbooks

1. Power Electronics – by P.S.Bhimbra, Khanna Publishers.
2. M. H. Rashid, “Power electronics: circuits, devices, and applications”, Pearson Education India, 2009.
3. N. Mohan and T. M. Undeland, “Power Electronics: Converters, Applications and Design”, John Wiley & Sons, 2007.

Reference Books

1. R. W. Erickson and D. Maksimovic, “Fundamentals of Power Electronics”, Springer Science & Business Media, 2007.
2. Power Electronics: Essentials & Applications by L.Umanand, Wiley, Pvt. Limited,India, 2009
3. Power Electronics : by M.D.Singh , K.B.Khanchandani, Tata McGraw-Hill Publications

Web Links

1 https://swayam.gov.in/nd1_noc20_ee97/preview
2 https://nptel.ac.in/courses/108/105/108105066/

Course Code	Course Title	Hrs./Week L: T: P	Credits
R19ECE-OE3101	Linear and Digital IC Applications (Open Elective-1)	3:0:0	3

Course Objectives:

1. To introduce the basic building blocks and operation of linear integrated circuits.
2. To understand the linear and non-linear applications of operational amplifiers.
3. To acquire the knowledge in analysis and design of different types of active filters and analog multipliers using op-amps.
4. To learn the internal structure, operation and applications of different analog ICs such as Timers and PLL.
5. To understand the various types of ADCs and DACS using ICs.

Course Outcomes:

1. Understand the internal components and characteristics of Op-Amp (L1).
2. Understand the various linear and non-linear applications using Op-amps (L2).
3. Analyze active filters using Op-amp and understand the frequency response of the amplifier configurations (L3).
4. Understand thoroughly the function of ICs such as 555 and PLL (L4).
5. Acquire the knowledge about various techniques of ADCs and DACs (L5).

UNIT I

Introduction to Operational Amplifiers: Differential Amplifier- DC and AC analysis of Dual input Balanced output Configuration and Properties of other differential amplifier configuration, Introduction and Classification of IC's, basic information of Op-Amp IC741 Op-Amp and its features, Op-Amp internal circuit, Op-Amp characteristics - DC and AC, Op-Amp parameters and Measurements.

Applications:

1. Op-amps are used as amplifier
2. Op-amps used as voltage regulator current regulator
2. Op-amps used as Oscillators and waveform generators.

Learning Outcomes:

At the end of this unit the student will be able to

- Understand the internal components and pin diagram of Op-Amp (L1).
- Understand the characteristics of Op-Amp (L1).

UNIT II

Linear Applications of OP-AMPS: Inverting and Non-inverting amplifier, adder, Difference amplifier, Integrator and differentiator, Instrumentation amplifier, AC amplifier, V to I and I to V converters.

Non-Linear Applications of OP-AMPS: Sample and Hold circuits, Log and Anti log Amplifiers, Comparators, Schmitt trigger, Precision rectifiers, Triangular and Square wave generators.

Applications:

1. Sign changer, scale changer, inverting, and non-inverting amplifier.
2. Integrator, differentiator, and its application in analog computer.
3. Used as a conversion circuits.
4. Different circuits using op amps are analyzed with input and output signal waveforms.

Learning Outcomes:

At the end of this unit the student will be able to

- Understand the linear applications using Op-amps (L2).
- Understand the non-linear applications using Op-amps (L2).

UNIT III

Active Filters: Introduction, Design and Analysis of Butterworth active filters – 1st order, 2nd order low pass and high pass filters, band pass, band reject and all pass filters.
Analog multiplier using emitter coupled transistor pair, multiplier and divider.

Applications:

1. Active filters are used in communication systems for suppressing noise
2. Active filters are used in biomedical instruments
3. Used in Pre-amplification, Equalization, Tone Control in Audio Systems
4. They are used in Radio tuning to a specific frequency

Learning Outcomes:

At the end of this unit the student will be able to

- Analyze active filters using Op-amp and understand the frequency response (L3).
- Able to design a filter using Op-amp (L3).

UNIT IV

Timers: Introduction to 555 timer, functional diagram, Multivibrators – Astable Multivibrators, Monostable Multivibrators description, functional diagram and Applications, Schmitt trigger.

Phased Locked Loop: Introduction, block schematic, principles and description of
Individual blocks of 565 PLL, PLL Applications for AM detection, FM detection, FSK modulation and demodulation and Frequency synthesizing and clock synchronization, VCO, Applications of VCO (566).

Applications:

1. PLL is used to synthesize new frequencies
2. Recovery of clock timing information from a data stream such as from a disk drive
3. VCOs are used in function generators
4. VCOs are used in Electronic jamming equipment.

Learning Outcomes:

At the end of this unit the student will be able to

- Understand the function of 555 IC (L4).
- Understand thoroughly the function of PLL and VCO (L4).

UNIT V

Analog to Digital and Digital to Analog Converters: Introduction, Different types of ADCs – Flash type, Successive Approximation type, Dual Slope type, A/D Converter using Voltage-to-Time Conversion, Different types of DACs -weighted resistor type, R-2R Ladder type, R - 2R Ladder types, DAC and ADC Specifications.

Voltage RegulatoRS: Introduction, Three terminal fixed and adjustable voltage regulators - IC 723 general purpose regulator.

Applications:

1. DACs can in Televisions and mobile phones to convert digital data to analog audio signal.
2. DACs can in music players to convert digital data to analog audio signal.
3. ADCs can used in microcontrollers, digital signal processing.
4. ADCs can used in digital storage oscilloscopes, scientific instruments etc.

Learning Outcomes:

At the end of this unit the student will be able to

- Understand various techniques of ADCs (L5).
- Understand various techniques of DACs (L5).

Text Books

1. Linear Integrated Circuits – D. Roy Choudhury, New Age International (p) Ltd, 2nd Edition,2003.

2. Op-Amps & Linear ICs - Ramakanth A. Gayakwad, PHI, 1987.

References

1. Operational Amplifiers & Linear Integrated Circuits –Sanjay Sharma; SK Kataria& Sons;2nd Edition,2010
2. Design with Operational Amplifiers & Analog Integrated Circuits – Sergio Franco, McGraw Hill, 1988.
3. OP AMPS and Linear Integrated Circuits concepts and Applications, James M Fiore, Cenage Learning India Ltd.
4. Operational Amplifiers & Linear Integrated Circuits–R.F.Coughlin& Fredrick Driscoll, PHI, 6th Edition.
5. Operational Amplifiers & Linear ICs – David A Bell, Oxford Uni. Press, 3rd Edition
6. Digital Fundamentals - Floyd and Jain, Pearson Education

Course Code	Course Title	Hrs./Week L: T: P	Credits
R19CSE-OE3101	Big Data Analysis (Open Elective-1)	3:0:0	3

Course Objectives:

- Optimize business decisions and create competitive advantage with Big Data analytics
- Introducing Java concepts required for developing map reduce programs
- Derive business benefit from unstructured data
- Imparting the architectural concepts of Hadoop and introducing map reduce paradigm
- To introduce programming tools PIG & HIVE in Hadoop echo system.

Course Outcomes:

1. Understand the generic data structures and implement the persistence of object using file IO.
2. Create and configure distributed Hadoop cluster by understanding HDFS architecture.
3. Implement the map reduce paradigm by analyzing different case studies.
4. Analyze data across distributed environment using hadoop writable APIs.
5. Generate map reduce jobs by writing pig Latin scripts and HIVE to handle different kinds of data.

UNIT I

Data structures in Java: Linked List, Stacks, Queues, Sets, Maps; Generics: Generic classes and Type parameters, Implementing Generic Types, Generic Methods, Wrapper Classes, Concept of Serialization.

Reference: Big Java 4th Edition, Cay Horstmann, Wiley John Wiley & Sons, INC

Learning Outcomes: After completion of this unit Student will be able to,

- Understand the concepts of data structures in JAVA. (L2)
- Implement Generic Data Structures and iterables. (L3)

Applications:

1. Banking Sector
2. Health Care

UNIT II

Working with Big Data: Google File System, Hadoop Distributed File System (HDFS) – Building blocks of Hadoop (Namenode, Datanode, Secondary Namenode, JobTracker, Task Tracker), Introducing and Configuring Hadoop cluster (Local, Pseudo-distributed mode, Fully Distributed mode), Configuring XML files.

References: Hadoop: The Definitive Guide by Tom White, 3rd Edition, O'reilly Hadoop in Action by Chuck Lam, MANNING Publ.

Learning Outcomes: After completion of this unit Student will be able to,

- Understand GFS and HDFS architectures with multiple clusters. (L2)
- Understand Hadoop Cluster using different modes of installation. (L2)

Applications:

1. Health care
2. Manufacturing
3. Media & Entertainment
4. IoT (Internet on Things)

UNIT III

Writing MapReduce Programs: A Weather Dataset, Understanding Hadoop API for MapReduce Framework (Old and New), Basic programs of Hadoop MapReduce: Driver code, Mapper code, Reducer code, RecordReader, Combiner, Partitioner

Reference: Hadoop: The Definitive Guide by Tom White, 3rd Edition, O'reilly

Learning Outcomes: After completion of this unit Student will be able to,

- Understand Map Reduce framework architecture and work flow. (L2)
- Implement Hadoop map reduce API for real time scenarios. (L3)

Applications:

1. Weather Patterns
2. Transportation Industry

UNIT IV

Hadoop I/O: The Writable Interface, WritableComparable and comparators, Writable Classes: Writable wrappers for Java primitives, Text, BytesWritable, NullWritable, ObjectWritable and GenericWritable, Writable collections, Implementing a Custom Writable: Implementing a RawComparator for speed, Custom comparators

Reference: Hadoop: The Definitive Guide by Tom White, 3rd Edition, O'reilly

Learning Outcomes: After completion of this unit Student will be able to,

- Implement hadoop core APIs for writable classes. (L3)
- Implement custom comparables and comparators for efficiency. (L3)

Applications:

1. IoT (Internet on Things)
2. Weather Patterns

UNIT V

Pig: Hadoop Programming Made Easier Admiring the Pig Architecture, Going with the Pig Latin Application Flow, Working through the ABCs of Pig Latin, Evaluating Local and Distributed Modes of Running Pig Scripts, Checking out the Pig Script Interfaces, Scripting with Pig Latin.

Reference: Hadoop for Dummies by Dirk deRoos, Paul C.Zikopoulos, Roman B.Melnyk,Bruce Brown, Rafael Coss

Applying Structure to Hadoop Data with Hive: Saying Hello to Hive, Seeing How the Hive is Put Together, Getting Started with Apache Hive, Examining the Hive Clients, Working with Hive Data Types, Creating and Managing Databases and Tables, Seeing How the Hive Data Manipulation Language Works, Querying and Analyzing Data

References: Hadoop for Dummies by Dirk deRoos, Paul C.Zikopoulos, Roman B.Melnyk,Bruce Brown, Rafael Coss.

Learning Outcomes: After completion of this unit Student will be able to,

- Understand Pig and Hive architectures and their interfaces. (L2)
- Generate external and internal data tables into HDFS databases. (L3)
- Apply complex Pig Latin Scripts for user defined objects. (L3)

Applications:

1. IoT (Internet on Things)
2. Weather Patterns
3. Transportation Industry
4. Banking Sector

Text Books

1. Big Java 4th Edition, Cay Horstmann, Wiley John Wiley & Sons, INC
2. Hadoop: The Definitive Guide by Tom White, 3rd Edition, O'reilly
3. Hadoop in Action by Chuck Lam, MANNING Publ.

4. Hadoop for Dummies by Dirk deRoos, Paul C.Zikopoulos, Roman B.Melnyk,Bruce Brown, Rafael Coss

References

1. Hadoop in Practice by Alex Holmes, MANNING Publ.
2. Hadoop MapReduce Cookbook,Srinath Perera, Thilina Gunarathne
3. Software Links: Hadoop:http://hadoop.apache.org/
4. Hive: https://cwiki.apache.org/confluence/display/Hive/Home
5. Piglatin: http://pig.apache.org/docs/r0.7.0/tutorial.html

Course Code	Course Title	Hrs./Week L: T: P	Credits
R19CSE-OE3102	Internet of Things (Open Elective-1)	3:0:0	3

Course Objectives:

- Introduce the fundamental concepts of IoT and physical computing
- Expose the student to a variety of embedded boards and IoT Platforms
- To introduce the Raspberry PI platform, that is widely used in IoT applications
- Create a basic understanding of the communication protocols in IoT communications.
- Familiarize the student with application program interfaces for IoT.
- Enable students to create simple IoT applications and implementation of web based services on IoT devices.

Course outcomes:

1. Illustrate the architecture and principles in Internet of Things.
2. Outline the Arduino platform and its applications.
3. Develop applications using Raspberry Pi.
4. Select protocols for a specific IoT application.
5. Utilize the cloud platform and APIs for IoT application.

UNIT-I

Overview of IoT: The Internet of Things: An Overview; The Flavor of the Internet of Things; The "Internet" of "Things"; The Technology of the Internet of Things; Enchanted Objects; Who is Making the Internet of Things?; M2M Communications, Examples of IOT,Design Principles for Connected Devices; Calm and Ambient Technology; Privacy; Keeping Secrets; Whose Data Is It Anyway?; Web Thinking for Connected Devices; Small Pieces, Loosely Joined; First-Class Citizens On The Internet; Graceful Degradation; Business Models for Business Processes in the Internet Of Things

Learning Outcomes:

After completing this Unit, students will be able to

- Explain IoT architecture. [L2]
- Interpret the design principles that govern connected devices [L2]
- Summarize the roles of various organizations for IoT [L2]

Applications:

- Smart Cities
- Smart Appliances

UNIT-II

Embedded Devices - I: Embedded Computing Basics; Microcontrollers; System-on-Chips; Choosing Your Platform; Arduino; Introduction to Arduino Developing on the Arduino; Some Notes on the Hardware; Openness;

Learning Outcomes:

After completing this Unit, students will be able to

- Explain the basics of microcontrollers [L2]
- Outline the architecture of Arduino [L2]
- Develop simple applications using Arduino [L3]

Applications:

- Smart Traffic Lights
- Wireless control
- Robots

UNIT-III

Embedded Devices - II: Raspberry Pi ; Introduction to Raspberry Pi,Cases and Extension Boards; Developing on the Raspberry Pi; Some Notes on the Hardware; Openness; Other notable platforms; Mobile phones and tablets; Plug Computing: Always-on Internet of Things

Learning Outcomes:

After completing this Unit, students will be able to

- Outline the architecture of Raspberry Pi [L2]
- Develop simple applications using Raspberry Pi [L3]
- Select a platform for a particular embedded computing application [L3]

Applications:

- Connected Cars
- Home automation

UNIT-IV

Communication in the IoT: Internet Principles; Internet Communications: An Overview; Message Communication Protocols , IP; TCP; The IP Protocol Suite (TCP/IP); UDP ; IP Addresses; DNS; Static IP Address Assignment ; Dynamic IP Address Assignment; IPv6 ; MAC Addresses ; TCP and UDP Ports ; An Example: HTTP Ports ; Other Common Ports; Application Layer Protocols- HTTP; HTTPS: Encrypted HTTP ; Other Application Layer Protocols & Constrained Application Protocol

Learning Outcomes:

After completing this Unit, students will be able to

- Interpret different protocols and compare them [L2]
- Select which protocol can be used for a specific application [L3]
- Utilize the Internet communication protocols for IoT applications [L3]

Applications:

- Smart Cities
- Wifi Based Applications, Smart Grids

UNIT-V

Prototyping Online Components: Getting Started with an API; Data Acquiring ,Organising data, Mashing Up APIs; Scraping; Legalities; Writing a New API; Clockodillo; Security; Implementing the API; Using Curl to Test; Going Further; Real-Time Reactions; Polling; Comet; Sensor Technology: Introduction of sensor technology, Participatory Sensing, Actuator, Radio Frequency Identification, and Wireless Sensor Network Technology ,Data Collection, Storage and Computing Using a Cloud Platform for IoT/M2M Applications/Services, IOT cloud-based services using the Xively (Pachube/COSM), Nimbits and other platforms.

Learning Outcomes:

After completing this Unit, students will be able to

- Select IoT APIs for an application [L3]
- Design and develop a solution for a given application using APIs [L6]
- Test for errors in the application [L4]
- Implement Cloud platform for IOT applications and services[L3]

Applications:

- Agricultural in IOT
- Automotive and Industries IOT.
- Health Monitor System
- Safety and security

Text Books

1 Adrian McEwen, Hakim Cassimally - Designing the Internet of Things, Wiley Publications, 2012

2 Internet of Things: Architecture, Design Principles And Applications, Rajkamal, McGraw Hill Higher Education

3 Internet of Things - A Hands-on Approach, Arshdeep Bahga and Vijay Madisetti, Universities Press, 2015, ISBN: 9788173719547

Reference Books

1. The Internet of Things, Enabling technologies and use cases – Pethuru Raj, Anupama C. Raman, CRC Press.

2. Getting Started with Raspberry Pi, Matt Richardson & Shawn Wallace, O'Reilly (SPD), 2014, ISBN: 9789350239759

Reference sites

1. https://www.arduino.cc/
2. https://www.raspberrypi.org/

Course Code	Course Title	Hrs./Week L: T: P	Credits
R19CSE-OE3103	Python Programming (Open Elective-1)	3:0:0	3

Course Objectives:

- To understand structure and data types of python script.
- To implement iterations and functions in python.
- To implement modules and data structures using mutable & immutable objects.
- To understand object oriented concepts on real world scenarios.
- To understand packages for statistics and gaming.

Course Outcomes:

1. Understand python shell environment and its program constructs.
2. Implement iterators and functions for data processing.
3. Implement modules and install packages.
4. Implement sequences and data structures for data organization.
5. Implement Object oriented concepts and handle different errors through exceptions.

Unit 1

Introduction: History of Python, Features of Python, Applications, Python Using the REPL (Shell), Running Python Scripts, Variables, Assignment forms, Keywords, Input-Output, Indentation.

Operators and Type Conversion: Data Types: Numeric, Booleans, Sequence, Strings, Operators, Type conversions, Expressions.

Learning Outcomes:

After completing this chapter, student will be able to

- Understand the environment of python. (L2)
- Create and run simple scripts in python. (L2)
- Understand data types and their conversions. (L2)
- Understand operators for doing operations on different expressions. (L2)

Unit 2

Decision &Control Statements: if, if-elif-else, for, while, break, continue, pass.

Functions: Defining Functions, Calling Functions, Arguments types, Fruitful Functions (Function Returning Values), Scope of the Variables in a Function - Global and Local Variables, Anonymous Functions, Lambdas with map, reduce and filter.

Learning Outcomes:

After completing this chapter, student will be able to

- Understand the iterations using looping structures. (L2)
- Make decisions through conditional statements. (L2)
- Understand functions to define call and pass as arguments. (L2)
- Write anonymous functions for resolving complex problems. (L2)

Unit 3

Modules: Creating modules, import statement, from Import statement, name space, builtin modules- os, random, math, json, request, date, RegEx, itertools.

Packages: Introduction to PIP**,** Installing packages using PIP.

Exploring Data Science Libraries: NumPy, Pandas, Matplotlib

Learning Outcomes: After completing this chapter, student will be able to

- Create and implement modules using import. (L3)
- Understand different built-in modules. (L2)
- Understand PIP to install new packages in python. (L2)

- Apply mathematical libraries for analysing data sets. (L2)

Unit 4

Strings & Data Structures: String**,** String Formatting**,** List, String and List Slicing, Tuple, Sets, Frozen Sets, Dictionaries, Comprehensions, Built-in methods of all sequences.

Files in Python: Types of files,File Operations, Understanding read functions, read(), readline() and readlines(), Understanding write functions, write() and writelines(), reading and writing different file formats(.txt,.json,.csv etc)Programming using file operations

Learning Outcomes: After completing this chapter, student will be able to

- Implement Data structures on different real time data. (L2)
- Understand text processing using String Object. (L2)

Unit 5

Object Oriented Programming OOP in Python: Classes, 'self-variable', Methods, Constructor, Inheritance, Polymorphism, and Data Abstraction.

Errors and Exceptions: Syntax Errors, Exceptions, Exception Handlers, Raising Exceptions, User-defined Exceptions

Learning Outcomes: After completing this chapter, student will be able to

- Implement Object oriented concepts with real world scenarios. (L2)
- Understand Methods and decorators for annotating objects. (L2)
- Understand error handling and handle exceptions. (L2)

Applications:

- Web Application Development and Scraping
- Designing Games
- Machine Learning and AI based applications
- Data Science and Visualization
- Embedded and CAD Applications

Text Books

1. Core Python Programming by R Nageswara Rao ,dreamtech press publications
2. Python Programming: Using Problem Solving Approach by Reema Theraja, Oxford publications

Reference Books

1. Python Programming: A Modern Approach, Vamsi Kurama, Pearson.
2. Learning Python, Mark Lutz, Orielly.
3. Python Programming by Ashok N Kamathane, McGrawhill
4. Fundamentals of Python by Kenneth H Lambert, Cengage

Course Code	Course Title	Hrs./Week L: T: P	Credits
R19EEE-PE3101.1	Digital Control Systems (Professional Elective-1)	3:0:0	3

Course Objectives: The objectives of the course are to make the students learn about

- To understand the concepts of digital control systems.
- To understand z–transformations and mathematical analysis of digital control systems.
- To understand the concepts of state–space analysis.
- To analyze the stability of the digital control systems.
- To analyze digital control systems in the w–plane and the design of state feedback controller

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

1. Understand the concepts of digital control systems (L2).
2. Understand z–transformations and mathematical analysis of digital control systems (L2).
3. Understand the concept of state–space analysis (L2).
4. Analyze the stability of the digital control systems (L2).
5. Analyze digital control systems in the w–plane and the design of state feedback controller (L4).

UNIT – I

Introduction and signal processing: Introduction to analog and digital control systems – Advantages of digital systems – Typical examples – Sample and hold devices – Sampling theorem and data reconstruction – Frequency domain characteristics of zero order hold.

Learning Outcomes: The students are able to

- Understand discrete time control systems (L2)
- Analyze the mathematical Concepts of zero order hold (L4)

UNIT – II

z–transformations: z–Transforms – Theorems – inverse z–transforms – difference equations– Block diagram representation – Pulse transfer functions of open loop and closed loop responses.

Learning Outcomes: The students are able to

- Understand the concepts of z–transforms and inverse Z- transforms (L2).
- Analyze the Concept of difference equation approach(L4)

UNIT – III

State space analysis and the concepts of Controllability and Observability: State space representation of discrete time systems – State transition matrix and methods of evaluation – Discretization of continuous – Time state equations – Concepts of controllability and observability – Tests(without proof).

Learning Outcomes: The students are able to

- Understand State Space Representation of discrete time systems (L2)
- Analyze the Concepts of Controllability and Observability (L4)

UNIT – IV

Stability analysis: Mapping between the s–Plane and the z–Plane – Primary strips and Complementary strips – Stability criterion – Modified Routh's stability criterion and Jury's stability test.

Learning Outcomes: The students are able to

- Understand the concept of S-plane and Z-plane (L2)

- Apply the different stability methods for digital systems (L3)

UNIT – V

Design of discrete–time control systems by conventional methods and State feedback controllers: Transient and steady state specifications – Design using frequency response in the w–plane for lag and lead compensators, Design of state feedback controller through pole placement – Necessary and sufficient conditions – Ackerman's formula.

Learning Outcomes: The students are able to

- Understand discrete time control system by conventional methods for Lead, Lag and Lead-Lag compensators (L2)
- Analyze of state feedback controller through pole placement (L4)

Textbooks

1. Discrete–Time Control systems – K. Ogata, Pearson Education/PHI, 2nd Edition.
2. Digital Control and State Variable Methods by M.Gopal, TMH, 4th Edition.

Reference Books

1. Digital Control Systems, Kuo, Oxford University Press, 2nd Edition, 2003.
2. Systems and Control by Stains law H. Zak , Oxford Press, 2003.
3. Modern Control System Theory – by M. Gopal, New Age International Publishers, 2nd edition,1996

Web Links

1. https://howthingsfly.si.edu/flight-dynamics/roll-pitch-and-yaw
2. https://www.aircraftsystemstech.com/2017/05/autopilot-systems.html
3. https://en.wikiversity.org/wiki/Aircraft_piloting/Attitude_flying

Course Code	Course Title	Hrs./Week L: T: P	Credits
R19EEE-PE3101.2	Electrical Machine Design (Professional Elective-1)	3:0:0	3

Course Objectives

- To study mmf calculation and thermal rating of various types of electrical machines.
- To design armature and field systems for D.C. machines.
- To design core, yoke, windings and cooling systems of transformers.
- To design stator and rotor of induction machines and synchronous machines.
- To study the limitation of traditional designs and analyze the need of CAD for electrical machine design.

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

1. Understand the various factors influence the design of electrical machines. (L2)
2. Design the armature, commutator and brushes of DC machines. (L5)
3. Design the core, yoke, windings of transformers and also deign the rotor bars & slots and end rings of Induction motor. (L4)
4. Design the field winding, damper winding and rotor of synchronous machines. (L4)
5. Use the software tools to design the calculation. (L6)

Unit 1

Introduction to Machine Design: Major considerations in Electrical Machine Design – Electrical Engineering Materials – Space factor – Choice of Specific Electrical and Magnetic loadings – Thermal considerations – Heat flow – Temperature rise and Rating of machines.

Learning Outcomes: The students are able to

- Discuss the major considerations and engineering materials used in Electrical machine design. (L2)
- Calculate the specific electrical and magnetic loading (L5)

Unit 2

Design of DC Machines: Output Equations – Main Dimensions – Choice of Specific Electric and Magnetic Loading –Maganetic Circuits Calculations – Carter's Coefficient – Net length of Iron –Real & Apparent flux densities –Selection of number of poles – Design of Armature – Design of commutator and brushes – performance prediction using design values.

Learning Outcomes: The students are able to

- Derive the output equation for DC machine. (L4)
- Design the Armature, commutator and brushes of the DC machine and also analyze the machine performance by using design values. (L5).

Unit 3

Design of Transformers and Induction Motors:

Transformer Design: Sizing of a transformer, Main Dimensions – KVA output for single and three phase transformers – Window space factor – Overall dimensions –Regulation- No load current – Temperature rise in Transformers – Methods for cooling of Transformers.

Induction Motor Design: Sizing of an induction motor, Main dimensions – Length of air gap- Rules for selecting rotor slots of squirrel cage machines – Design of rotor bars & slots – Design of end rings – Design of wound rotor – Magnetic leakage calculations – Leakage reactance of poly-phase machines- Magnetizing current – Short circuit current.

Learning Outcomes: The students are able to

- Discuss the Main dimensions of transformer and also calculate the output equation for single and three phase transformers. (L2)

- Design the different methods for cooling of transformers (L5)
- Design of rotor bars & slots and end rings of induction motors. (L5)
- Calculate the Leakage reactance, Magnetizing current and Short circuit current.(L6)

Unit 4

Design of Synchronous Machines: Sizing of a synchronous machine, main dimensions – Design of salient pole machines – Short circuit ratio – shape of pole face – Armature design – Armature parameters – Estimation of air gap length – Design of rotor –Design of damper winding – Determination of full load field mmf – Design of field winding – Design of turbo alternators – Rotor design.

Learning Outcomes: The students are able to

- Design of armature, rotor and damper winding of salient pole synchronous machine. (L5)
- Design of field winding and turbo alternator. (L5)

Unit 5

Computer aided design (CAD): Limitations of traditional designs need for CAD analysis, synchronous and hybrid methods, design optimization methods, variables, constraints and objective function, problem formulation. Introduction to FEM based machine design, SRM and claw-pole machines.

Learning Outcomes: The students are able to

- Discuss the limitations of traditional designs and need for CAD analysis (L2)
- Discuss the different methods used in CAD (L6)

Textbooks

1. A.K.Sawhney, "A Course in Electrical Machine Design", Dhanpat Rai and Sons, 1970.
2. Ramamoorthy M, "Computer Aided Design of Electrical Equipment", East-West Press.

References

1. M.G.Say, "Theory & Performance & Design of A.C.Machines", ELBS London.
2. R. K. Agarwal, "Principles of Electrical Machine Design", Essakay Publications, Delhi.
3. S.K.Sen, "Principles of Electrical Machine Design with Computer programmes", Oxford and IBH Publishing, 2006.

Web Links

1. https://jcboseust.ac.in/electrical/images/transformer_design.pdf
2. https://rmd.ac.in/dept/eee/sp/6/DEA/unit4.pdf

Course Code	Course Title	Hrs./Week L: T: P	Credits
R19ECE-PE3101.3	Embedded Systems (Professional Elective-1)	3:0:0	3

Course Objectives:

- To introduce major components of an embedded system
- To introduce INTEL 8051 micro controller
- To explain interfacing of various communication and I/O devices to an embedded system
- To expose role of firmware, operating systems in correlation with hardware systems.
- To explain embedded software development tools
- To demonstrate implementation of embedded system

Course Outcomes:

1. Interpret embedded system and its hardware and software.
2. Comprehend the knowledge of microcontrollers
3. Develop interfacing with hardware
4. Illustrate different types of operating systems and Multitasking
5. Apply embedded Software development tools and Design and develop the embedded system

Unit 1

Introduction to Embedded Systems: What is embedded system, embedded systems vs general computing systems, history of embedded systems, classification of embedded systems, major application areas of embedded systems, purpose of embedded systems, Processor and OS trends in embedded system. Embedded hardware units and devices in a system, embedded software in a system and an overview of programming languages, skills required for an embedded system designer, examples of the embedded systems.

Learning Outcomes:

1. Differentiate embedded system and general computing system (L4)
2. Classify embedded systems based on performance, complexity and era in which they are evolved (L4)
3. Discuss basic hardware and software units used in embedded systems (L2)

Unit 2

Intel 8051 micro controller: Microcontrollers and embedded processors, Introduction to Classic 8051 family Architecture, Von Neumann Architecture and Harvard architecture, Address and data bus with multiplexed I/O pins. Addressing modes, instruction set, I/O programming and other application programming in Assembly and C language.

Learning Outcomes:

- Differentiate processor architectures (L4)
- Discuss instruction set and addressing modes (L2)
- Discuss basic programming in Assembly and C language (L2)

Unit 3

Interfacing: Interfacing with Keyboards, Displays, D/A and A/D Conversions, Multiple Interrupts, Serial Data Communication.

Learning Outcomes:

- Understand and apply Interfacing (L2)
- Understand Serial Data Communication(L2)

Unit4

Hardware& software Codesign: Operating system basics, Types of operating systems, Tasks, Process and Threads, Multiprocessing and Multitasking, Task Scheduling, Threads, Processes and Scheduling, Task communication, Task synchronisation, Device Drivers, Fundamental Issues in Hardware Software Co-Design.

Learning Outcomes:

- Understand and apply hardware & software architectures(L2)
- Describe scheduling of Tasks(L2)

Unit 5

Embedded Software development tools and debugging techniques: Embedded Software development tools, Host and target systems, cross compilers, linkers, locators for embedded systems. Getting embedded software in to the target system. Debugging techniques. Testing on host machine, Instruction set emulators, logic analyzers. In-circuit emulators and monitors.

Learning Outcomes:

- Understanding and use tools for Embedded Software development(L2)
- Burning embedded software in to the target system(L3)
- Apply debugging techniques (L3)

Text Books

1. Computers as Components-principles of embedded computer system design, Wayne Wolf, Elseveir.
2. Ali Mazidi Mohammed Gillispie, Mazide Janice, "The 8051Microcontroller and Embedded Systems using assembly& C", 2nd Edition, Pearson Education, 2009.
3. An Embedded Software Primer, David E. Simon, Pearson Education.

References

1. Raj Kamal, Embedded Systems: Architecture, Programming and Design, 3rd edition, McGraw Hill Education, 2017.
2. Shibu K V, Introduction to Embedded Systems, 2nd edition, McGraw Hill Education,2017.
3. Embedding system building blocks, Labrosse, via CMP publishers.
4. The 8051 Microcontroller, Third Edition, Kenneth J.Ayala, Thomson.

Course Code	Course Title	Hrs./Week L: T: P	Credits
R19CSE-ES3101	Data Structures	3:0:0	3

Course Objectives:

- Describe to algorithmic complexities, recursive algorithms, searching and sorting techniques.
- Applying stack and queue techniques for logical operations
- Describe to list representation models in various types of applications
- Implementation of tree implementation in various forms
- Describe orientation on graphs, representation of graphs, graph traversals, spanning trees

Course Outcomes:

1. Analyze different searching and sorting Techniques.
2. Apply the concepts of stacks and queues in real time applications
3. Analyze concepts of linked lists and with their implementation of different Linked Lists
4. Analyze the nonlinear data structures trees and their operations
5. Evaluating concepts of graphs and their applications

Unit 1

Data structure- Definition, types of data structures, Recursion: Definition, Design Methodology and Implementation of recursive algorithms, recursive algorithms for factorial function, GCD computation, Fibonacci sequence, Towers of Hanoi.

Search Techniques: List Searches using Linear Search and Binary Search.

Sorting Techniques: Basic concepts, Sorting by: Selection Sort, Bubble Sort, Insertion Sort, Quick Sort, Merge Sort: Iterative Merge Sort, Recursive Merge Sort, Heap Sort.

Learning Outcomes: student will be able to

- Describe algorithms and its analysis procedure (L2).
- Analyze sorting techniques (L4).
- Analysis procedure of search (L4).

Applications: Social Graphs, Knowledge Graphs, Recommendation Engines, Path Optimization Algorithms, sort sets of data that are too large to be loaded entirely into memory, sort is used in programming TV remote to sort channels on the basis of longer viewing time.

Unit 2

Stacks and Queues: ADT concept, Linear List ADT, Basic Stack Operations, Representation of a Stack using Arrays, Stack Applications: Reversing list, Infix to postfix Transformation, Infix to prefix Transformation, Evaluating Arithmetic Expressions.

Queues: Basic Queues Operations, Representation of a Queue using array, Implementation of Queue Operations using Stack, Applications of Queues, Circular Queues.

Learning Outcomes: Student will be able to

- Understand working process of stack and Queue (L2)
- Evaluating Arithmetic Expressions (L5)
- Apply Transformation of infix to postfix conversion (L3)

Applications: Language processing, Recursive processes, A stack of plates/books in a cupboard, Wearing/Removing Bangles

Unit 3

Linked Lists: Data structures- Linked representation, Singly linked lists : insertion, deletion, search and Traversal operations, implementation of polynomial, stack and Queue using

Single Linked List, doubly linked lists: insertion, deletion and traversal operations, circular lists.

Learning Outcomes: Student will be able to

- Understand the linked list process (L2).
- Analyze operation on different Linked lists (L4).
- Apply linked list into polynomial expressions (L3).

Applications: Adjacency list representation of graphs, Dynamic memory allocation: We use linked list of free blocks, maintaining directory of names.

Unit 4

Trees: Basic tree concepts, Binary Trees: Properties, Representation of Binary Trees using arrays and linked lists, operations on a Binary tree , Binary Tree Traversals (recursive),Creation of binary tree from in, pre and post order traversals, Binary search tree: Basic concepts, BST operations: insertion, deletion, Threaded Binary Trees.

Learning Outcomes: Student will be able to

- Create Binary Tree using linked list and Arrays(L6)
- Analyze implementation of different Trees.(L4)
- Analyze different Operation of Binary Search Tree (L4)
- Create Binary tree from different Traversals(L6)

Applications: Used in Compilers, Ordered storage to be used in binary search, Decision trees, Binary Search Tree is a tree that allows fast search, insert, delete on a sorted data .

Unit 5

Graphs: Basic concepts, Representations of Graphs: using Linked list and adjacency matrix, Graph algorithms: Graph Traversals (BFS & DFS), Spanning Trees, Minimum Cost Spanning Trees: Prim's Algorithm, Kruskal's Algorithm. Transitive closure, Single Source shortest Path: Dijkstra's Algorithm.

Learning Outcomes: Student will be able to

- Create the spanning tree from graphs(L6)
- Analyze implementation of Graph Traversals(L4)
- Create minimal spanning tree by using different algorithms(L6)

Applications: Networks to find best path in the Internet , Connecting with friends on social media, where each user is a vertex, and when users connect they create an edge, using GPS/Google Maps/Yahoo Maps, to find a route based on shortest route.

Text Books

1. Data Structure with C, Seymour Lipschutz, TMH
2. Fundamentals of Data Structures in C++, Ellis Horowitz, Sartaj Sahni and Dinesh Mehta, 2nd Edition, Universities Press (India) Pvt. Ltd.
3. Data Structures using C, Reema Thareja, Oxford
4. Data Structures, 2/e, Richard F, Gilberg , Forouzan, Cengage
5. Data structures and algorithm analysis in C, 2nd edition, mark Allen Weiss

Reference Books

1. Data Structures and Algorithms, 2008,G.A.V.Pai, TMH
2. Classic Data Structures, 2/e, Debasis ,Samanta,PHI,2009
3. Fundamentals of Data Structure in C, 2/e, Horowitz, Sahni , Anderson Freed,University Prees

Course Code	Course Title	Hrs./Week L: T: P	Credits
R19EEE-PC3103	**Electrical Machines - II Laboratory**	**0:0:3**	**1.5**

Course Objectives:

- To Determine the Performance of Three Phase Induction Motors.
- To improve the power factor of Single-Phase Induction Motor.
- To predetermine the regulation of Three–Phase Alternator by various methods.
- To Evaluate X_d / X_q ratio of Alternator and asses the Performance of Three–Phase Synchronous Motor.
- To Assess the V & Inverted V Curves of Three–Phase Synchronous Motor.

Course outcomes: At the end of this Course, the Student will be able to

1. Assess the Performance of Single-Phase and Three Phase Induction Motor. (L3)
2. Speed control of Three Phase Induction Motor. (L3)
3. Predetermine the Regulation of Three–Phase Alternator by various Methods. (L5)
4. Evaluate the X_d / Xq ratio of Alternator and asses the regulation of Three–Phase Synchronous Alternator (L5).
5. Determine V and Inverted V curves of a Three Phase Synchronous Motor (L5)

The following Experiments are required to be conducted as compulsory experiments:

1. Brake test on Three Phase Induction Motor.
2. No–load & Blocked Rotor Tests on Three Phase Induction Motor.
3. Speed Control of Induction Motor by V/f method.
4. Regulation of a Three –Phase Alternator by Synchronous Impedance method and MMF method.
5. Regulation of Three–Phase Alternator by Potier Triangle Method.
6. Determination of X_d, X_q and Regulation of a Salient Pole Synchronous Machine.
7. Synchronization of alternator by Dark Lamp method.
8. V and Inverted V Curves of a Three Phase Synchronous Motor.
9. Equivalent circuit parameters of Single-Phase Induction Motor
10. Power factor improvement of Single-Phase Induction motor by using Capacitor bank.

Course Code	Course Title	Hrs./Week L: T: P	Credits
R19EEE-PC3104	**Control Systems Lab**	**0:0:3**	**1.5**

Course Objectives:

- To impart hands on experience to understand the performance of basic control system.
- To study the characteristics of Synchro's.
- To understand the working of magnetic amplifiers, D.C. servo motors, A.C. Servo motors, and potentiometer.
- To understand time and frequency responses of control system with and without controllers and compensators.

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

1. Analyze the performance and working of Magnetic amplifier, D.C and A.C. servo motors (L4)
2. Design P, PI,PD and PID controllers. (L6)
3. Design lag, lead and lag–lead compensators (L6)
4. Determine the transfer function of D.C. motor (L5)
5. Test the performance of D.C servo motor using position control system.(L4)

The following Experiments are required to be conducted as compulsory experiments:

1. Time response of Second order system
2. Characteristics of Synchro's
3. Effect of P, PD, PI, PID Controller on a second order systems
4. Lag and lead compensation – Magnitude and phase plot
5. DC position control system
6. Transfer function of DC motor
7. Characteristics of magnetic amplifiers
8. Characteristics of AC servo motor
9. Characteristics of DC servo motor
10. Potentiometer as an error detector

Course Code	Course Title	Hrs./Week L: T: P	Credits
R19EEE-PC3105	Electrical Measurements and Instrumentation Laboratory	0:0:3	1.5

Course Objectives:

- To understand the testing of oil transformer.
- To understand the design and working of DC, AC bridges.
- To analyze the dynamic response and calibration of few instruments.
- To understand the measurement of devices, their characteristics and their operation.
- To analyze statistical data analysis.

Course Outcomes: At the end of this Course, the students will be able to

1. Understand the testing of transformer oil. (L2)
2. Understand the design and working of DC, AC bridges. (L2)
3. Analyze the dynamic response and calibration of few instruments. (L4)
4. Understand the measurement of devices, their characteristics and operation.(L2)
5. Analyze statistical data analysis. (L4)

Lectures/Demonstrations:

1. Concepts relating to Measurements: True value, Accuracy, Precision, Resolution, Drift, Hysteresis, Dead-band, Sensitivity.
2. Errors in Measurements. Basic statistical analysis applied to measurements: Mean, Standard Deviation, Six-sigma estimation.
3. Sensors and Transducers for physical parameters: temperature, pressure, torque, flow. Speed and Position Sensors.
4. Current and Voltage Measurements. Shunts, Potential Dividers. Instrument Transformers.
5. Measurements of R, L and C.
6. Digital Multi-meter, True RMS meters, Clamp-on meters, Meggers.
7. Digital Storage Oscilloscope.

Experiments

1. Dielectric oil testing using H.T test kit.
2. Measurement of L using a bridge technique.
3. Measurement of C using a bridge technique.
4. Measurement of Low Resistance using Kelvin's double bridge.
5. Measurement of High resistance and Insulation resistance using Megger.
6. Usage of DSO for steady state periodic waveforms produced by a function generator. Selection of time-scale and voltage scale.
7. Download of one-cycle data of a periodic waveform from a DSO and use values to compute the RMS values, average values and peak values.
8. Calibration and testing of single phase Energy meter.
9. Calibration of dynamometer wattmeter using phantom loading.
10. Parameters of choke coil.

Course Code	Course Title	Hrs./Week L: T: P	Credits
R19CSE-SD3101	Data Structures Lab	0:0:2	0

Course Objectives:

- To develop skills to design and analyze simple linear and nonlinear data structures
- To Strengthen the ability to identify and apply the suitable data structure for the given real world problem
- To Gain knowledge in practical applications of data structures

Course Outcomes:

1. Analyze different searching and sorting Techniques.
2. Analyze concepts of linked lists and with their implementation of different Linked Lists
3. Apply the concepts of stacks and queues in real time applications
4. Analyze the nonlinear data structures trees and their operations
5. Implementation of different advanced Trees, Graphs with their applications.

List of Programs

1. Write C programs that uses recursive function to:
   i) Compute factorial of a given number
   ii) Solve the towers of Hanoi problem.
2. Write C programs to implement the following search algorithms:
   i) Linear Search ii) Binary Search
3. Write C programs to implement the following sorting algorithms:
   i) Bubble Sort ii) Insertion Sort iii) Selection Sort.
4. Write C programs to implement the following sorting algorithms
   i) Merge Sort ii) Quick Sort.
5. Write C programs that implement the following data structures using arrays:
   i) Stack ii) Queue.
6. Write C programs to Evaluate postfix expression
7. Write C programs to implement the following types of Lists
   i) Singly linked list ii) doubly linked list.
8. Write C programs to implement the following data structures using Linked Lists
   i) Stack ii) Queue.
9. Write a C program to perform the following operations
   i) Insert an element into a binary search tree.
   ii) Delete an element from a binary search tree.
   iii) Search for a key element in a binary search tree.
   iv) Tree Traversals
10. Write C programs for the implementation of BFS for a given graph.
11. Write C programs for the implementation of DFS for a given graph
12. Write a C program for the implementation of Prim's algorithm to obtain the minimum cost spanning tree from a connected undirected graph.
13. Write a C program to implement Dijkstra's algorithm for the single source shortest path problem.

References

1. G A V PAI, "Data Structures and Algorithms, Concepts,Techniques and Applications", Volume-1, 1st Edition, TataMcGraw-Hill, 2008.
2. Richard F. Gilberg & Behrouz A. Forouzan, "Data Structures,A Pseudo code Approach with C", 2nd Edition, CengageLearning India Edition, 2007.

Course Code	Course Title	Hrs./Week L: T: P	Credits
R19BSH-MC3102	Entrepreneurship and Incubation	2:0:0	0

Course Objectives:

- Creation of environment and facilities to instruct students and assist in identifying products or services.
- Develop innovative products, services, processes and techniques.
- Able to prepare financial proposals and start-ups.
- Promote the ideas to collaborate with entrepreneur skills in establishment of start-ups.
- Encourage the students to learn current trends of Science and Technology opportunities.

Course outcomes:

1. Enriches the knowledge of Entrepreneurial behavior, and skill development.
2. Initiate business ideas that have value in the end-market.
3. Identify the validity of idea and its unique selling proportion.
4. Comprehend opportunity and challenges of-start up (L2)
5. Analyze various Government and non-Government financial resource.

Unit I

Fundamentals of Entrepreneurship: Fundamentals of Entrepreneurship – Characteristics of Entrepreneurs –Myths of Entrepreneurship -Role of Entrepreneurs in Indian economy – Social and Ethical Perspectives of Entrepreneurship.

Case lets: Business cases of TATA Steel, Infosys, Visakha dairy.

Learning Outcomes: At the end of this unit students will be able to

- Interpret the concepts of entrepreneurship and the characteristics of an entrepreneur. (L2)
- Explain the significance of entrepreneurship in the economic development of a nation.(L3)

Unit II

Ideation and Evaluation of Business Ideas: Opportunity identification – Ideations process - Sources of business ideas – Role of creativity – Sources of Innovation –Technological Innovation And Entrepreneurship -Business Idea Evaluation - Product/ Service design – Design Thinking – Customer.

Case lets: Business cases of OYO, Paytm and Ola automobiles.

Activity: Concept generation methods.

Learning Outcomes: At the end of this unit students will be able to

- At the end of this unit students will be able to:
- Choose the right business ideas. (L3)
- Evaluate the business idea. (L2)

Unit III

Feasibility Analysis and Business plan: Thrust areas of entrepreneurship - Techno-economic feasibility assessment- Financial feasibility – Market feasibility – Preparation of Business plan – Business canvas & Lean canvas- Challenges & Pitfalls in selecting new venture.

Activity: Preparation of business plan (draft)

Learning Outcomes: At the end of this unit students will be able to

- Evaluate technical feasibility.(L1)
- Develop business canvas. (L4)

Unit IV

Business Incubation and startups: Fundamentals of business incubation - Business incubator models - Services of incubators - Start-ups-practical applications and challenges-start up strategy -blue ocean strategy vs red ocean strategy.

Activity: Business plan presentation.

Learning Outcomes: At the end of this unit students will be able to

- Describe the process of business incubation/incubators (L2)
- Select a suitable incubator and build a feasible business model. (L3)

Unit V

Financial resources : Sources of finance – Bootstrapping - Government Support – Financial & Non-financial– Venture Capitalists & Angel Investors.

Activity: Business plan final version

Learning Outcomes: At the end of this unit students will be able to

- Knowledge about various sources of finance for entrepreneurship. (L2)
- Analyze the opportunities Seed capital /Angel financiers and understand operation.(L3)

Text Book

1. T.V Rao, Donald F. Kuratko, Entrepreneurship,A South-Asian Perspective, Cengage Learning, 2012
2. Datsy Davies, Indian Startups, Amazon Asia-Pacific Holdings Private Limited, 2016

Reference Books

1. P.N.Rath, Sarjue Pandita, Entrepreneurship: Startup India & Stand up India, Lexicon Publishing House, 2018
2. MadhurimaLall, Shikha Sahai, Entrepreneurship, Excel Books (P) Ltd. 2008
3. Rajeev Roy, Entrepreneurship, Oxford Higher Education. 2011
4. H. Nandan, Fundamentals of Entrepreneurship, PHI Learning (P) Ltd, 2013

Web Resources

1. https://www.startupindia.gov.in/
2. https://strategyzer.com/canvas/business-model-canvas
3. https://canvanizer.com/new/lean-canvas
4. https://msme.gov.in/
5. https://t-hub.co/
6. http://www.apinnovationsociety.com/index.php
7. https://aim.gov.in/atal-incubation-centres.php
8. https://nptel.ac.in/courses/110/106/110106141/

III Year – II Semester

Course Code	Course Title	Hrs./Week L: T: P	Credits
R19EEE-PC3201	Electric Drives	3:0:0	3

Course Objectives:

- To analyze the characteristics of DC motors.
- To understand the process for speed control of DC motors by choppers.
- To analyze the process for speed control of DC motors in four quadrants.
- To analyze the characteristics of Induction Motor form the fundamental equations.
- To understand the speed control of squirrel cage and slip ring Induction Motor by controlling stator and rotor parameters.

Course outcomes: At the end of this course, the students will be able to

1. Analyze the characteristics of a DC motors.(L4)
2. Understand the process for speed control of DC motors by choppers. (L2)
3. Analyze the process for speed control of DC motors in four quadrants.(L4)
4. Analyze the characteristics of an Induction Motor from the fundamental equations.(L4)
5. Understand the speed control of squirrel cage and slip ring Induction Motor by controlling the stator and rotor parameters.(L2)

UNIT-I

Electric Drives: Electric drive, Block diagram of electric drive, torque equations of DC machine, -Dynamic Torque equation and Load torque equation, torque-speed characteristics of separately excited dc motor, change in torque-speed curve with armature voltage, armature voltage control for varying motor speed, – Four quadrant operation of drive (hoist control) – Braking methods**:** Dynamic – Plugging – Regenerative methods.

Learning outcomes: The students are able to

- Observe the speed torque characteristics of a DC machine. (L2)
- Develop the speed control methods for a DC motor. (L3)

UNIT-II

Chopper fed DC drive: Review of dc chopper and duty ratio control, chopper fed dc motor for speed control, steady state operation of a chopper fed drive, armature current waveform and ripple, calculation of losses in dc motor and chopper, efficiency of dc drive, smooth starting-Numerical Problems-Applications

Learning outcomes: The students are able to

- Design the chopper fed DC drive. (L2)
- Study the operation of a chopper fed drive at steady state condition. (L2)
- Determine the losses and efficiency of a dc motor. (L5)

UNIT-III

Multi-quadrant DC drive: Review of motoring and generating modes operation of a separately excited dc machine, four quadrant operation of dc machine; single-quadrant, two-quadrant and four-quadrant choppers; steady-state operation of multi-quadrant chopper fed dc drive, regenerative braking-Numerical Problems-Applications

Learning outcomes: The students are able to

- Study the operation of four quadrants in all modes. (L2)
- Observe the steady state operation of DC drive in all quadrants. (L2)
- Design the braking system for a DC motor. (L5)

UNIT-IV

Induction motor characteristics: Torque-speed characteristic of an Induction Motor, variation of torque-speed curve with (i) applied voltage, (ii) applied frequency and (iii) applied voltage and frequency, typical torque-speed curves of fan and pump loads, operating point, constant flux operation, flux weakening operation.

Learning outcomes: The students are able to

- Observe the speed torque characteristics for an induction motor.(L2)
- Study the different parameters from speed torque curve.(L2)

UNIT-V

Control of induction motors on stator and rotor side:

Scalar control or constant V/f control of induction motor: constant V/f control of induction motor, steady-state performance analysis based on equivalent circuit, speed drop with loading, slip regulation-Applications, Introduction to Stator voltage control using 3-phase AC voltage regulators

Control of slip ring induction motor: Impact of rotor resistance of the induction motor torque-speed curve, operation of slip-ring induction motor with external rotor resistance, starting torque, power electronic based rotor side control of slip ring motor, slip power recovery.-Applications

Learning outcomes: The students are able to

- Control the speed of induction motor by constant V/f ratio.(L3)
- Apply different modulation techniques to control the speed of induction motor.(L3)
- Design the rotor resistance control of induction motor. (L5)

Textbooks

1. G. K. Dubey, “Power Semiconductor Controlled Drives”, Prentice Hall,1989.
2. R. Krishnan, “Electric Motor Drives: Modeling, Analysis and Control” , Prentice Hall, 2001.

References Books

1. G. K. Dubey, “Fundamentals of Electrical Drives”, CRC Press,2002.
2. W. Leonhard,“ControlofElectricDrives”,SpringerScience&BusinessMedia,2001.

Web Links

1. http://sdeuoc.ac.in/sites/default/files/sde_videos/Electrical%20Drives%20and%20Controls_0.pdf
2. https://nptel.ac.in/courses/108/108/108108077/

Course Code	Course Title	Hrs./Week L: T: P	Credits
R19EEE-PC3202	Power System Analysis	3:0:0	3

Course objectives:

- To develop the impedance diagram (p.u) and formation of Y_{bus}
- To study the different load flow methods
- To study the concept of the Z_{bus} building algorithm
- To study the effects of symmetrical and unsymmetrical faults
- To study the rotor angle stability of power systems

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

1. Apply the mathematical knowledge of per-unit quantities for the formation of Y-bus matrix to the power system (L3)
2. Analyze the numerical methods for the power flow studies(L4)
3. Develop the Z_{BUS} Matrix using step by step procedure of a power system network(L3)
4. Analyze the unsymmetrical faults in power system (L4)
5. Explain stability and various methods to improve stability of power system(L2)

UNIT –I

Per Unit Representation & Topology: Per Unit Quantities–Single line diagram– Impedance diagram of a power system–Graph theory definition – Formation of element node incidence and bus incidence matrices – Primitive network representation – Formation of Y–bus matrix by singular transformation and direct inspection methods.

Learning Outcomes: The students are able to

- Model the impedance & Reactance diagram for a power system network (L1)
- Understand the per unit quantities (L2).
- Develop a Y_{bus} matrix for a power system network (L3).

UNIT – II

Power flow studies: Necessity of power flow studies – Derivation of static power flow equations – Power flow Solution using Gauss-Seidel Method – Newton Raphson Method (Rectangular and polar Coordinates form) –Decoupled and Fast Decoupled methods – Algorithmic approach –Problems on 3–bus system only.

Learning Outcomes: The students are able to

- Analyze the load flow solution of a power system (L4).
- Compare different iterative techniques for load flow studies (L4).

UNIT – III

Z–Bus formulation & Symmetrical Fault analysis: Formation of Z–Bus**:** Partial network– Algorithm for the Modification of Zbus Matrix for the addition of branch and addition of link (Derivations and Numerical Problems)–Modification of Z–Bus for the changes in network (Problems).

Transients on a Transmission line-short circuit of synchronous machine (on no-load) - 3–Phase short circuit currents and reactance's of synchronous machine–Short circuit MVA Calculations -Series reactors – selection of reactors.

Learning outcomes: The students are able to

- Understand the concept of Z_{bus} building algorithm (L2)
- Develop a Z_{bus} matrix for a power system networks (L3)
- Understand the effects of Symmetrical faults(L2)

UNIT – IV

Un Symmetrical Fault analysis: Definition of symmetrical components - symmetrical components of unbalanced three phase Systems – Power in symmetrical components – Sequence impedances – Synchronous Generator – Transmission line and transformers – Sequence networks –Various types of faults LG– LL– LLG and LLL on unloaded alternator– unsymmetrical faults on power system.

Learning outcomes: The students are able to

- Understand the effects of Unsymmetrical faults (L2)
- Determine the fault currents for various types of faults in a power system (L5).

UNIT –V

Power System Stability Analysis: Elementary concepts of Steady state, Dynamic and Transient Stabilities– Description of Steady State Stability Power Limit–Transfer Reactance– Synchronizing Power Coefficient –Power Angle Curve and Determination of Steady State Stability –Derivation of Swing Equation–Determination of Transient Stability by Equal Area Criterion–Applications of Equal Area Criterion–Methods to improve steady state and transient stability.

Learning outcomes: The students are able to

- Analyze the steady state, transient and dynamic stability concepts of a power system (L4).
- Derive the Swing equation of a single machine connected system(L3)

Textbooks

1. Power System Analysis by Grainger and Stevenson, Tata McGraw Hill.
2. Modern Power system Analysis – by I.J.Nagrath & D.P.Kothari: Tata McGraw–Hill Publishing Company, 2nd edition.

Reference Books

1. Power System Analysis – by A.R.Bergen, Prentice Hall, Inc.
2. Power System Analysis by HadiSaadat – TMH Edition.
3. Power System Analysis by B.R.Gupta, Wheeler Publications.
4. Power System Analysis and Design by J.Duncan Glover, M.S.Sarma, T.J.Overbye-Cengage Learning publications.

Weblinks

1. https://nptel.ac.in/courses/108/105/108105067/
2. https://nptel.ac.in/courses/108/104/108104051/

Course Code	Course Title	Hrs./Week L: T: P	Credits
R19ECE-PC3207	**Microprocessors and Microcontrollers**	3:0:0	3

Course Objectives:

- To introduce fundamental architectural concepts of microprocessors and microcontrollers.
- To impart knowledge on addressing modes and instruction set of 8085 & 8086.
- To introduce assembly language programming concepts.
- To impart knowledge on addressing modes and instruction set of 8051
- To explain memory and I/O interfacing with 8086 and 8051.

Course Outcomes:

1. Distinguish between microprocessors & microcontrollers (L2)
2. Develop assembly language programming Using assembler directives.(L2)
3. Describe interfacing of 8086 with peripheral devices (L3)
4. Discuss architecture and features of Intel 8051 microcontroller (L2)
5. Develop assembly language programming Using 8051 instructions. (L3)

Unit 1

Introduction to 8085 Microprocessor: Basic microprocessor system-working, 8085 Microprocessor Architecture, register organization, Pin Diagram, Flag Register, Instruction Cycle, Timing Diagram.

Applications:

1. Construct the machine code generation like arithmetic, logical, shift and rotate instructions.

Learning Outcomes:

- At the end of this unit students will be able to summarize features of a 8085 microprocessor (L2)
- At the end of this unit students will be able to explain about Instruction cycle and timing diagram of 8085 (L3)

Unit 2

8085 Microprocessor programming: Interrupts of 8085, instructions set of 8085 and addressing modes, programming of 8085.

Applications:

1. Construct the machine code generation like arithmetic, logical, string, branch and machine controlling instructions

Learning Outcomes:

- At the end of this unit students will be able to develop assembly language programs for various problems (L3)
- At the end of this unit students will be able to explain about ISR and interrupt structure of 8086 (L2)

Unit 3

8086 Microprocessor: Introduction **,** Register Organization of 8086, Architecture, Pin Diagram, Physical Memory concept, Interrupt structure of 8086. minimum and maximum mode microprocessor system, Timing diagram and Genaral Bus operation.

Applications:

1. Using assembler directives Construct simple programs like addition, subtraction, multiplication, division, shift, rotate etc**.**

Learning Outcomes

- At the end of this unit students will be able to summarize features of a 8086

microprocessor (L2).

- At the end of this unit students will be able to explain about Instruction cycle and timing diagram of 8086 (L3).

Unit 4

Programming and interacting with 8086: Addressing Modes, Instruction Set of 8086, Assembler Directives, Assembly Language Programming: Simple programs, Procedures and Macros Programme. Programmable Peripheral Interface 8255, Programmable Interrupt Controller 8259, Programmable Communication Interface 8251 USART, DMA Controller 8257.

Applications:

1. Design interfacing with 8086 to generate the square wave forms, 8251 interfacing asynchronous and synchronous to telephone lines.

Learning Outcomes:

- At the end of this unit students will be able to understand instruction set of 8086 microprocessor (L2)
- At the end of this unit students will be able to develop assembly language programs for various problems (L2)
- At the end of this unit students will be able to demonstrate memory & I/O interfacing with 8086 (L3)

Unit 5

Intel 8051 Microcontroller: 8051 Microcontroller Architecture, Microcontroller 8051 pin diagram, 8051 Ports, Internal and External Memory, Counters and Timers, Serial Communication in 8051, Interrupts in 8051, Addressing Modes, Data Transfer Instructions, Data and Bit-Manipulation Instructions, Arithmetic Instructions, simple programs.

Applications:

1. Construct the controller programs like addition, subtraction, multiplication, division, shift, rotate etc.

Learning Outcomes:

- At the end of this unit students will be able to distinguish between microprocessor and a microcontroller (L4)
- At the end of this unit students will be able to describe architecture and features of Intel 8051 microcontroller (L2)
- At the end of this unit students will be able to develop assembly language programs to perform various operations using 8051 (L3)

Text Books

1. Ramesh S Gaonkar, Microprocessor Architecture Programming and Applications with the 8085, 6th edition, Penram International Publishing, 2013
2. K M Bhurchandi, A K Ray, Advanced Microprocessors and Peripherals, 3rd edition, McGraw Hill Education, 2017.
3. Microcontrollers and application, Ajay.V.Deshmukh,TMGH,2005

References

1. The 8085 microprocessor: Architecture, programming and interfacing- K.Uday Kumar, B.S.Umashankar,2008
2. D.V.Hall, Microprocessors and Interfacing. TMGH, 2nd editionKenneth J. Ayala, The 8051 Microcontroller, 3rd edition, Cengage Learning, 2004.
3. Barry B.Brey, "The Intel Microprocessors: Architecture, Programming and Interfacing", PHI, 6th Edition.
4. The 8051 microcontrollers, architecture and programming and applications-K.UmaRao, AndhePallavi., Pearson, 2009.

Course Code	Course Title	Hrs./Week L: T: P	Credits
R19EEE-PC3203	**Switch Gear and Protection**	3:0:0	3

Course Objectives:

- To examine the technical aspects involved in the operation of circuit breakers.
- To understand different types of electromagnetic relays.
- To determine the Generator and Transformers protection schemes.
- To understand the protection of feeders and lines.
- To analyze the different types of static Relays, microprocessor based relays and Generation of over voltages and protection from over voltages.

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

1. Solve numerical problems for arc interruption and recovery in circuit breakers (L3)
2. Understand the principles of operation of electromagnetic relays (L2)
3. Determine the unprotected percentage of generator and transformer winding under fault conditions (L3)
4. Explain the use of relays in protecting feeders, lines and bus bars (L2)
5. Understand and elaborate the working principle and operation of different types of static relays and understand different types of over voltages and protective schemes required (L4)

UNIT – I

Circuit Breakers: Elementary Principles of Arc Interruption, Restriking Voltage and Recovery Voltage - Restriking Phenomenon, RRRV, Average and Max. RRRV, Current Chopping and Resistance Switching - Description and Operation of Following Types of Circuit Breakers: Oil Circuit Breakers, Air Blast Circuit Breakers, Vacuum and SF6 Circuit Breakers–CB Ratings, Specifications and Applications- Concept of Auto Reclosing.

Learning outcomes: The students are able to

- Understand the principle of arc interruption (L2)
- Examine the Construction and Operation of different types of circuit breakers (L3)

UNIT – II

Electromagnetic Protection Relays: Balanced beam type attracted armature relay - induction disc and induction cup relays–Torque equation - Relays classification– Instantaneous– DMT and IDMT types– Applications of relays: Over current and under voltage relays– Directional relays– Differential relays and percentage differential relays– Universal torque equation– Distance relays: Impedance– Reactance– Mho and offset mho relays– Characteristics of distance relays and comparison.

Learning outcomes: The students are able to

- Understand the working principle and operation of different types of relays (L2)
- Classify the characteristics of relays (L2)

UNIT – III

Generator Protection: Protection of generators against stator faults– Rotor faults and abnormal conditions– restricted earth fault and inter turn fault protection– Numerical examples. Transformer Protection

Protection of transformers: Percentage differential protection– Design of CT's ratio– Buchholz relay protection–Numerical examples.

Learning outcomes: The students are able to

- Identify faults for high power generator and transformers (L3)
- Identify protective schemes for high power generator and transformers (L3)

UNIT – IV

Feeder and Bus bar Protection: Protection of lines: Over current Protection schemes – PSM,TMS - Numerical examples -Carrier current and three zone distance relay using impedance relays–Protection of bus bars by using Differential protection.

Learning outcomes: The students are able to

- Understand protective schemes used for feeder (L2)
- Understand protective schemes used for bus bar (L2)

UNIT – V

Static and Digital Relays & Protection against over voltage and grounding

Static relays: Static relay components– Static over current relays– Static distance relay– Microprocessor based over current relay.

Generation of over voltages in power systems: Protection against lightning over voltages– Valve type and zinc oxide lighting arresters – Grounded and ungrounded neutral systems– Effects of ungrounded neutral on system performance– Methods of neutral grounding: Solid–resistance– Reactance–Arcing grounds and grounding Practices.

Learning outcomes: The students are able to

- Understand and compare the working principle of different types of static relays (L4)
- Understand the reason of generating over voltages in power systems (L2)
- Analyse the need of Lightning arresters in power systems and protective schemes required (L4)

Textbooks

1. Power System Protection and Switchgear, Badri Ram, D.N Viswakarma, TMH Publications, 2011.
2. Switchgear and Protection, Sunil S Rao, Khanna Publishers, 1992.

Reference Books

1. Electrical Power Systems, C.L.Wadhwa, New Age international (P) Limited, Publishers, 2012.
2. Transmission network Protection, Y.G. Paithankar ,Taylor and Francis,2009.
3. Power system protection and switch gear, Bhuvanesh Oza, TMH, 2010.

Web Links

1. https://nptel.ac.in/courses/108/107/108107167/
2. https://nptel.ac.in/courses/108/101/108101039/
3. https://www.electrical4u.com/

Course Code	Course Title	Hrs./Week L: T: P	Credits
R19EEE-PE3201.1	Advanced Control Systems (Professional Elective-2)	3:0:0	3

Course Objectives:

- To evaluate the state space representation of a control system and formulation of different models from the signal flow graph.
- To understand the concept of controllability, observability and design of plant controller by using pole placement technique.
- To analyze nonlinear system using describing function approach and phase plane analysis.
- To analyze the stability of a system using Lyapunov's method.
- To understand the different types of non-linear controllers.

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

1. Understand the State space representation of control system and formulation of different state models (L2).
2. Design of control system using the pole placement technique after introducing the concept of controllability and observability(L5)
3. Analyze the nonlinear system using the describing function technique and phase plane analysis(L4)
4. Analyze the stability of nonlinear systems using Lyapunov's method(L4)
5. Understand the concept of different nonlinear controllers(L2)

UNIT – I

State space analysis: State Space Representation – Solution of state equation – State transition matrix, –Canonical forms – Controllable canonical form – Observable canonical form, Diagonal Canonical Form.

Learning outcomes: The students are able to

- Understand the State space representation of control system and formulation of different state models (L2).
- Analyze the different Canonical forms of state space models (L4).

UNIT – II

Controllability, Observability and design of pole placement: Tests for controllability and observability for continuous time systems – Principle of duality – Effect of state feedback on controllability and observability – Design of state feedback control through pole placement.

Learning outcomes: The students are able to

- Understand the concept of Controllability & Observability Canonical forms of state model (L2).
- Design the controller using the pole placement technique (L5).

UNIT – III

Describing function analysis: Introduction to nonlinear systems, Types of nonlinearities – Saturation, Friction, Backlash, Dead-Zone, Describing functions – Dead-zone and Saturation, Relay with Dead-zone and Hysteresis, Introduction to phase–plane analysis.

Learning outcomes: The students are able to

- Analyze the nonlinear system using the describing function technique and phase plane analysis (L4).

UNIT–IV

Stability analysis: Lyapunov's stability and Lyapunov's instability theorems. Direct method of Lyapunov for the linear, methods of constructing Lyapunov's functions for nonlinear systems.

Learning outcomes: The students are able to

- Analyze the Stability for linear and nonlinear systems using Lyapunov's method (L4).

UNIT – V

Advances in control systems: Overview of nonlinear controllers: Adaptive control, Fuzzy Logic control and Neural Networks.

Learning outcomes: The students are able to

- Understand the different types of nonlinear controllers (L2).

Textbooks

1. Modern Control Engineering – by K. Ogata, Prentice Hall of India, 3rd edition, 1998
2. Automatic Control Systems by B.C. Kuo, Prentice Hall Publication

Reference Books

1. Modern Control System Theory – by M. Gopal, New Age International Publishers, 2nd edition,1996
2. Control Systems Engineering by I.J. Nagarath and M.Gopal, New Age International (P) Ltd.
3. Digital Control and State Variable Methods – by M. Gopal, Tata McGraw– Hill
4. Companies, 1997.
5. Systems and Control by Stainslaw H. Zak , Oxford Press, 2003.
6. Optimal control theory: an Introduction by Donald E.Kirk by Dover publications.

Web Links

- https://nptel.ac.in/courses/108/107/108107115/
- https://nptel.ac.in/courses/108/105/108105019/

Course Code	Course Title	Hrs./Week L: T: P	Credits
R19EEE-PE3201.2	HVAC Transmission (Professional Elective-2)	3:0:0	3

Course Objective: The objectives of the course are to make the students learn about:

- To learn about the trends in EHV AC transmission
- To apply knowledge to calculate the line inductance and capacitance of bundle conductors.
- To understand the effect of Corona and radio interference..
- To Explore the concept of Electrostatic field and the travelling wave theory
- To Analyze compensated devices for voltage control..

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

1. Calculate the line inductance and capacitance of bundle conductors.(L3)
2. Calculate electrostatic field of AC lines and Effect of high electrostatic field on biological organisms and human beings (L3 & L4)
3. Understand the sources and impacts of corona in EHV lines(L2)
4. Analyze compensated devices for voltage control(L4)
5. Design filters for suppressing harmonics injected into the system (L3)

UNIT-I

E.H.V. A.C. Transmission, line trends and preliminary aspects, standard transmission voltages – power handling capacities and line losses – mechanical aspects. Calculation of line resistance and inductance: resistance of conductors, temperature rise of conductor and current carrying capacity. Properties of bundled conductors and geometric mean radius of bundle, inductance of two conductor lines and multi conductor lines, Maxwell's coefficient matrix. Line capacitance calculation: capacitance of two conductor line, and capacitance of multi conductor lines, potential coefficients for bundled conductor lines, sequence inductances and capacitances and diagonalization.

Learning Outcomes: The students are able to

- Understand the the trends in EHV AC transmission(L2)
- Calculate the line inductance and capacitance of bundle conductors.(L3)

UNIT -II

Calculation of electrostatic field of AC lines - Effect of high electrostatic field on biological organisms and human beings. Surface voltage Gradient on conductors, surface gradient on two conductor bundle and cosine law, maximum surface voltage gradient of bundle with more than 3 sub conductors, Mangolt formula.

Learning Outcomes: The students are able to

- Calculate electrostatic field of AC lines.
- Understand Effect of high electrostatic field on biological organisms and human beings

UNIT-III

Corona : Corona in EHV lines – corona loss formulae – attenuation of traveling waves due to corona – Audio noise due to corona, its generation, characteristics and limits, measurement of audio noise.

Learning Outcomes: The students are able to

- Analyze attenuation of traveling waves due to corona
- Understand the sources and impacts of corona in EHV lines

UNIT-IV

Power Frequency voltage control : Problems at power frequency, generalized constants, No load voltage conditions and charging currents, voltage control using synchronous condenser, cascade connection of components : Shunt and series compensation, sub synchronous resonance in series – capacitor compensated lines

Learning Outcomes: The students are able to

- Understand the concepts of power frequency voltage control
- Understand the methods of Shunt and series compensation

UNIT –V

Static reactive compensating systems: Introduction, SVC schemes, Harmonics injected into network by TCR, design of filters for suppressing harmonics injected into the system.

Learning Outcomes: The students are able to

- Understand the operation of SVC systems
- Design filters for suppressing harmonics injected into the system

Textbooks

1. Extra High Voltage AC Transmission Engineering – Rakesh Das Begamudre, Wiley Eastern ltd., New Delhi – 1987.
2. EHV Transmission line reference book – Edison Electric Institute (GEC) 1986.

Reference Books

1. EHVAC Transmission Engineering by R. D. Begamudre, New Age International (p) Ltd.
2. HVAC and DC Transmission by S. Rao
3. Padiyar K.R., “HVDC Power Transmission Systems” -New Age International Ltd.

Weblinks

1. http://www.electricalquizzes.com/electric-transmissiondistribution/electric
2. www.electrical4u.com/corona-effect-in-power-system.html
3. www.electricaleasy.com/2016/07/corona-discharge.html
4. www.sitehostplus.com/extra-high-voltage-ac-transmission/nptel.iitm.ac.in

Course Code	Course Name	Hrs./Week L: T: P	Credits
R19EEE-PE3201.3	Special Electrical Machines (Professional Elective-2)	3:0:0	3

Course Objective:

- To explain theory of operation and control of switched reluctance motor.
- To explain the performance and control of stepper motors, and their applications.
- To describe the operation and characteristics of permanent magnet dc motor.
- To distinguish between brush dc motor and brush less dc motor**.**
- To explain the theory of travelling magnetic field and applications of linear motors.

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

1. Distinguish between brush dc motor and brush less dc motor. (L4)
2. Explain the performance and control of stepper motors, and their applications. (L2)
3. Explain theory of operation and control of switched reluctance motor. (L2)
4. Explain the theory of travelling magnetic field and applications of linear motors. (L2)
5. Understand the significance of electrical motors for traction drives. (L2)

Unit I

Permanent magnet materials and PMDC motors: Introduction-classification of permanent magnet materials used in electrical machines-minor Hysteresis loop and recoil line-Stator frames of conventional dc machines-Development of Electronically commutated dc motor from conventional dc motor-Permanent-magnet materials and characteristics-B-H loop and demagnetization characteristics-high temperature effects reversible losses-Irreversible losses-Mechanical properties, handling and magnetization-Application of permanent magnets in motors-power density-operating temperature range-severity of operation duty.

Learning outcomes:

- Understand the permanent magnet materials and its usage in electrical machines. (L2)
- Determine the electrical equivalent circuit of PM DC motor. (L5)

Unit II

Stepper Motors: Principle of operation of Stepper Motor – Constructional details - Classification of stepper motors – Different configuration for switching the phase windings - Control circuits for stepper motors – Open loop and closed loop control of two phase hybrid stepping motor.

Learning outcomes:

- Study the operation and performance of different stepper motors. (L2)
- Design the open loop and closed loop control for different stepper motors. (L3)

Unit III

Switched Reluctance Motors: Construction and Principle of operation of Switched Reluctance Motor – Comparison of conventional and switched reluctance motors – Design of stator and rotor pole arcs – Torque producing principle and torque expression – Different converter configurations for SRM – Drive and power circuits for SRM – Position sensing of rotor – Applications of SRM.

Learning outcomes:

- Understand the principle operation and design of stator and rotor pole arc of switched reluctance motor.(L2)
- Study the rotor sensing mechanism and logic controller of switched reluctance motor (L2)

Unit IV

Permanent Magnet Brushless DC Motor: Principle of operation of BLDC motor - Types of constructions - Surface mounted and interior type permanent magnet DC Motors - Torque and EMF equations for Square wave & Sine wave for PMBLDC Motor – Torque - Speed characteristics of Square wave & Sine wave for PMBLDC Motor - Merits & demerits of Square wave & Sine wave for PMBLDC Motor - Performance and efficiency – Applications.

Learning outcomes:

- Understand the construction and operation of Brushless DC Motor and its advantages. (L2)
- Study the torque speed characteristics, performance and efficiency of square wave brushless DC motor. (L2)
- Study the Comparison between square wave and sine wave permanent magnet motors. (L2)

Unit V

Linear Induction Motors (LIM): Construction– principle of operation–Double sided LIM from rotating type Induction Motor –

Schematic of LIM drive for traction – Development of one sided LIM with back iron-equivalent circuit of LIM.

Learning outcomes:

- Understand the construction and operation of Linear Induction Motor and Linear Synchronous Motor. (L2)
- Study the application of Linear Induction Motors used in traction system. (L2).

Text Books

1. Brushless Permanent magnet and reluctance motor drives, Clarenden press, T.J.E. Miller, 1989, Oxford.
2. Special Electrical Machines, K.Venkata Ratnam, University press, 2009, New Delhi.

Reference Books

1. Special electrical machines, E.G. Janardhanan, PHI learning private limited, 2014,

Course Code	Course Title	Hrs./Week L: T: P	Credits
R19EEE-PE3201.4	Wavelet Transforms (Professional Elective-2)	3:0:0	3

Course Objectives:

- To expose the students to the basics of wavelet theory and
- To illustrate the different types of wavelets
- Understand the use of wavelet processing for data compression and noise suppression.
- Understand the concept of lifting schemes

Course Outcomes: After successful completion of this course, students should able to

1. Classify various wavelet transform and explain importance of it (L2).
2. Describe Continuous Wavelet Transform (CWT) and Discrete Wavelet Transform (DWT) (L2).
3. Explain the properties and application of wavelet transform. (L2).
4. Develop and realize computationally efficient wavelet-based algorithms for signal and image processing. (L3).
5. Explain brief features and applications of wavelet transform. (L2).

Unit I

Continuous Wavelet Transform: Continuous time frequency representation of signals, The Windowed Fourier Transform, Uncertainty Principle and time frequency tiling, Wavelets, specifications, admissibility conditions, Continuous wavelet transform, CWT as a correlation, CWT as an operator, Inverse CWT.

Learning Outcomes: At the end of the unit, the student will be able to

- Describe importance of Wavelet Transform Applications (L2).
- Determine the damping ratio of oscillating signals (L5).

Unit-II

Discrete wavelet Transform: Approximations of vectors in nested linear vector spaces, Example of an MRA, Formal definition of MRA, Construction of genera orthonormal MRA, a Wavelet basis for MRA, Digital filtering interpretations- Decomposition and Reconstruction filters, examples of orthogonal basis generating wavelets, interpreting ortho normal MRA for Discrete time signals, Mall at algorithm Filter bank implementation of DWT.

Learning Outcomes: At the end of the unit, the student will be able to

- Understand the concept of discrete wavelet transform (L2).
- Apply the discrete wavelet transform for filter based applications. (L3).

Unit-III

Alternative wavelet representations- Biorthogonal Wavelets: biorthogonality in vector space, biorthogonal wavelet bases, signal representation using biorthogonal wavelet system, advantages of biorthogonal wavelets, biorthogonal analysis and synthesis, Filter bank implementation, Two dimensional Wavelets, filter bank implementation of two-dimensional wavelet transform.

Learning Outcomes:

At the end of the unit, the student will be able to

- Illustrate the concepts of Bi-orthogonal discrete wavelet transform (L2).
- Analyze the filter bank using Bi-orthogonal discrete wavelet transform (L4).

UNIT-IV

Lifting scheme: Wavelet Transform using poly phase matrix factorization, Geometrical foundations of the lifting scheme, lifting scheme in the z- domain, mathematical preliminaries for poly phase factorization, Dealing with Signal Boundary.

Learning Outcomes:

At the end of the unit, the student will be able to

- Explain the poly phase matrix factorization for wavelet transforms (L2).
- Apply the wavelet transform based various lifting schemes for dealing with signal boundary conditions. (L3).

UNIT-V

Applications: Image Compression: EZW Coding, SPIHT, Wavelet Difference Reduction Compression Algorithm, Denoising, speckle removal, edge detection and object isolation, audio compression, communication applications – scaling functions as signalling pulses, Discrete Wavelet Multitone Modulation.

Learning Outcomes:

At the end of the unit, the student will be able to

- Understand the signal compression techniques in which Wavelet transform are used as crucial role. (L2).
- Explain the wavelet transform based audio and vedio applications (L2).

Textbooks

1. Wavelet Transforms –Introduction and applications - Raguveer M. Rao and Ajit S. Bopardikar-Pearson Education, 2008.
2. Insight into Wavelets from Theory to practice - K.P Soman, K. I. Ramachandran, PHI, 2006.

References

1. Fundamentals of Wavelets: Theory, Algorithms and Applications- J C Goswamy and A K Chan, Wiley- Inderscience Publications, John Wiley and Sons, 1999.
2. Wavelet Transforms, Addition Wesley, . R.M. Rao & A.S. Bopardikar 1998.

Course Code	Course Title	Hrs./Week L: T: P	Credits
R19ECE-OE3201	Communication Systems (Open Elective-2)	3:0:0	3

Course Objective

- To expose on the analog and digital communication principles.
- To study the recent trends adopted in communication systems.

Course Outcomes: On successful completion of this course the student will be able to

1. Explain the concept of amplitude and angle modulations(L2)
2. Understanding the concept of noise in communication systems(L2)
3. Describe various pulse communication schemes(L2)
4. Analyze various pulse transmission schemes(L4)
5. Explain the errors obtained in the communication system by using error Control coding techniques

UNIT I

Analog Communications: Introduction to Communication Systems: Modulation–Types-Need for Modulation, Theory Of Amplitude Modulation-Evolution and Description of SSB Techniques, Theory of Frequency and Phase Modulation,

Applications:

1. Amplitude modulation is used in a variety of applications. Broadcast transmissions, Air band radio, single side band, quadrature amplitude modulation
2. In order to transmit 2 channel stereo signals, **DSB** signals are used in Television and FM broadcasting.
3. SSB-SC modulation techniques are used in mobile communication, telemetry, military communications, navigation and amateur radio.
4. Frequency modulation is widely used for **FM** radio broadcasting, telemetry, radar, seismic prospecting, and monitoring newborns for seizures via EEG, two-way radio systems, sound synthesis, magnetic tape-recording systems and some video-transmission systems.

Learning Outcomes:

At the end of this unit the student will be able to

- Understand the need for modulation, time domain and frequency domain representation (L2).
- Understand the different modulation techniques of AM, DSB-SC,SSB and FM (L2)

UNIT II

Noise : Noise: Source of Noise –External Noise –Internal Noise-Noise Calculation, Comparison of Various Analog Communication Systems (AM–FM–PM).

Applications:

1. The noise calculation is used in all analog and digital communications systems, which limits the transmission distance.

2.It is used to improve the quality of transmission and reduce the cost of the of system.

Learning Outcomes:

At the end of this unit, the student will be able to

- Apply the noise theory on analog signals (L3)
- Apply the noise theory on modulation techniques(L3)

UNIT III

Pulse Communication: Pulse Communication: Pulse Amplitude Modulation (PAM) –Pulse Time Modulation (PTM)–Pulse Code Modulation (PCM), Comparison of Various Pulse Communication Systems (PAM–PTM –PCM).

Applications:

1. Pulse and digital modulation techniques are used in Ethernet communication, many micro-controllers for generating control signals.
2. These techniques are used in Photo-biology, an electronic driver for LED lighting.

Learning Outcomes:

At the end of this unit the student will be able to

- Compare various types of pulse communications systems(L2)
- Understand pulse digital modulation techniques. (L2).

UNIT IV

Digital Communication : Amplitude Shift Keying (ASK), Frequency Shift Keying (FSK), Minimum Shift Keying (MSK) Phase Shift Keying (PSK) :BPSK–QPSK –8PSK, Quadrature Amplitude Modulation (QAM): 8QAM, Bandwidth Efficiency, Comparison of Various Digital Communication System (ASK–FSK–PSK–QAM).

Applications:

1. Digital nodulation techniques are used in QPSK, CDMA, Cellular service, Wireless local loop, Digital video broadcasting-satellite.

Learning Outcomes:

At the end of this unit the student will be able to

- Understand the digital modulation and demodulation tecniques (L1).
- Calculate probability of error for ASK, FSK, BPSK, BFSK, QPSK (L3).

UNIT V

Source and Error Control coding: Entropy, Source Encoding Theorem-Shannon Fanon Coding-Huffman Coding, Mutual Information-Channel Capacity, Channel Coding Theorem, Error Control Coding-Linear Block Codes-Cyclic Codes-Convolution Codes.

Applications:

1. Information theory is used in, Data compression, Error correcting and detecting codes, Cryptology.
2. Shannon fano coding is used in digital communications, random variable sequence generator
3. Huffman encoding is widely used in compression formats like GZIP, PKZIP (winzip) and BZIP2 ,Multimedia codec like JPEG, PNG and MP3

Learning Outcomes:

At the end of this unit the student will be able to

- Calculate entropy for different message signals. (L3).
- Analyze different coding techniques. (L3)

Text books

1. Simon Haykin, “Communication Systems”, 4th Edition, John Wiley & Sons, 2004
2. H.Taub, D L Schilling and G Saha, “Principles of Communication”, 3rd Edition, Pearson
   Education, 2007.
3. B. P.Lathi, “Modern Analog and Digital Communication Systems”, 3rd Edition, Oxford

Reference books

1. WayneTomasi,“AdvancedElectronicCommunicationSystems”,6thEdition,PearsonEducation,2009.
2. RappaportT.S, "Wireless Communications: Principles and Practice", 2ndEdition,PearsonEducation,2007.

Subject Code	Subject Name	Hrs./Week L: T: P	Credits
R19CSE-OE3203	Database Management Systems (Open Elective-2)	3:0:0	3

Course objectives:

- Learn the fundamental concepts of database systems.
- Enable students to design ER diagram for any customized applications
- Learn simple and Complex queries using SQL.
- Learn schema refinement techniques (Normalization).
- Knowledge about transaction and recovery techniques.

Course Outcomes:

1. Understand File System Vs Databases.
2. Design and implement ER-model and Relational models.
3. Construct simple and Complex queries using SQL.
4. Analyze schema refinement techniques.
5. Design and build database system for a given real world problem

UNIT-I

INTRODUCTION-Database system, Characteristics (Database Vs File System), Database Users (Actors on Scene, Workers behind the scene), and Advantages of Data base systems, Database applications. Brief introduction of different Data Models; Concepts of Schema, Instance and data independence; Three tier schema architecture for data independence; Database system structure, environment, Centralized and Client Server architecture for the database.

Learning outcomes: Student will be able to

- Distinguish between Database System and File System (L2)
- Categorize different kinds of data models (L2)

Applications:

1. Universities and Colleges

UNIT-II

RELATIONAL MODEL: Introduction to relational model, concepts of domain, attribute, tuple, relation, importance of null values, constraints (Domain, Key constraints, integrity constraints) and their importance , Relational algebra, Relational Calculus.

ENTITY RELATIONSHIP MODEL: Introduction, Representation of entities, attributes, entity set, relationship, relationship set, constraints, sub classes, super class, inheritance, specialization, generalization using ER Diagrams.

Learning Outcomes: Student will be able to

- Develop E-R model for the given problem (L6)
- Knowledge about integrity constraints in relational model (L1)

Applications:

1. Railway reservation Systems

UNIT-III

SCHEMA REFINEMENT (NORMALIZATION): Purpose of Normalization or schema refinement, concept of functional dependency, normal forms based on functional dependency(1NF, 2NF and 3NF), concept of surrogate key, Boyce-codd normal form(BCNF), Lossless join and dependency preserving decomposition, Fourth normal form(4NF).

Learning Outcomes: Student will be able to

- Differentiate between various normal forms based on functional dependency (L2)
- Apply Normalization techniques to eliminate redundancy (L3)

Applications:

1. Library Management systems.

UNIT-IV

TRANSACTION AND RECOVERY: Transaction State, Implementation of Atomicity and Durability, Concurrent Executions, Serializability,Deadlocks in transactions, Recoverability, Implementation of Isolation, Testing for Serializability, Failure Classification, Storage, Recovery and Atomicity, Recovery algorithm.

Learning Outcomes: Student will be able to

- Summarize transaction properties and recoverability (L2)

Applications:

1. Banking
2. Credit card transactions

UNIT-V

File Organization and Indexing, File Types, File Operations ,Cluster Indexes, Primary and Secondary Indexes , Index data Structures, Hash Based Indexing: Tree based Indexing, Indexes and Performance Tuning

Learning Outcomes: Student will be able to

- Understand basic concepts of File Organization and Indexing (L2)

Applications:

1. Telecom
2. Online shopping

Text Books

1. Database Management Systems, 3/e, Raghurama Krishnan, Johannes Gehrke,TMH
2. Database System Concepts,5/e, Silberschatz, Korth, TMH
3. Introduction to Database Systems, 8/e C J Date, PEA..

Reference Books

1. Database Management System, 6/e Ramez Elmasri, Shamkant B. Navathe, PEA
2. Database Principles Fundamentals of Design Implementation and Management, Carlos Coronel, Steven Morris, Peter Robb, Cengage Learning.

Subject Code	Subject Name	Hrs./Week L: T: P	Credits
R19CSE-OE3201	OOPS Through JAVA (Open Elective-2)	3:0:0	3

Course Objectives:

- To understand the structure and environment of Java.
- To implement the relationship between objects.
- To apply data hiding strategy in objects.
- To implement text processing and error handling.
- To organize data using different data structures.
- To create multi-threaded graphical user interface applications.

Course Outcomes:

1. Understand the environment of JRE and Control Statements.
2. Implement real world objects using class Hierarchy.
3. Implement generic data structures for iterating distinct objects.
4. Implement error handling through exceptions and file handling through streams.
5. Design thread-safe GUI applications for data communication between objects.

Unit I

Java Environment and Program Structure

History of Java, Features, Applications, Java Installation - JDK and JRE, JVM Architecture, OOPS Principles, Class and Object, Naming Convention, Data Types, Type Casting, Type Conversion, Wrapper classes, Operators, instance of operator, Command Line Arguments, Decision making, Arrays, and Looping statements.

Learning Outcomes: Student will be able to

- Understand architecture of Java Virtual Machine.(L2)
- Understand the structure of java program and its environment. (L2)

Unit II

Class Hierarchy & Data Hiding

Property, Method, Constructor, Inheritance (IS-A) , Aggregation and Composition (HAS-A), this and super, static and initialize blocks, Method overloading and overriding, static and final keywords, Types of Inheritance, Compile time and Runtime Polymorphism, Access Specifiers and scope, packages and access modifiers, Abstract class, Interface, Interface Inheritance, Achieving Multiple Inheritance, Class casting, Object Cloning, Inner Classes.

Learning Outcomes: Student will be able to

- Understand the class hierarchy and their scope. (L2)
- Implement relationship between objects. (L3)
- Understand data hiding and nested classes. (L2)
- Implement data type casting and cloning of objects. (L3)

Unit III

Strings and Collections

String: Methods, String Buffer and String Builder, String Tokenizer,

Collections: Exploring java.util.*, Scanner, Iterable, Collection Hierarchy, Set, List, Queue and Map, Comparable and Comparator, Iterators: for each, Enumeration, Iterator and List Iterator.

Learning Outcomes: Student will be able to

- Understand the usage of String and its properties and methods.(L2)
- Understand data structures and Iterators. (L2)
- Create the data structures and implement different utility classes. (L3)

Unit IV

IO and Error Handling

IO Streams: Exploring java.io.*, Character and Byte Streams, Reading and Writing, Serialization and De-serialization,

Error Handling: Error vs Exception, Exception hierarchy, Types of Exception, Exception handlers, User defined exception, Exception propagation.

Learning Outcomes: Student will be able to

- Understand character and byte streams. (L2)
- Understand the hierarchy of errors and exceptions. (L2)
- Implement data streams and exception handlers. (L3)

Unit V

Threads and GUI

Multi-Threading: Process vs Thread, Thread Life Cycle, Thread class and Runnable Interface, Thread synchronization and communication.

GUI: Component, Container, Applet, Applet Life Cycle, Event delegation model, Layouts, Menu, MenuBar, MenuItem.

Learning Outcomes: Student will be able to

- Understand the Thread Life Cycle and its scheduling.(L2)
- Implement the synchronization of threads. (L2)
- Create graphical components using Abstract window toolkit. (L3)

Text Books

1. The complete Reference Java, 8th edition, Herbert Schildt, TMH.
2. Programming in JAVA, Sachin Malhotra, SaurabhChoudary, Oxford.
3. Introduction to java programming, 7th edition by Y Daniel Liang, Pearson.
4. Java: How to Program, 9th Edition (Deitel) 9th Edition.
5. Core Java: An Integrated Approach, Java 8 by R. Nageswara Rao.

Reference Books

1. Swing: Introduction, JFrame, JApplet, JPanel, Componets in Swings, Layout Managers in
2. Swings, JList and JScrollPane, Split Pane, JTabbedPane, JTree, JTable, Dialog Box.

Subject Code	Subject Name	Hrs./Week L: T: P	Credits
R19MEC-OE3201	Robotics (Open Elective-2)	3:0:0	3

Course Objectives: The objectives of this course are to

- Define the fundamental concepts of industrial robotic technology.
- Apply the basic mathematics to calculate kinematic forces in robot manipulator.
- Apply the basic mathematics to calculate dynamic forces in robot manipulator.
- Understand the robot controlling and programming methods.
- Illustrate concept of robot vision system.

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

- Explain fundamentals of Robots. (L2)
- Apply kinematics and differential motions and velocities. (L3)
- Demonstrate control of manipulators. (L2)
- Understand robot vision. (L2)
- Develop robot cell design and programming. (L3)

UNIT – I

Fundamentals of Robots: Introduction, definition, classification and history of robotics, robot characteristics and precision of motion, advantages, disadvantages and applications of robots.Introduction to matrix representation of a point in a space a vector in space, a frame in space, Homogeneous transformation matrices, representation of a pure translation, pure rotation about an axis.

Applications: welding , material handling

Learning outcomes: At the end of this unit, the student will be able to

- Explain a robot and homogeneous transformations. (L2)
- Compare the types of robot manipulators based on applications.(L2)
- Outline the advantages, disadvantages and applications of robot. (L2)
- Explain the robot characteristics. (L2)

UNIT – II

Kinematics of robot: Forward and inverse kinematics of robots- forward and inverse kinematic equations for position and orientation, Denavit-Hartenberg(D-H) representation of forward kinematic equations of robots, the inverse kinematic of robots, degeneracy and dexterity, simple problems with D-H representation.

Applications: pick and place robot, robot arm trajectory planning

Learning outcomes: At the end of this unit, the student will be able to

- Evaluate D-H notations for simple robot manipulator.(L5)
- Identify the position of robot gripper within work volume. (L3)

UNIT – III

Differential motions and Velocities: Introduction, differential relationship, Jacobian, differential motions of a frame-translations, rotation, rotating about a general axis, differential transformations of a frame. Differential changes between frames, differential motions of a robot and its hand frame, calculation of Jacobian, relation between Jacobian and the differential operator, Inverse Jacobian.

Applications: Material Handling Robot

Learning outcomes: At the end of this unit, the student will be able to

- Select Jacobian, Lagrange-Euler and Newton- Euler formations to solve manipulator dynamic problems. (L3)
- Explain the concepts of manipulator kinematics and dynamics. (L2)

UNIT – IV

Control of Manipulators: Open- and close-loop control, the manipulator control problem, linear control schemes, characteristics of second-order linear systems, linear second-order SISO model of a manipulator joint, joint actuators, partitioned PD control scheme, PID control Scheme, computer Torque control, force control of robotic manipulators, description of force-control tasks, force control strategies, hybrid position/force control, impedance force/torque control.

Applications: Welding robots, painting robots

Learning outcomes: At the end of this unit, the student will be able to

- Explain the basic concepts of robot controlling systems. (L2)
- utline PD and PID control schemes. (L2)
- Apply force control strategies to determine the forces in robot. (L3)
- Explain the force control and torque control techniques. (L2)

UNIT – V

Robot Vision: Introduction, architecture of robotic vision system, image processing, image acquisition camera, image enhancement, image segmentation, imaging transformation, Camera transformation and calibrations, industrial applications of robot vision. Robot Cell **Design and Programming:** Robot cell layouts-Robot centred cell, In-line robot cell, considerations in work cell design, work cell control, inter locks, error detection, work cell controller. methods of robot programming, WAIT, SIGNAL, and DELAY commands, Robotic languages, VAL system.

Applications: Humanoid Robot

Learning outcomes: At the end of this unit, the student will be able to

- Identify the components of robot vision system. (L3)
- Illustrate the industrial applications of robot vision system. (L2)
- List the various methods of robot programming. (L1)
- Design the robot cell for simple manufacturing system. (L6)
- Explain the concepts of work cell control, inter locks and error detection. (L2)

Text Books

1. Mikell P. Groover and Mitchell Weiss, Roger N. Nagel,Nicholas G.Odrey , IndustrialRobotics — Mc Graw Hill,
2. R K Mittal and I J Nagrath, Robotics and control, Illustrated Edition, Tata McGrawHill India

References

1. Saeed B. Niku, Introduction to Robotics – Analysis, System, Applications, 2nd Edition, John Wiley & Sons.
2. H. Asada and J.J.E. Slotine, Robot Analysis and Control, 1st Edition Wiley-Interscience
3. Robert J. Schillin, Fundamentals of Robotics: Analysis and control, Prentice-Hall OfIndia Pvt. Limited,
4. Mohsen shahinpoor, A robot Engineering text book, Harper & Row Publishers,1987.
5. John.J.Craig Addison, Introduction to Robotics: Mechanics and Control, Wesley, 1999.
6. K.S. FU, R.C. Gonzalez and C.S.G Lee, Robotics: Control, sensing, vision, and intelligence . Mc Graw Hill, 1987.
7. Richard D. Klafter, Thomas Robotic Engineering an integrated approach, PHI publications 1988.

Course Code	Course Title	Hrs./Week L: T: P	Credits
R19EEE-PC3204	Power Electronics Laboratory	0:0:3	1.5

Course objectives:

- To study the characteristics of various power electronic devices and analyze firing circuits and commutation circuits of SCR.
- To analyze the performance of single–phase and three–phase full–wave bridge converters with both resistive and inductive loads.
- To understand the operation of AC voltage regulator with resistive and inductive loads.
- To understand the working of Buck converter, Boost converter and inverters.

Course outcomes: At the end of this course, the students will be able to

1. Discuss the characteristics of various power electronic devices (L6).
2. Analyze the performance of single–phase and three-phase AC-DC converters with both resistive and inductive loads (L4).
3. Develop the single phase and three phase AC voltage regulator (L6).
4. Design the Buck converter and Boost converter (L6).
5. Understand single–phase square wave inverter with PWM technique (L2)

Any 10 of the Following Experiments are to be conducted

1. Study of Characteristics of Thyristor, MOSFET & IGBT.
2. Design and development of a firing circuit for Thyristor.
3. Design and development of gate drive circuits for IGBT.
4. Single -Phase Half controlled converter with R and RL load
5. Single -Phase fully controlled bridge converter with R and RL loads
6. Single -Phase AC Voltage Regulator with R and RL Loads
7. Single -Phase square wave bridge inverter with R and RL Loads
8. Three- Phase fully controlled converter with RL–load.
9. Design and verification of voltages gain of Boost converter in Continuous Conduction Mode (CCM) and Discontinuous Conduction Mode(DCM).
10. Design and verification of voltages ripple in buck converter in CCM operation.
11. Single -phase PWM inverter with sine triangle PWM technique.
12. 3-phase AC-AC voltage regulator with R-load.

Subject Code	Subject Name	L	T	P	C
R19ECE-PC3208	**Microprocessor And Microcontroller Lab**	**0**	**0**	**3**	**1.5**

Course Objectives:

- To impart the basic instructions of 8086 microprocessor for implementation of arithmetic, logical, BCD and ASCII operations.
- To demonstrate various string, branching and process control instructions for implementation of different array-based operations.
- To explain the mechanism of DOS based interrupt handling services with demonstrated examples.
- To explain the process of interfacing 8086 microprocessor with peripheral control ICs like 8255 and 8259.
- To explain the procedure of interfacing 8051 microcontroller with timers, parallel and serial communication ports.
- To demonstrate the usage of 8051 as embedded controller with real world applications like calculator, LCD and hex keypad etc.

Course Outcomes:

1. Develop programming skills for data operations and different interfacing circuits of microprocessor and microcontrollers.
2. Develop 8086 Assembly language programs to demonstrate the arithmetic operations of binary, BCD, ASCII, logical operations and standard DOS functions to display message on screen, reading keys from keyboard with and without echo.
3. Examine different string, branch and process control-based operations in assembly language such as moving string, finding length of string, reverse of string, insertion, deletion, sorting.
4. Demonstrate the process of interfacing 8086 microprocessor with peripheral control ICs like 8255 and 8259.
5. Develop assembly language programs to make use of parallel ports, timers and serial port of 8051 microcontroller.

List of Experiments

Intel 8086 (16-bit Micro Processor)- assembly language programming

1. Perform simple arithmetic operations.
2. Sort an array of binary numbers.
3. Code Conversion (Eg. ASCII to Packed BCD form).
4. Addition of an array of BCD numbers stored in packed form.
5. Finding the reverse of a string.
6. Multiplying two 3x3 matrices.
7. Generation of Prime numbers.
8. Identification & displaying the activated key using DOS & BIOS function calls.
9. Interface a stepper motor to 8086 through 8255.
10. Interfacing with a 8259 interrupt controller.

Intel 8051 (8-bit Microcontroller)- assembly language and C programming experiments in 8051 using keil.

1. Detection of key closure (connected to a port line) by polling technique.
2. Delay generation using i) Nested loop & ii) Timers.
3. Counting of external event occurrence through port line.
4. 8051 serial communication interfaces with PC.
5. Develop a embedded C program to interface seven segment display to port1 and port2and display the count from 00 to FFH.

6. Implement the functionality of traffic signal controller using 8051 microcontrollers.
7. Develop an embedded C program to display the given string on LCD.

Text Books

1. K M Bhurchandi, A K Ray, Advanced Microprocessors and Peripherals, 3rd edition, McGraw Hill Education, 2017.
2. Raj Kamal, Microcontrollers: Architecture, Programming, Interfacing and System Design, 2nd edition, Pearson, 2012.

References

1. Ramesh S Gaonkar, Microprocessor Architecture Programming and Applications with the 8085, 6th edition, Penram International Publishing, 2013.
2. Kenneth J. Ayala, The 8051 Microcontroller, 3rd edition, Cengage Learning, 2004.
3. Andrew N. Sloss, Dominic Symes, Chris Wright, ARM System Developer's Guide: Designing and Optimizing System Software, Elsevier, 2004.
4. John H. Davies, Newnes, MSP 430 Microcontroller Basics, Elsevier Pulications,2008.
5. Barry B.Brey, "The Intel Microprocessors: Architecture, Programming and Interfacing", PHI, 6th Edition.

Course Code	Course Title	Hrs./Week L: T: P	Credits
R19EEE-SD3201	Electrical Engineering Virtual Lab	0:0:3	0

Course objectives:

- To verify the Basic Laws & Theorems.
- To Control the Speed of the DC Motors & Induction Motor.
- To Evaluate the Performance of DC Machines.
- To Evaluate the Performance of Transformer.
- To Obtain Equivalent circuit parameters of Induction Motor
- To Assess the V & Inverted V Curves of Three–Phase Synchronous Motor.

Course outcomes: At the end of this course, the students will be able to

1. Analyze Basic Laws & Theorems.(L2)
2. Analyze the performance and characteristics of DC Machine.(L3)
3. Obtain Equivalent circuit parameters of Induction Motor.(L3)
4. Control the Speed of Induction Motor.(L2)
5. Develop the V & Inverted V Curves of Three–Phase Synchronous Motor.(L4)

Conduct all the Experiments

1. Verification of Kirchhoff Laws.
2. Verification of Thevenin‘s Theorem
3. Verification and Norton‘s Theorem
4. Magnetization characteristics of DC shunt generator. Determination of critical field Resistance and critical speed.
5. Load test on DC Shunt Generator
6. Speed control of DC shunt motor by Field and armature Control.
7. Equivalent circuit of Three phase Induction motor
8. Speed control of Slip ring Induction Motor.
9. OC & SC Test on single phase transformer.
10. V and Inverted V curves of a three—phase synchronous motor.

Web links:

1. https://www.vlab.co.in/broad-area-electrical-engineering

Course Code	Course Title	Hrs./Week L: T: P	Credits
R19EEE-SD3202	Introduction to MATLAB	1:0:2	0

Course Objective: The objectives of the course are to make the students learn about:

- To Understand the MATLAB environment.
- To do simple calculations using MATLAB
- To write simple programs in MATLAB to solve scientific and mathematical problems
- To use the MATLAB GUI effectively
- To get familiar with Simulink models.
- To understand image processing.

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

1. State the MATLAB environment and its applications(L1)
2. Illustrate file management and the use of arrays and strings(L2)
3. Develop program scripts and functions using MATLAB environment and to use basic flow controls (L6)
4. Create plots and to carryout numerical computations and analysis(L6)
5. Develop mathematical modelling of physical systems using Simulink(L6)

UNIT-I

Introduction to MATLAB: Historical Background, Applications, Scope of MATLAB, Importance of MATLAB for Engineers, Features, MATLAB Windows (Editor, Workspace, Command History, Command Window). Operations with Variables, Naming and Checking Existence, Clearing Operations, Commands, Data types, Operators-Applications

Learning Outcomes: The students are able to

- Know the history and applications of MATLAB.(L2)
- Understand the importance of MATLAB.(L2)
- Explain different data types.(L2)

UNIT-II

Data and Data Flow in MATLAB: Vectors, Matrix Operations & Operators, Reshaping Matrices, Arrays, Colon Notations, Numbers, Strings, Functions, File Input-Output, Importing and Exporting of data-Applications

Learning Outcomes: The students are able to

- Analyse matrix operations and operators.(L4)
- Make use of strings and functions.(L3)

UNIT-III

MATLAB PROGRAMMING: MATLAB Programming: Conditional Statements, Loops, Writing Script Files, Error Correction, Saving Files, Worked out Examples-applications

Learning Outcomes: The students are able to

- Write simple loop programs, script files etc.,(L3)
- Execute simple programs.(L3)

UNIT-IV

MATLAB Advanced: Plotting, Graphics, Creating Plot & Editing Plot, GUI (Graphical User Interface). MATLAB- Algebra, Calculus, Differential, Integration, Polynomials, solving a system of linear equations-Applications

Learning Outcomes: The students are able to

- Create and edit plots, graphics(L6)
- Use GUI effectively(L3)
- Perform different algebraic calculations using MATLAB.(L3)

UNIT-V

SIMULINK: Introduction, Importance, Model Based Design, Tools, Mathematical Modeling, Converting Mathematical Model into Simulink Model, Running Simulink Models, Importing Exporting Data, Solver Configuration, Masking Block/Model-Applications

Learning Outcomes: The students are able to

- Understand the tools in Simulink.(L2)
- Design mathematical models.(L6)
- Execute the models.(L3)

Textbooks

1. Getting Started with MATLAB: A Quick Introduction For Scientists And Engineers (English) by Rudra Pratap, OXFORD University Press.
2. MATLAB Programming by Y. Kirani Singh, B.B. Chaudhuri, PHI Publication

Reference Books

1. MATLAB Programming for Engineers Fourth edition by Stephen J. Chapman
2. Applied Numerical Methods Using MATLAB 1st Edition by Won Y. Yang ,Wenwu Cao, Tae-Sang Chung, John Morris.