



JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY KAKINADA
KAKINADA-533003, Andhra Pradesh, India
DEPARTMENT OF ELECTRICAL AND ELECTRONICS ENGINEERING

COURSE STRUCTURE AND SYLLABUS

For

B.TECH – ELECTRICAL AND ELECTRONICS ENGINEERING

(Applicable for batches admitted from 2020-2021)



JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY KAKINADA
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II B.Tech – I Semester

Sl. No	Course Components	Subjects	L	T	P	Credits
1	BSC	Mathematics– IV	3	0	0	3
2	PCC	Electronic Devices and Circuits	3	0	0	3
3	PCC	Electrical Circuit Analysis –II	3	0	0	3
4	PCC	DC Machines and Transformers	3	0	0	3
5	PCC	Electro Magnetic Fields	3	0	0	3
6	PCC	Electrical Circuits Lab	0	0	3	1.5
7	PCC	DC Machines and Transformers Lab	0	0	3	1.5
8	PCC	Electronic Devices and Circuits lab	0	0	3	1.5
9	SC	Skill oriented course - Design of Electrical Circuits using Engineering Software Tools	0	0	4	2
10	MC	Professional Ethics & Human Values	2	0	0	0
Total Credits			21.5			

II B.Tech – II Semester

Sl. No	Course Components	Subjects	L	T	P	Credits
1	ESC	Python Programming	3	0	0	3
2	PCC	Digital Electronics	3	0	0	3
3	PCC	Power System-I	3	0	0	3
4	PCC	Induction and Synchronous Machines	3	0	0	3
5	HSMC	Managerial Economics & Financial Analysis	3	0	0	3
6	ESC	Python Programming Lab	0	0	3	1.5
7	PCC	Induction and Synchronous Machines Lab	0	0	3	1.5
8	PCC	Digital Electronics Lab	0	0	3	1.5
9	SC	Skill oriented course- IoT Applications of Electrical Engineering Lab	0	0	4	2
Total Credits			21.5			
		Minors Course*	4	0	0	4
		Honors Course*	4	0	0	4



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Professional Elective Subjects offered to EEE Branch Students:

Professional Elective – I:

1. Linear IC Applications
2. Utilization of Electrical Energy
3. Computer Architecture and Organization
4. Optimization Techniques
5. Object Oriented Programming through Java

Professional Elective – II:

1. Signal and Systems
2. Electric Drives
3. Advanced Control Systems
4. Switchgear and Protection
5. Big Data Analytics

Professional Elective –III:

1. Digital Signal Processing
2. Renewable and Distributed Energy Technologies
3. Flexible Alternating Current Transmission Systems
4. Power Systems Deregulation
5. Data Base Management Systems

Professional Elective – IV:

1. Hybrid Electric Vehicles
2. High Voltage Engineering
3. Programmable Logic Controllers and Applications
4. Cloud Computing with AWS
5. Deep Learning Techniques

Professional Elective – V:

1. Power System Operation and Control
2. Switched Mode Power Conversion
3. AI Applications to Electrical Engineering
4. Data Science
5. MEAN Stack Technologies

Open Electives offered by EEE Department for Other Branches (Except EEE Branch)

Open Elective-I:

1. Renewable Energy Sources
2. Concepts of Optimization Techniques
3. Concepts of Control Systems

Open Elective-II:

1. Battery Management Systems and Charging Stations
2. Fundamentals of utilization of Electrical Energy
3. Indian Electricity Act

Open Elective-III:

1. Concepts of Microprocessors and Microcontrollers
2. Fundamentals of Electric Vehicles
3. Concepts of Internet of Things

Open Elective-IV:

1. Concepts of Power System Engineering
2. Concepts of Smart Grid Technologies



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***For Honor's/ Minor Course Fullfillments:**

- The 20 additional Credits need to be acquired, 16/15 credits can be earned by undergoing specified courses listed as pools, with 4/5 courses, each carrying 4/3 credits. The remaining 4/5 credits must be acquired through two online MOOCs (Swayam/NPTEL), which shall be domain specific, with 2/3 credits and with a minimum duration of 8/12weeks as recommended by the Board of Studies.
- Minor Engineering subjects are offered to other branches by EEE Department (except for EEE Students).
- Honors Engineering subjects are offered to EEE Students.
- The head of the department will float the list of allowed MOOC electives in each academic year, based on the list floated by MOOCs (Swayam/NPTEL).

***Honors Engineering Courses offered EEE Branch students**

II B.Tech II Semester:

1. Communication Systems
2. Electrical Wiring, Estimation and Costing
3. Electrical Distribution Systems

III B.Tech I Semester:

1. Advanced Computer Networks
2. Power Quality
3. Special Electrical Machines

III B.Tech II Semester:

1. Digital Control Systems
2. Analysis of Power Electronic Converters
3. HVDC Transmission

IV B.Tech I Semester:

1. EHV AC Transmission
2. Smart Grid Technologies
3. Power Electronic Control of Electrical Drives

***Minor Engineering Courses offered by EEE Department for Other Branches**
(Except EEE Branch)

II B.Tech II Semester:

1. Fundamentals of Electrical Circuits
2. Concepts of Electrical Measurements

III B.Tech I Semester:

1. Analysis of Linear Systems
2. Energy Auditing, Conservation and Management

III B.Tech II Semester:

1. Evolutionary Algorithms
2. Fundamentals of Power Electronics

IV B.Tech I Semester:

1. Neural Networks and Fuzzy Logic
2. Concepts of Electric Drives and Its Applications



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II Year II Semester		L	T	P	C
		3	0	0	3
PYTHON PROGRAMMING					

Preamble:

This course is developed to impart the programming skills to the students and prepare them to suitable for industry ready

Course Objectives:

The Objectives of Python Programming are

- To learn about Python programming language syntax, semantics, and the runtime environment
- To be familiarized with universal computer programming concepts like data types, containers
- To be familiarized with general computer programming concepts like conditional execution, loops & functions
- To be familiarized with general coding techniques and object-oriented programming

UNIT-I**Introduction:**

Introduction to Python, Program Development Cycle, Input, Processing, and Output, Displaying Output with the Print Function, Comments, Variables, Reading Input from the Keyboard, Performing Calculations, Operators. Type conversions, Expressions, More about Data Output.

Data Types, and Expression: Strings Assignment, and Comment, Numeric Data Types and Character Sets, Using functions and Modules.

Decision Structures and Boolean Logic: if, if-else, if-elif-else Statements, Nested Decision Structures, Comparing Strings, Logical Operators, Boolean Variables. Repetition Structures: Introduction, while loop, for loop, Calculating a Running Total, Input Validation Loops, Nested Loops.

UNIT- II**Control Statement:**

Definite iteration for Loop Formatting Text for output, Selection if and if else Statement Conditional Iteration The While Loop

Strings and Text Files: Accessing Character and Substring in Strings, Data Encryption, Strings and Number Systems, String Methods Text Files.

UNIT -III**List and Dictionaries:**

Lists, Defining Simple Functions, Dictionaries

Design with Function: Functions as Abstraction Mechanisms, Problem Solving with Top Down Design, Design with Recursive Functions, Case Study Gathering Information from a File System, Managing a Program's Namespace, Higher Order Function.

Modules: Modules, Standard Modules, Packages.



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UNIT- IV

File Operations:

Reading config files in python, Writing log files in python, Understanding read functions, read(), readline() and readlines(), Understanding write functions, write() and writelines(), Manipulating file pointer using seek, Programming using file operations

Object Oriented Programming: Concept of class, object and instances, Constructor, class attributes and destructors, Real time use of class in live projects, Inheritance , overlapping and overloading operators, Adding and retrieving dynamic attributes of classes, Programming using OOPs support

Design with Classes: Objects and Classes, Data modeling Examples, Case Study An ATM, Structuring Classes with Inheritance and Polymorphism

UNIT -V

Errors and Exceptions:

Syntax Errors, Exceptions, Handling Exceptions, Raising Exceptions, User-defined Exceptions, Defining Clean-up Actions, Redefined Clean-up Actions.

Graphical User Interfaces: The Behavior of Terminal Based Programs and GUI -Based, Programs, Coding Simple GUI-Based Programs, Other Useful GUI Resources.

Programming: Introduction to Programming Concepts with Scratch.

Course Outcomes:

- Develop essential programming skills in computer programming concepts like data types, containers
- Apply the basics of programming in the Python language Solve coding tasks related
- conditional execution, loops
- Solve coding tasks related to the fundamental notions and techniques used in object- oriented programming

Text Books

- 1) Fundamentals of Python First Programs, Kenneth. A. Lambert, Cengage, 2/e, 2011.

Reference Books:

- 1) Introduction to Python Programming, Gowrishankar S., VeenaA, CRC Press, 2nd Edition, 2019.
- 2) Introduction to Programming Using Python, Y. Daniel Liang, Pearson, 1st Edition, 2012.

e-Resources:

- 1) https://www.tutorialspoint.com/python3/python_tutorial.pdf



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KAKINADA – 533 003, Andhra Pradesh, India
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II Year II Semester		L	T	P	C
		3	0	0	3
DIGITAL ELECTRONICS					

Preamble:

This course covers the topics related to representation numbers in different radix formats, complements and codes. It also introduces the basic gates and their realization in SOP and POS form. Boolean algebra and various logic gates minimization process is introduced. Design principles of combinational and sequential circuits are explained to make the students thorough in design of these circuits.

Course Objectives:

- To solve a typical number base conversion and analyze new error coding techniques.
- Theorems and functions of Boolean algebra and behavior of logic gates.
- To optimize logic gates for digital circuits using various techniques.
- To understand concepts of combinational circuits.
- To develop advanced sequential circuits.

UNIT - I**Review of Number Systems & Codes:**

Representation of numbers of different radix, conversion from one radix to another radix, $r-1$'s complements and r 's complements of signed members. Gray code, 4 bit codes; BCD, Excess-3, 2421, 84-2-1 code etc., Error detection & correction codes: parity checking, even parity, odd parity, Hamming code.

Boolean theorems and logic operations

Boolean theorems, principle of complementation & duality, De-Morgan theorems. Logic operations; Basic logic operations -NOT, OR, AND, Universal Logic operations, EX-OR, EX-NOR operations. Standard SOP and POS Forms, NAND-NAND and NOR-NOR realizations.

UNIT - II**Minimization Techniques:**

Minimization and realization of switching functions using Boolean theorems, K-Map (up to 6 variables) and tabular method.

Combinational Logic Circuits Design:

Design of Half adder, full adder, half subtractor, full subtractor, applications of full adders; 4-bit adder-subtractor circuit, BCD adder circuit, Excess 3 adder circuit and carry look-a-head adder circuit

UNIT - III**Combinational Logic Circuits Design Using MSI &LSI:**

Design of encoder, decoder, multiplexer and demultiplexers, Implementation of higher order circuits using lower order circuits. Realization of Boolean functions using decoders and multiplexers. Design of Priority encoder, 4-bit digital comparator and seven segment decoder

Introduction of PLD's:

PLDs: PROM, PAL, PLA -Basics structures, realization of Boolean functions.



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UNIT - IV

Sequential Circuits-I:

Classification of sequential circuits (synchronous and asynchronous) , operation of NAND & NOR Latches and flip-flops; truth tables and excitation tables of RS flip-flop, JK flip-flop, T flip-flop, D flip-flop with reset and clear terminals. Conversion from one flip-flop to another flip-flop. Design of ripple counters, design of synchronous counters, Johnson counter, ring counter. Design of registers - Buffer register, control buffer register, shift register, bi-directional shift register, universal shift register.

UNIT - V

Sequential Circuits -II:

Finite state machine; state diagrams, state tables, reduction of state tables. Analysis of clocked sequential circuits Mealy to Moore conversion and vice-versa. Realization of sequence generator and sequence detector circuits, Races and Hazards.

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

- Classify different number systems and apply to generate various codes.
- Use the concept of Boolean algebra in minimization of switching functions
- Design different types of combinational logic circuits.
- Apply knowledge of flip-flops in designing of Registers and counters
- The operation and design methodology for synchronous sequential circuits and algorithmic state machines.

Text Books:

1. Switching and finite automata theory:ZviKohavi, Niraj K. Jha,Cambridge University Press, 3rd Edition, 2009.
2. Digital Design by Morris Mano, Prentice Hall India, 5th Edition.

Reference Books:

1. Digital Principles and Applications by Leach , Malvino , Saha, Mc-Graw Hill, 8th Edition, 2014.
2. Switching Theory and Logic Design by A. Anand Kumar, PHI learning, 3rd edition.
3. Introduction to Switching Theory and Logic Design – Fredriac J Hill, Gerald R Peterson, 3rdEdition, John Willey and Sons Inc,
4. Fundamentals of Logic Design by Charles H. RothJr., Cengage Learning, 7th edition,2013.



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II Year II Semester		L	T	P	C
		3	0	0	3
POWER SYSTEMS - I					

Preamble:

Electrical Power plays significant role in day-to-day life of entire mankind. The aim of this course is to allow the students to understand the concepts of the generation and distribution of power along with economic aspects.

Course Objectives:

- To study the principle of operation of different components of a thermal power stations.
- To study the principle of operation of different components of a Nuclear power stations.
- To study the constructional and operation of different components of an Air and Gas Insulated substations.
- To study the constructional details of different types of cables.
- To study different types of load curves and tariffs applicable to consumers.

UNIT - I**Hydroelectric Power Stations:**

Selection of site, general layout of a hydroelectric power plant with brief description of major components and principle of operation

Thermal Power Stations

Selection of site, general layout of a thermal power plant. Brief description of components: boilers, super heaters, economizers and electrostatic precipitators, steam turbines: impulse and reaction turbines, condensers, feed water circuit, cooling towers and chimney.

UNIT - II**Nuclear Power Stations**

Location of nuclear power plant, working principle, nuclear fission, nuclear fuels, nuclear chain reaction, nuclear reactor components: moderators, control rods, reflectors and coolants, types of nuclear reactors and brief description of PWR, BWR and FBR. Radiation: radiation hazards and shielding, nuclear waste disposal.

UNIT - III**Classification of Air and Gas Insulated substations**

Air Insulated Substations – indoor & outdoor substations, substations layouts of 33/11 kV showing the location of all the substation equipment.

Bus bar arrangements in the sub-stations: simple arrangements like single bus bar, sectionalized single bus bar, double bus bar with one and two circuit breakers, main and transfer bus bar system with relevant diagrams.

Gas Insulated Substations (GIS) – advantages of gas insulated substations, constructional aspects of GIS, installation and maintenance of GIS, comparison of air insulated substations and gas insulated substations.



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UNIT- IV

Underground Cables

Types of cables, construction, types of insulating materials, calculation of insulation resistance, stress in insulation and power factor of cable.

Capacitance of single and 3-Core belted Cables. Grading of cables: capacitance grading and intersheath grading.

UNIT - V

Economic Aspects of Power Generation & Tariff

Economic Aspects – load curve, load duration and integrated load duration curves, discussion on economic aspects: connected load, maximum demand, demand factor, load factor, diversity factor, plant capacity factor and plant use factor, base and peak load plants.

Tariff Methods– costs of generation and their division into fixed, semi-fixed and running costs, desirable characteristics of a tariff method, tariff methods: simple rate, flat rate, block-rate, two-part, three-part, and power factor tariff methods.

Course Outcomes:

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

- Identify the different components of thermal power plants.
- Identify the different components of nuclear Power plants.
- Identify the different components of air and gas insulated substations.
- Identify single core and three core cables with different insulating materials.
- Analyse the different economic factors of power generation and tariffs.

Text Books:

1. A Text Book on Power System Engineering by M.L.Soni, P.V.Gupta, U.S.Bhatnagar and A. Chakrabarti, DhanpatRai & Co. Pvt. Ltd, 2016.
2. Generation, Distribution and Utilization of Electric Energy by C.L.Wadhawa, New age International (P) Limited, Publishers, 3rd edition.

Reference Book:

1. Elements of Electrical Power Station Design by M V Deshpande, PHI, New Delhi, 2009.



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II Year II Semester		L	T	P	C
		3	0	0	3
INDUCTION AND SYNCHRONOUS MACHINES					

Preamble:

This course covers the topics on 3-phase induction motor, 1-phase induction motor and synchronous machines which have wide application in power systems. The main aim of the course is to provide a detailed analysis of operation and performance of 3-phase induction motor, 1-phase induction motor and synchronous machines. In addition, it also covers voltage regulation and parallel operation of synchronous generators.

Course Objectives:

- Understand the principle of operation and performance of 3-phase induction motor.
- Quantify the performance of induction motor and induction generator in terms of torque and slip.
- To understand the torque producing mechanism of a single phase induction motor.
- To understand the principle of emf generation, the effect of armature reaction and predetermination of voltage regulation in synchronous generators.
- To study parallel operation and control of real and reactive powers for synchronous generators.
- To understand the operation, performance and starting methods of synchronous motors.

UNIT - I**3-phase induction motors**

Construction details of squirrel cage and slip ring induction motors – production of rotating magnetic field – principle of operation – Equivalent circuit – phasor diagram- slip speed-rotor emf and rotor frequency – rotor current and pf at standstill and during running conditions – rotor power input, rotor copper loss and mechanical power developed and their interrelationship.

UNIT - II**Characteristics and testing methods of induction motors**

Torque equation – expressions for maximum torque and starting torque – torque slip characteristic – double cage and deep bar rotors – crawling and cogging – speed control of induction motor with V/f control method – no load and blocked rotor tests – circle diagram for predetermination of performance – induction generator operation (Qualitative treatment only)

UNIT - III**Starting methods of 3-phase induction motors**

Methods of starting of three phase Induction motors: DOL, Auto transformer, Star-Delta and rotor resistance methods.

Single phase induction motors:

Constructional features- equivalent circuit- problem of starting-double revolving field theory- Methods of starting. AC series motors.



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KAKINADA – 533 003, Andhra Pradesh, India
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UNIT - IV

Construction, operation, voltage regulation and parallel operation of synchronous generator:

Constructional features of non-salient and salient pole machines –types of armature windings – distribution, pitch and winding factors – E.M.F equation –improvements of waveform and armature reaction –phasor diagrams- voltage regulation by synchronous impedance method – MMF method and Potier triangle method– two reaction analysis of salient pole machines and phasor diagram.

Parallel operation with infinite bus and other alternators – synchronizing power – load sharing – control of real and reactive power – numerical problems.

UNIT - V

Synchronous motor – operation, starting and performance

Synchronous motor principle and theory of operation – phasor diagram – starting torque – variation of current and power factor with excitation – capability curves - synchronous condenser – mathematical analysis for power developed – hunting and its suppression – methods of starting – applications.

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

- Explain the operation and performance of three phase induction motor.
- Analyze the torque-speed relation, performance of induction motor and induction generator.
- Implement the starting of single phase induction motors.
- Develop winding design and predetermine the regulation of synchronous generators.
- Explain hunting phenomenon, implement methods of starting and correction of power factor with synchronous motor.

Text Books:

1. Electrical Machines by P.S. Bhimbra, Khanna Publishers
2. Electric Machinery by A.E.Fitzgerald, Charles Kingsley, Stephen D.Umans, TMH

Reference Books:

1. Performance and design of AC machines – M.G. Say
2. Alternating Current Machines by A.F.Puchstein, T.C. Lloyd, A.G. Conrad, ASIA Publishing House
3. Electrical Machinery Fundamentals by Stephen J Chapman McGraw Hill education, 2010.
4. Electrical Machines by R.K.Rajput, Lakshmi publications, 5th edition



JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY KAKINADA
KAKINADA – 533 003, Andhra Pradesh, India
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II Year II Semester		L	T	P	C
		3	0	0	3
MANAGERIAL ECONOMICS & FINANCIAL ANALYSIS					

Course Objectives:

- The Learning objectives of this paper are to understand the concept and nature of Managerial Economics and its relationship with other disciplines and also to understand the Concept of Demand and Demand forecasting.
- To familiarize about the Production function, Input Output relationship, Cost-Output relationship and Cost-Volume-Profit Analysis.
- To understand the nature of markets, Methods of Pricing in the different market structures and to know the different forms of Business organization and the concept of Business Cycles.
- To learn different Accounting Systems, preparation of Financial Statement and uses of different tools for performance evaluation.
- Finally, it is also to understand the concept of Capital, Capital Budgeting and the techniques used to evaluate Capital Budgeting proposals.

Unit-I

Introduction to Managerial Economics and demand Analysis:

Definition of Managerial Economics –Scope of Managerial Economics and its relationship with other subjects –Concept of Demand, Types of Demand, Determinants of Demand-Demand schedule, Demand curve, Law of Demand and its limitations- Elasticity of Demand, Types of Elasticity of Demand and Measurement- Demand forecasting and Methods of forecasting, Concept of Supply and Law of Supply.

Unit – II:

Theories of Production and Cost Analyses:

Theories of Production function- Law of Variable Proportions-Isoquants and Isocosts and choice of least cost factor combination-Concepts of Returns to scale and Economies of scale-Different cost concepts: opportunity costs, explicit and implicit costs-Fixed costs, Variable Costs and Total costs –Cost –Volume-Profit Analysis-Determination of Breakeven point(problems)-Managerial significance and limitations of Breakeven point.

Unit – III:

Introduction to Markets, Theories of the Firm & Pricing Policies:

Market Structures: Perfect Competition, Monopoly, Monopolistic competition and Oligopoly – Features – Price and Output Determination – Managerial Theories of firm: Marris and Williamson’s models – other Methods of Pricing: Average cost pricing, Limit Pricing, Market Skimming Pricing, Internet Pricing: (Flat Rate Pricing, Usage sensitive pricing) and Priority Pricing, Business Cycles: Meaning and Features – Phases of a Business Cycle. Features and Evaluation of Sole Trader, Partnership, Joint Stock Company – State/Public Enterprises and their forms.

Unit – IV:

Introduction to Accounting & Financing Analysis:

Introduction to Double Entry System, Journal, Ledger, Trail Balance and Preparation of Final Accounts with adjustments – Preparation of Financial Statements-Analysis and Interpretation of Financial Statements-Ratio Analysis – Preparation of Funds flow and cash flow analysis (Problems)



JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY KAKINADA
KAKINADA – 533 003, Andhra Pradesh, India
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Unit – V:

Capital and Capital Budgeting: Capital Budgeting: Meaning of Capital-Capitalization- Meaning of Capital Budgeting-Time value of money- Methods of appraising Project profitability: Traditional Methods (payback period, accounting rate of return) and modern methods (Discounted cash flow method, Net Present Value method, Internal Rate of Return Method and Profitability Index)

Course Outcomes:

- The Learner is equipped with the knowledge of estimating the Demand and demand elasticities for a product.
- The knowledge of understanding of the Input-Output-Cost relationships and estimation of the least cost combination of inputs.
- The pupil is also ready to understand the nature of different markets and Price Output determination under various market conditions and also to have the knowledge of different Business Units.
- The Learner is able to prepare Financial Statements and the usage of various Accounting tools for Analysis.
- The Learner can able to evaluate various investment project proposals with the help of capital budgeting techniques for decision making.

Text Books:

1. Managerial Economics and Financial Analysis by A R Aryasri, McGraw – Hill, 3rdedition.

References Books:

1. Managerial Economics by Varshney R.L, K.L Maheswari, S. Chand & Company Ltd,
2. Managerial Economics, JL Pappas and EF Brigham, Holt, R & W; New edition.
3. Accounting for Management, N.P Srinivasn and M. Sakthivel Murugan, S. Chand & Company Ltd, 1st edition, 2011.
4. An Introduction to Accountancy by Maheswari S.N, Vikas Publishing House Pvt Ltd, 12th edition, 2018.
5. Financial Management by I.M Pandey, Vikas Publishing House Pvt Ltd, 9th edition, 2009.
6. Managerial Economics by V. Maheswari, S. Chand & Company Ltd, 2002.



JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY KAKINADA
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II Year II Semester		L	T	P	C
		0	0	3	1.5
PYTHON PROGRAMMING LAB					

Preamble:

This lab is designed to impart the advanced programming skills to the students and prepare them to suitable for industry ready

Course Objectives:

The aim of Python Programming Lab is

- To acquire programming skills in core Python.
 - To acquire Object Oriented Skills in Python
 - To develop the skill of designing Graphical user Interfaces in Python
 - To develop the ability to write database applications in Python
- 1) Write a program that asks the user for a weight in kilograms and converts it to pounds. There are 2.2 pounds in a kilogram.
 - 2) Write a program that asks the user to enter three numbers (use three separate input statements). Create variables called total and average that hold the sum and average of the three numbers and print out the values of total and average.
 - 3) Write a program that uses a *for* loop to print the numbers 8, 11, 14, 17, 20, . . . , 83, 86,89.
 - 4) Write a program that asks the user for their name and how many times to print it. The program should print out the user's name the specified number of times.
 - 5) Use a *for* loop to print a triangle like the one below. Allow the user to specify how high the triangle should be.


```
*
**
***
****
```
 - 6) Generate a random number between 1 and 10. Ask the user to guess the number and print a message based on whether they get it right or not.
 - 7) Write a program that asks the user for two numbers and prints *Close* if the numbers are within .001 of each other and *Not close* otherwise.
 - 8) Write a program that asks the user to enter a word and prints out whether that word contains any vowels.
 - 9) Write a program that asks the user to enter two strings of the same length. The program should then check to see if the strings are of the same length. If they are not, the program should print an appropriate message and exit. If they are of the same length, the program should alternate the characters of the two strings. For example, if the user enters *abcde* and *ABCDE* the program should print out *AaBbCcDdEe*.
 - 10) Write a program that asks the user for a large integer and inserts commas into it according to the standard American convention for commas in large numbers. For instance, if the user enters 1000000, the output should be 1,000,000.



JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY KAKINADA
KAKINADA – 533 003, Andhra Pradesh, India
DEPARTMENT OF ELECTRICAL AND ELECTRONICS ENGINEERING

- 11) In algebraic expressions, the symbol for multiplication is often left out, as in $3x+4y$ or $3(x+5)$. Computers prefer those expressions to include the multiplication symbol, like $3*x+4*y$ or $3*(x+5)$. Write a program that asks the user for an algebraic expression and then inserts multiplication symbols where appropriate.
- 12) Write a program that generates a list of 20 random numbers between 1 and 100.
 - (a) Print the list.
 - (b) Print the average of the elements in the list.
 - (c) Print the largest and smallest values in the list.
 - (d) Print the second largest and second smallest entries in the list
 - (e) Print how many even numbers are in the list.
- 13) Write a program that asks the user for an integer and creates a list that consists of the factors of that integer.
- 14) Write a program that generates 100 random integers that are either 0 or 1. Then find the longest run of zeros, the largest number of zeros in a row. For instance, the longest run of zeros in $[1,0,1,1,0,0,0,0,1,0,0]$ is 4.
- 15) Write a program that removes any repeated items from a list so that each item appears at most once. For instance, the list $[1,1,2,3,4,3,0,0]$ would become $[1,2,3,4,0]$.
- 16) Write a program that asks the user to enter a length in feet. The program should then give the user the option to convert from feet into inches, yards, miles, millimeters, centimeters, meters, or kilometers. Say if the user enters a 1, then the program converts to inches, if they enter a 2, then the program converts to yards, etc. While this can be done with if statements, it is much shorter with lists and it is also easier to add new conversions if you use lists.
- 17) Write a function called *sum_digits* that is given an integer num and returns the sum of the digits of num.
- 18) Write a function called *first_diff* that is given two strings and returns the first location in which the strings differ. If the strings are identical, it should return -1.
- 19) Write a function called *number_of_factors* that takes an integer and returns how many factors the number has.
- 20) Write a function called *is_sorted* that is given a list and returns True if the list is sorted and False otherwise.
- 21) Write a function called *root* that is given a number x and an integer n and returns $x^{1/n}$. In the function definition, set the default value of n to 2.
- 22) Write a function called *primes* that is given a number n and returns a list of the first n primes. Let the default value of n be 100.
- 23) Write a function called *merge* that takes two already sorted lists of possibly different lengths, and merges them into a single sorted list.
 - (a) Do this using the sort method.
 - (b) Do this without using the sort method.
- 24) Write a program that asks the user for a word and finds all the smaller words that can be made from the letters of that word. The number of occurrences of a letter in a smaller word can't exceed the number of occurrences of the letter in the user's word.
- 25) Write a program that reads a file consisting of email addresses, each on its own line. Your program should print out a string consisting of those email addresses separated by semicolons.



JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY KAKINADA

KAKINADA – 533 003, Andhra Pradesh, India

DEPARTMENT OF ELECTRICAL AND ELECTRONICS ENGINEERING

- 26) Write a program that reads a list of temperatures from a file called *temps.txt*, converts those temperatures to Fahrenheit, and writes the results to a file called *ftemps.txt*.
- 27) Write a class called Product. The class should have fields called name, amount, and holding the product's name, the number of items of that product in stock, and the regular price of the product. There should be a method *get_price* that receives the number of items to be bought and returns a the cost of buying that many items, where the regular price is charged for orders of less than 10 items, a 10% discount is applied for orders of between 10 and 99 items, and a 20% discount is applied for orders of 100 or more items. There should also be a method called *make_purchase* that receives the number of items to be bought and decreases amount by that much.
- 28) Write a class called Time whose only field is a time in seconds. It should have a method called *convert_to_minutes* that returns a string of minutes and seconds formatted as in the following example: if seconds is 230, the method should return '5:50'. It should also have a method called *convert_to_hours* that returns a string of hours, minutes, and seconds formatted analogously to the previous method.
- 29) Write a class called Converter. The user will pass a length and a unit when declaring an object—from the class for example, `c = Converter(9,'inches')`. The possible units are inches, feet, yards, miles, kilometers, meters, centimeters, and millimeters. For each of these units there should be a method that returns the length converted into those units. For example, using the Converter object created above, the user could call `c. feet()` and should get 0.75 as the result.
- 30) Write a Python class to implement $\text{pow}(x,n)$.
- 31) Write a Python class to reverse a string word byword.
- 32) Write a program that opens a file dialog that allows you to select a text file. The program then displays the contents of the file in a textbox.
- 33) Write a program to demonstrate Try/except/else.
- 34) Write a program to demonstrate try/finally and with/as.

Course Outcomes:

By the end of this lab, the student is able to

- Write, Test and Debug Python Programs
- Use Conditionals and Loops for Python Programs
- Use functions and represent Compound data using Lists, Tuples and
- Dictionaries Use various applications using python



JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY KAKINADA
KAKINADA – 533 003, Andhra Pradesh, India
DEPARTMENT OF ELECTRICAL AND ELECTRONICS ENGINEERING

II Year II Semester		L	T	P	C
		0	0	3	1.5
INDUCTION AND SYNCHRONOUS MACHINES LAB					

Preamble:

The aim of the lab is to provide a detailed analysis of operation and performance of 3-phase induction motor, 1-phase induction motor and synchronous machines. In addition, it also covers voltage regulation and parallel operation of synchronous generators.

Course Objectives:

The students are able to understand the,

- Speed control methods of three-phase induction motors.
- Performance characteristics of three-phase and single-phase induction motors.
- Principles of power factor improvement of single-phase induction motor.
- Voltage regulation calculations of three-phase alternator by various methods,
- Performance curves of three-phase synchronous motor.

(Any 10 of the following experiments are to be conducted)

1. Performance characteristics of a three-phase Induction Motor by conducting Brake test
2. Determination of equivalent circuit parameters, efficiency and regulation of a three phase Induction motor by conducting No-load & Blocked rotor tests
3. Determination of Regulation of a three-phase alternator by using synchronous impedance & m.m.f. methods
4. Determination of Regulation of a three-phase alternator by using Potier triangle method
5. Determination of V and Inverted V curves of a three phase synchronous motor.
6. Determination of X_d and X_q of a salient pole synchronous machine
7. Speed control of three phase induction motor by V/f method.
8. Determination of equivalent circuit parameters of single phase induction motor
9. Determination of efficiency of three-phase alternator by loading with three phase induction motor.
10. Power factor improvement of single-phase induction motor by using capacitors.
11. Parallel operation of three-phase alternator under no-load and load conditions
12. Determination of efficiency of a single-phase AC series Motor by conducting Brake test.
13. Starting of single-phase Induction motor by using capacitor start and capacitor start run methods.
14. Determination of efficiency of a single-phase Induction Motor by conducting Brake test.

Course Outcomes:

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

- Assess the performance of single phase and three phase induction motors.
- Control the speed of three phase induction motor.
- Predetermine the regulation of three-phase alternator by various methods.
- Find the X_d/X_q ratio of alternator and assess the performance of three-phase synchronous motor.
- Determine the performance of single phase AC series motor.



JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY KAKINADA
KAKINADA – 533 003, Andhra Pradesh, India
DEPARTMENT OF ELECTRICAL AND ELECTRONICS ENGINEERING

II Year II Semester		L	T	P	C
		0	0	3	1.5
DIGITAL ELECTRONICS LAB					

Preamble:

The aim of this lab is to understand the Basics of digital electronics and able to design basic logic circuits, combinational and sequential circuits.

Course Objectives:

- To know the concept of Boolean laws for simplifying the digital circuits.
- To understand the concepts of flipflops.
- To understand the concepts of counters.
- To analyze and design various circuits.

List of Experiments:

Any TEN of the following Experiments are to be conducted

1. Verification of truth tables of Logic gates: Two input (i) OR (ii) AND (iii) NOR (iv) NAND (v) Exclusive OR (vi) Exclusive NOR
2. Design a simple combinational circuit and obtain minimal SOP expression and verify the truth table using Digital Trainer Kit
3. Verification of functional table of 3 to 8 line Decoder / De-multiplexer
4. 4 variable logic function verification using 8 to 1 multiplexer.
5. Design full adder circuit and verify its functional table.
6. Design full Subtractor circuit and verify its functional table.
7. Verification of functional tables of Flip-Flops
8. Design a four bit ring counter using D Flip – Flops / JK Flip Flop and verify output
9. Design a four bit Johnson’s counter using D Flip-Flops / JK Flip Flops and verify output
10. Draw the circuit diagram of MOD-8 ripple counter and construct a circuit using T-Flip-Flops and Test it with a low frequency clock and Sketch the output waveforms.
11. Design MOD – 10 ripple counter using T- Flip-Flop and verify the result and Sketch the output waveforms
12. Design MOD – 8 synchronous counter using D Flip-Flop and verify the result and Sketch the output waveforms.

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

- Learn the basics of gates, filp-flops and counters.
- Construct basic combinational circuits and verify their functionalities
- Apply the design procedures to design basic sequential circuits
- To understand the basic digital circuits and to verify their operation
- Apply Boolean laws to simplify the digital circuits.



JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY KAKINADA
KAKINADA–533003, Andhra Pradesh, India
DEPARTMENT OF ELECTRICAL AND ELECTRONICS ENGINEERING

II Year II Semester		L	T	P	C
		0	0	4	2
SKILL ORIENTED COURSE					
IOT APPLICATIONS OF ELECTRICAL ENGINEERING					

Preamble:

The aim of this course is to introduce Internet of Things to simulate real time applications using Arduino/Raspberry Pi.

Course Objectives:

- To understand fundamentals of various technologies of Internet of Things.
- To know various communication technologies used in the Internet of Things.
- To know the connectivity of devices using web and internet in the IoT environment.
- To understand the implementation of IoT by studying case studies like Smart Home, Smart city, etc.

List of Experiments:

Any TEN of the following Experiments are to be conducted

1. Familiarization with Arduino/Raspberry Pi and perform necessary software installation.
2. To interface LED/Buzzer with Arduino/Raspberry Pi and write a program to turn ON LED for 1 sec after every 2 seconds.
3. To interface Push button/Digital sensor (IR/LDR) with Arduino/Raspberry Pi and write a program to turn ON LED when push button is pressed or at sensor detection.
4. To interface temperature sensor with Arduino/Raspberry Pi and write a program to print temperature and humidity readings.
5. To interface Organic Light Emitting Diode (OLED) with Arduino/Raspberry Pi
6. To interface Bluetooth with Arduino/Raspberry Pi and write a program to send sensor data to smartphone using Bluetooth.
7. To interface Bluetooth with Arduino/Raspberry Pi and write a program to turn LED ON/OFF when '1'/'0' is received from smartphone using Bluetooth.
8. Write a program on Arduino/Raspberry Pi to upload and retrieve temperature and humidity data to thingspeak cloud.
9. 7 Segment Display
10. Analog Input & Digital Output
11. Night Light Controlled & Monitoring System
12. Fire Alarm Using Arduino
13. IR Remote Control for Home Appliances
14. A Heart Rate Monitoring System
15. Alexa based Home Automation System

Course Outcomes:

After the completion of the course the student should be able to:

- apply various technologies of Internet of Things to real time applications.
- apply various communication technologies used in the Internet of Things.
- connect the devices using web and internet in the IoT environment.
- implement IoT to study Smart Home, Smart city, etc.



JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY KAKINADA
KAKINADA–533003, Andhra Pradesh, India
DEPARTMENT OF ELECTRICAL AND ELECTRONICS ENGINEERING

II Year – II SEMESTER		L	T	P	C
		3	0	0	3
COMMUNICATION SYSTEMS (Honors Engineering Course)					

Preamble:

Awareness on the concepts and working of communication blocks is inevitable for an electrical engineering student to excel in smart grid applications.

Course Objectives:

- To develop a fundamental understanding on communication systems with emphasis on analog and digital modulation techniques.
- To get introduced to the basics of error control coding techniques.

Unit – I:**Basic blocks of Communication System**

Analog Modulation - Principles of Amplitude Modulation, DSBSC, SSB-SC and VSB-SC, AM transmitters and receivers.

Unit- II**Angle Modulation - Frequency and Phase Modulation**

Transmission Bandwidth of FM signals, Methods of generation and detection, FM Transmitters and Receivers.

Unit–III**Sampling theorem - Pulse Modulation Techniques**

PAM, PWM and PPM concepts - PCM system – Data transmission using analog carriers (BASK, BFSK, BPSK, QPSK).

UNIT -IV**Error control coding techniques**

Linear block codes- Encoder and decoder, Cyclic codes – Encoder, Syndrome Calculator, Convolution codes.

UNIT -V**Modern Communication Systems**

Microwave communication systems, Optical communication system, Satellite communication system, Mobile communication system.

Course Outcomes:

After the completion of the course the student should be able to:

- Understand the basics of communication system, analog and digital modulation techniques.
- Apply the knowledge of digital electronics and understand the error control coding techniques.
- Summarize different types of communication systems and its requirements.

Text Books:

1. Simon Haykins, ‘Communication Systems’, John Wiley, 3rd Edition, 1995.
2. D.Roddy & J.Coolen, ‘Electronic Communications’, Prentice Hall of India, 4th Edition, 1999.
3. Kennedy G, ‘Electronic Communication System’, McGraw Hill, 1987.



JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY KAKINADA
KAKINADA–533003, Andhra Pradesh, India
DEPARTMENT OF ELECTRICAL AND ELECTRONICS ENGINEERING

Reference Books:

1. Shulin Daniel, ‘Error Control Coding’, Pearson, 2nd Edition, 2011.
2. B.P. Lathi and Zhi Ding, ‘Modern Digital and Analog Communication Systems’, OUP USA Publications, 4th Edition, 2009.



JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY KAKINADA
KAKINADA–533003, Andhra Pradesh, India
DEPARTMENT OF ELECTRICAL AND ELECTRONICS ENGINEERING

II Year – II SEMESTER		L	T	P	C
		3	0	0	3
ELECTRICAL WIRING, ESTIMATION AND COSTING (Honors Engineering Course)					

Preamble:

This course covers the topics on simple electrical connections design considerations of electrical installations and study of different types of electrical installations. It also covers the components of substations and various motor control circuits.

Course Objectives:

- Introduce the electrical symbols and simple electrical circuits
- Able to learn the design of electrical installations.
- Able to learn the design of electrical installation for different types of buildings and small industries.
- Learn the basic components of electrical substations.
- Familiarize with the motor control circuits

UNIT - I**Electrical Symbols and Simple Electrical Circuits**

Identification of electrical symbols - Electrical wiring Diagrams - Methods of representation of wiring diagrams - introduction to simple light and fan circuits - system of connection of appliances and accessories.

UNIT - II**Design Considerations of Electrical Installations**

Electric supply system - Three-phase four wire distribution system - protection of electric installation against overload - short circuit and earth fault - earthing - neutral and earth wire - types of loads - systems of wiring - permissible of voltage drops and sizes of wires - estimating and costing of electrical installations.

UNIT - III**Electrical Installation for Different Types of Buildings and Small Industries**

Electrical installations for electrical buildings - estimating and costing of material - simple examples on electrical installation for residential buildings - electrical installations for commercial buildings - electrical installation for small industries-case study.

UNIT - IV**Substations**

Introduction - types of substations - outdoor substations-pole mounted type - indoor substations-floor mounted type - simple examples on quantity estimation-case study.

UNIT - V**Motor control circuits**

Introduction to AC motors - starting of three phase squirrel cage induction motors - starting of wound rotor motors - starting of synchronous motors - contractor control circuit components - basic control circuits - motor protection.



JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY KAKINADA
KAKINADA–533003, Andhra Pradesh, India
DEPARTMENT OF ELECTRICAL AND ELECTRONICS ENGINEERING

Course Outcomes:

After the completion of the course the student should be able to:

- Demonstrate the various electrical apparatus and their interconnections.
- Examine various components of electrical installations.
- Estimate the cost for installation of wiring for different types of building and small industries.
- Illustrate the components of electrical substations.
- Design suitable control circuit for starting of three phase induction motor and synchronous motor.

Text Books:

1. Electrical Design and Estimation Costing - K. B. Raina and S.K.Bhattacharya – New Age International Publishers - 2007.

References Books:

1. Electrical wiring estimating and costing – S.L.Uppal and G.C.Garg – Khanna publishers - 6th edition - 1987.
2. A course in electrical installation estimating and costing – J.B.Gupta –Kataria SK & Sons - 2013.



JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY KAKINADA
KAKINADA–533003, Andhra Pradesh, India
DEPARTMENT OF ELECTRICAL AND ELECTRONICS ENGINEERING

II Year –II SEMESTER		L	T	P	C
		3	0	0	3
ELECTRICAL DISTRIBUTION SYSTEMS (Honors Engineering Course)					

Preamble:

This subject deals with the general concept of distribution system, substations and feeders as well as discusses distribution system analysis, protection and coordination, voltage control and power factor improvement.

Course Objectives

- To learn different factors of distribution system.
- To learn and design aspects of the substations and distribution systems.
- To learn the concepts of voltage drop and power loss.
- To learn the distribution system protection and its coordination.
- To learn the effect of compensation for power factor improvement.
- To learn the effect of voltage control on distribution system.

UNIT - I**General Concepts**

Introduction to distribution systems - Distribution system losses – Coincidence factor – Contribution factor – loss factor – Relationship between the load factor and loss factor – Numerical Problems – Load Modeling and Characteristics – Classification and characteristics of loads (Residential - commercial - Agricultural and Industrial).

UNIT - II**Substations**

Selection for location of substations - Rating of distribution substation – Service area with ‘n’ primary feeders – K- Factors - Benefits and methods of optimal location of substations.

Distribution Feeders

Design Considerations of distribution feeders: Radial and loop types of primary feeders – Voltage levels – Feeder loading – Basic design practice of the secondary distribution system.

UNIT - III**System Analysis**

Voltage drop and power – loss calculations: Derivation for voltage drop and power loss in lines – Uniformly distributed loads and non-uniformly distributed loads – Three phase balanced primary lines – and Non three phase balanced primary lines.

UNIT - IV**Protection**

Objectives of distribution system protection –Time current characteristics – Protective devices: Principle of operation of fuses – Circuit reclosures – Line sectionaliser and circuit breakers - Earth leakage circuit breakers – Protection schemes of parallel & Ring-main feeders.

Coordination of protective devices

General coordination procedure –Various types of co-ordinated operation of protective devices - Residual Current Circuit Breaker.



JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY KAKINADA
KAKINADA–533003, Andhra Pradesh, India
DEPARTMENT OF ELECTRICAL AND ELECTRONICS ENGINEERING

UNIT - V

Compensation for Power Factor Improvement

Capacitive compensation for power factor control – Different types of power capacitors – shunt and series capacitors – Effect of shunt capacitors (Fixed and switched) – Power factor correction – Capacitor allocation – Economic justification – Procedure to determine the best capacitor location.

Voltage Control

Equipment for voltage control – Effect of series capacitors – Effect of AVB/AVR – Line drop compensation.

Course Outcomes:

After the completion of the course the student should be able to:

- Discriminate various factors of distribution system - load modelling and characteristic of loads.
- Know the concept of design considerations of substation and feeders.
- Determine the voltage drop and power loss for different types of distribution loads.
- Analyse the protection and its coordination for distribution systems.
- Analyse the effect of compensation for p.f improvement and voltage improvement.

Text Book:

1. “Electric Power Distribution system - Engineering” – by Turan Gonen - McGraw–hill - 2nd edition - 2008.

Reference Books:

1. Electrical Distribution Systems by Dale R.Patrick and Stephen W.Fardo - CRC press - 2nd edition.
2. Electric Power Distribution – by A.S. Pabla - Tata McGraw–hill Publishing Company - 4th edition - 1997.
3. Electrical Power Distribution Systems by V.Kamaraju - Right Publishers.



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KAKINADA–533003, Andhra Pradesh, India
DEPARTMENT OF ELECTRICAL AND ELECTRONICS ENGINEERING

II Year – II SEMESTER		L	T	P	C
		3	0	0	3
FUNDAMENTALS OF ELECTRICAL CIRCUITS					
(Minors Engineering Course)					

Preamble:

Electrical circuit analysis is one of the most vital aspects of electrical & electronics engineering. Understanding how components work individually and collectively is the basis for designing electrical & electronics circuits. This course covers the aspects of various circuit components, laws, network theorems and analysis of single phase & three phase AC systems.

Course Objectives

- To learn about passive elements, sources, node and mesh analysis.
- To understand the basic concepts of single-phase AC systems.
- To learn network theorems and their applications to analyze electrical circuits.
- To analyze three-phase balanced and unbalanced circuits
- To perform transient analysis of RL, RC & RLC circuits

UNIT - I**Introduction to Electrical Circuits**

Basic Concepts of passive elements of R, L, C and their V-I relations, Sources (dependent and independent), Kirchoff's laws, Network reduction techniques (series, parallel, series - parallel, star-to-delta and delta-to-star transformation), source transformation technique, nodal analysis and mesh analysis to DC networks with dependent and independent voltage and current sources.

UNIT - II**Single Phase A.C Systems**

Periodic waveforms (determination of rms, average value and form factor), concept of phasor, phase angle and phase difference – waveforms and phasor diagrams for lagging, leading networks, complex and polar forms of representations-node and mesh analysis.

Steady state analysis of R, L and C circuits, power factor and its significance, real, reactive and apparent power, waveform of instantaneous power and complex power .

UNIT - III**Network theorems (DC & AC Excitations)**

Superposition theorem, Thevenin's theorem, Norton's theorem, Maximum Power Transfer theorem, Reciprocity theorem, Millman's theorem and compensation theorem.

UNIT - IV**Balanced and Unbalanced Three phase circuits****Analysis of three phase balanced circuits:**

Phase sequence, star and delta connection of sources and loads, relation between line and phase voltages and currents, analysis of balanced three-phase circuits, measurement of active and reactive power.

Analysis of three phase unbalanced circuits:

Loop method, Star-Delta transformation technique, two wattmeter method for measurement of three phase power.

UNIT - V**Transient Analysis in DC & AC Circuits**

Transient response of First order (R-L, R-C) and second order (R-L-C) circuits using Laplace transforms.



JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY KAKINADA
KAKINADA–533003, Andhra Pradesh, India
DEPARTMENT OF ELECTRICAL AND ELECTRONICS ENGINEERING

Course Outcomes:

After the completion of the course the student should be able to:

- Understand about the basic elements of electrical circuits.
- Learn to do steady state analysis of single-phase AC systems.
- Apply network theorems to analyze electrical circuits.
- Learn to analyze three-phase balanced and unbalanced circuits
- Perform transient analysis of different RL, RC & RLC circuits

Text Books:

1. Engineering Circuit Analysis by William Hayt and Jack E.Kemmerley, McGraw Hill Company, 9th edition, 2018.
2. Fundamentals of Electrical Circuits by Charles K.Alexander and Mathew N.O.Sadiku, McGraw Hill Education (India), 6th edition, 2019

Reference Books:

1. Network analysis: Van Valkenburg: Prentice-Hall of India Private Ltd, 3rd edition, 2019.
2. Electric Circuits by David A. Bell, Oxford publications, 7th edition, 2009.
3. Circuit Theory (Analysis and Synthesis) by A.Chakrabarthy, Dhanpat Rai & Co, 7th - Revised edition, 2018).



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KAKINADA–533003, Andhra Pradesh, India
DEPARTMENT OF ELECTRICAL AND ELECTRONICS ENGINEERING

II Year – II SEMESTER	L	T	P	C
	3	0	0	3
CONCEPTS OF ELECTRICAL MEASUREMENTS				
(Minors Engineering Course)				

Preamble:

The development of technologies in the measurement system leads on the periphery of interest. It provides a vital knowledge on analog & digital measuring Instruments.

Course Objectives:

- Interpret the working principles of various analog measuring Instruments.
- To understand the concept behind power and Energy measurements procedures.
- Calculate the resistance, inductance and capacitance using various bridges.
- Evaluate the importance and understand the concept of various transducers.
- To understand the various types of digital meters and their functionality.

UNIT – I**Analog Ammeter and Voltmeters**

Classification – deflecting - control and damping torques – Construction of PMMC - Moving Iron and Electrodynamic instruments - Torque equation - Errors and Compensation – Numerical Problems.

UNIT – II**Analog Wattmeters and Energy Meters**

Electrodynamometer type wattmeter (LPF and UPF) - Induction Type Energy meters-Construction and working - Errors and Compensation– Numerical Problems.

UNIT – III**Measurements of Electrical parameters**

DC Bridges: Measurement of Resistance – Kelvin’s double bridge - Wheatstone bridge – Numerical Problems.

AC Bridges: Measurement of inductance and quality factor - Maxwell’s bridge - measurement of capacitance - Schering Bridge– Numerical Problems.

UNIT – IV**Transducers**

Classification - Resistive (Strain Gauge) - Inductive (LVDT) and Capacitive (Piezo electric) Transducer – Numerical Problems.

UNIT – V**Digital Meters**

Successive approximation Digital Voltmeter — Digital frequency meter - Digital multimeter - Digital Energy Meter.

Course Outcomes:

After the completion of the course the student should be able to:

- Choose right type of instrument for measurement of ac and dc voltage and current.
- Analyse the operation of wattmeter and energy meter.
- Differentiate the operation of AC and DC bridges.
- Describe the operation various Transducers.
- Know the importance of Digital Meters and their working principles.



JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY KAKINADA
KAKINADA–533003, Andhra Pradesh, India
DEPARTMENT OF ELECTRICAL AND ELECTRONICS ENGINEERING

Text Books:

1. Electrical & Electronic Measurement & Instruments by A.K.Sawhney Dhanpat Rai & Co.Publications - 19th revised edition - 2011.
2. Electronic Instrumentation by H.S.Kalsi - THM.

Reference Books:

1. Electrical Measurements and measuring Instruments by E.W. Golding and F.C.Widdis - 5th Edition - Wheeler Publishing.
2. Modern Electronic Instrumentation and Measurement Techniques by A.D. Helfrick and W.D. Cooper - PHI - 5th Edition - 2002.
3. Electrical and Electronic Measurements and instrumentation by R.K.Rajput - S.Chand - 3rd edition.