

Insert and review comments
 Create bookmarks, hyperlinks, endnotes footnote
 Viewing document in different modes
 Working with document protection and security
 Inspect document for accessibility

MS EXCEL:

10 Hours

Create worksheets, insert and format data
 Work with different types of data: text, currency, date, numeric etc.
 Split, validate, consolidate, Convert data
 Sort and filter data
 Perform calculations and use functions: (Statistical, Logical, Mathematical, date, Time etc.,)
 Work with Lookup and reference formulae
 Create and Work with different types of charts
 Use pivot tables to summarize and analyse data
 Perform data analysis using own formulae and functions
 Combine data from multiple worksheets using own formulae and built-in functions to generate results
 Export data and sheets to other file formats
 Working with macros
 Protecting data and Securing the workbook

MS POWERPOINT:

10 Hours

Select slide templates, layout and themes
 Formatting slide content and using bullets and numbering
 Insert and format images, smart art, tables, charts
 Using Slide master, notes and handout master
 Working with animation and transitions
 Organize and Group slides
 Import or create and use media objects: audio, video, animation
 Perform slideshow recording and Record narration and create presentable videos

TOTAL: 30 PERIODS

COURSE OUTCOMES:

- On successful completion the students will be able to
- Use MS Word to create quality documents, by structuring and organizing content for their day to day technical and academic requirements
 - Use MS EXCEL to perform data operations and analytics, record, retrieve data as per requirements and visualize data for ease of understanding
 - Use MS PowerPoint to create high quality academic presentations by including common tables, charts, graphs, interlinking other elements, and using media objects.

GE3451

ENVIRONMENTAL SCIENCES AND SUSTAINABILITY

L	T	P	C
2	0	0	2

COURSE OBJECTIVES:

- To introduce the basic concepts of environment, ecosystems and biodiversity and emphasize on the biodiversity of India and its conservation.

- To impart knowledge on the causes, effects and control or prevention measures of environmental pollution and natural disasters.
- To facilitate the understanding of global and Indian scenario of renewable and nonrenewable resources, causes of their degradation and measures to preserve them.
- To familiarize the concept of sustainable development goals and appreciate the interdependence of economic and social aspects of sustainability, recognize and analyze climate changes, concept of carbon credit and the challenges of environmental management.
- To inculcate and embrace sustainability practices and develop a broader understanding on green materials, energy cycles and analyze the role of sustainable urbanization.

UNIT I ENVIRONMENT AND BIODIVERSITY

6

Definition, scope and importance of environment – need for public awareness. Eco-system and Energy flow– ecological succession. Types of biodiversity: genetic, species and ecosystem diversity– values of biodiversity, India as a mega-diversity nation – hot-spots of biodiversity – threats to biodiversity: habitat loss, poaching of wildlife, man-wildlife conflicts – endangered and endemic species of India – conservation of biodiversity: In-situ and ex-situ.

UNIT II ENVIRONMENTAL POLLUTION

6

Causes, Effects and Preventive measures of Water, Soil, Air and Noise Pollutions. Solid, Hazardous and E-Waste management. Case studies on Occupational Health and Safety Management system (OHSMS). Environmental protection, Environmental protection acts .

UNIT III RENEWABLE SOURCES OF ENERGY

6

Energy management and conservation, New Energy Sources: Need of new sources. Different types new energy sources. Applications of- Hydrogen energy, Ocean energy resources, Tidal energy conversion. Concept, origin and power plants of geothermal energy.

UNIT IV SUSTAINABILITY AND MANAGEMENT

6

Development, GDP, Sustainability- concept, needs and challenges-economic, social and aspects of sustainability-from unsustainability to sustainability-millennium development goals, and protocols - Sustainable Development Goals-targets, indicators and intervention areas Climate change- Global, Regional and local environmental issues and possible solutions-case studies. Concept of Carbon Credit, Carbon Footprint. Environmental management in industry-A case study.

UNIT V SUSTAINABILITY PRACTICES

6

Zero waste and R concept, Circular economy, ISO 14000 Series, Material Life cycle assessment, Environmental Impact Assessment. Sustainable habitat: Green buildings, Green materials, Energy efficiency, Sustainable transports. Sustainable energy: Non-conventional Sources, Energy Cycles-carbon cycle, emission and sequestration, Green Engineering: Sustainable urbanization- Socio-economical and technological change.

TOTAL: 30 PERIODS

COURSE OUTCOMES:

- To recognize and understand the functions of environment, ecosystems and biodiversity and their conservation.
- To identify the causes, effects of environmental pollution and natural disasters and contribute to the preventive measures in the society.
- To identify and apply the understanding of renewable and non-renewable resources and contribute to the sustainable measures to preserve them for future generations.
- To recognize the different goals of sustainable development and apply them for suitable technological advancement and societal development.

- To demonstrate the knowledge of sustainability practices and identify green materials, energy cycles and the role of sustainable urbanization.

TEXT BOOKS:

1. Anubha Kaushik and C. P. Kaushik's "Perspectives in Environmental Studies", 6th Edition, New Age International Publishers, 2018.
2. Benny Joseph, 'Environmental Science and Engineering', Tata McGraw-Hill, New Delhi, 2016.
3. Gilbert M. Masters, 'Introduction to Environmental Engineering and Science', 2nd edition, Pearson Education, 2004.
4. Allen, D. T. and Shonnard, D. R., Sustainability Engineering: Concepts, Design and Case Studies, Prentice Hall.
5. Bradley. A.S; Adebayo, A.O., Maria, P. Engineering applications in sustainable design and development, Cengage learning.
6. Environment Impact Assessment Guidelines, Notification of Government of India, 2006.
7. Mackenthun, K.M., Basic Concepts in Environmental Management, Lewis Publication, London, 1998.

REFERENCES

1. R.K. Trivedi, 'Handbook of Environmental Laws, Rules, Guidelines, Compliances and Standards', Vol. I and II, Enviro Media. 38.
2. Cunningham, W.P. Cooper, T.H. Gorhani, 'Environmental Encyclopedia', Jaico Publ., House, Mumbai, 2001.
3. Dharmendra S. Sengar, 'Environmental law', Prentice hall of India PVT. LTD, New Delhi, 2007.
4. Rajagopalan, R, 'Environmental Studies-From Crisis to Cure', Oxford University Press, 2005.
5. Erach Bharucha "Textbook of Environmental Studies for Undergraduate Courses" Orient Blackswan Pvt. Ltd. 2013.

MAPPING OF COs WITH POs AND PSOs

COs	POs												PSOs		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PS01	PS02	PS03
1	2	1	-	-	-	2	3	-	-	-	-	2	-	-	-
2	3	2	-	-	-	3	3	-	-	-	-	2	-	-	-
3	3	-	1	-	-	2	2	-	-	-	-	2	-	-	-
4	3	2	1	1	-	2	2	-	-	-	-	2	-	-	-
5	3	2	1	-	-	2	2	-	-	-	-	1	-	-	-
Avg.	2.8	1.8	1	1	-	2.2	2.4	-	-	-	-	1.8	-	-	-

EE3401

TRANSMISSION AND DISTRIBUTION

L T P C
3 0 0 3

COURSE OBJECTIVES:

- To impart knowledge about the configuration of the electrical power systems.
- To study the line parameters and interference with neighboring circuits.

- To understand the mechanical design and performance analysis of transmission lines.
- To learn about different insulators and underground cables.
- To understand and analyze the distribution system.

UNIT I TRANSMISSION LINE PARAMETERS 9

Structure of electric power system - Parameters of single and three phase transmission lines with single and double circuits -Resistance, inductance, and capacitance of solid, stranded, and bundled conductors - Typical configuration, conductor types - Symmetrical and unsymmetrical spacing and transposition – application of self and mutual GMD; skin and proximity effects - Effects of earth on the capacitance of the transmission line - interference with neighboring communication circuits.

UNIT II MODELLING AND PERFORMANCE OF TRANSMISSION LINES 9

Performance of Transmission lines – short line, medium line and long line – equivalent circuits, phasor diagram, attenuation constant, phase constant, surge impedance – transmission efficiency and voltage regulation, real and reactive power flow in lines – Power Circle diagrams – Ferranti effect – Formation of Corona – Critical Voltages – Effect on line Performance.

UNIT III SAG CALCULATION AND LINE SUPPORTS 9

Mechanical design of overhead lines – Line Supports –Types of towers – Tension and Sag Calculation for different weather conditions – Methods of grounding - Insulators: Types, voltage distribution in insulator string, improvement of string efficiency, testing of insulators.

UNIT IV UNDERGROUND CABLES 9

Underground cables – Types of cables – Construction of single-core and 3-core belted cables – Insulation Resistance – Potential Gradient – Capacitance of single-core and 3-core belted cables – Grading of cables – Power factor and heating of cables– DC cables.

UNIT V DISTRIBUTION SYSTEMS 9

Distribution Systems – General Aspects – Kelvin's Law – AC and DC distributions –Concentrated and Distributed loading- Techniques of Voltage Control and Power factor improvement – Distribution Loss – Types of Substations – Trends in Transmission and Distribution: EHVAC, HVDC and FACTS (Qualitative treatment only).

PROGRESS THROUGH KNOWLEDGE

TOTAL: 45 PERIODS

TEXT BOOKS:

1. D.P.Kothari, I.J. Nagarath, 'Power System Engineering', Mc Graw-Hill Publishing Company limited, New Delhi, Third Edition, 2019.
2. C.L.Wadhwa, 'Electrical Power Systems', New Age International Ltd, seventh edition 2022.
3. S.N. Singh, 'Electric Power Generation, Transmission and Distribution', Prentice Hall of India Pvt. Ltd, New Delhi, Second Edition, 2008.

REFERENCE BOOKS:

1. B.R.Gupta, 'Power System Analysis and Design' S. Chand, New Delhi, Sixth Edition, 2011.
2. Luces M.Fualken berry, Walter Coffey, 'Electrical Power Distribution and Transmission', Pearson Education, 2007.
3. Arun Ingole, "Power transmission and distribution" Pearson Education, first edition, 2018
4. J.Brian Hardy and Colin R.Bayliss 'Transmission and Distribution in Electrical Engineering', Newnes; Fourth Edition, 2011.
5. G.Ramamurthy, "Handbook of Electrical power Distribution," Universities Press, 2013.
6. V.K.Mehta, Rohit Mehta, 'Principles of power system', S. Chand & Company Ltd, New Delhi,

2013

7. Hadi Saadat, 'Power System Analysis', McGraw Hill Education Pvt. Ltd., New Delhi, 3rd Edition, 23rd reprint, 2015.
8. R.K.Rajput, 'A Text Book of Power System Engineering' 2nd edition, Laxmi Publications (P) Ltd, New Delhi, 2016.

COURSE OUTCOMES

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

- CO1 : Understand the structure of power system, computation of transmission line parameters for different configurations.
- CO2 : Model the transmission lines to determine the line performance and to understand the impact of Ferranti effect and corona on line performance.
- CO3 : Do Mechanical design of transmission lines, grounding and to understand about the insulators in transmission system.
- CO4 : Design the underground cables and understand the performance analysis of underground cable.
- CO5 : Understand the modelling, performance analysis and modern trends in distribution system.

MAPPING OF COs WITH POs AND PSOs

COs	POs												PSOs		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PS01	PS02	PS03
CO1	2	1	-	-	-	-	-	1	-	-	-	-	3	1	1
CO2	3	2	1	1	-	1	-	2	-	-	-	-	3	2	1
CO3	3	2	1	1	-	1	-	2	-	-	-	-	3	3	1
CO4	3	2	1	1	-	1	-	2	-	-	-	-	3	3	1
CO5	3	2	1	1	-	1	-	2	-	-	-	-	3	3	1
Avg	2.8	1.8	1	1		1	-	1.8					3	2.4	1

EE3402

LINEAR INTEGRATED CIRCUITS

L T P C
3 0 0 3

COURSE OBJECTIVES:

To impart knowledge on the following topics

- Signal analysis using Op-amp based circuits.
- Applications of Op-amp.
- Functional blocks and the applications of special ICs like Timers, PLL circuits, regulator Circuits.
- IC fabrication procedure.

UNIT I IC FABRICATION

9

IC classification, fundamental of monolithic IC technology, epitaxial growth, masking and etching, diffusion of impurities. Realisation of monolithic ICs and packaging. Fabrication of diodes, capacitance,

resistance, FETs and PV Cell.

UNIT II CHARACTERISTICS OF OPAMP

9

Ideal OP-AMP characteristics, DC characteristics, AC characteristics, differential amplifier; frequency response of OP-AMP; Voltage-shunt feedback and inverting amplifier - Voltage series feedback: and Non-Inverting Amplifier - Basic applications of op-amp –, summer, differentiator and Integrator-V/I & I/V converters.

UNIT III APPLICATIONS OF OPAMP

9

Instrumentation amplifier and its applications for transducer Bridge, Log and Antilog Amplifiers- Analog multiplier & Divider, first and second order active filters, comparators, multi vibrators, waveform generators, clippers, clampers, peak detector, S/H circuit, D/A converter (R- 2R ladder and weighted resistor types), A/D converters using OP-AMPs.

UNIT IV SPECIAL ICs

9

Functional block, characteristics of 555 Timer and its PWM application - IC-566 voltage controlled oscillator IC; 565-phase locked loop IC, AD633 Analog multiplier ICs.

UNIT V APPLICATION ICs

9

AD623 Instrumentation Amplifier and its application as load cell weight measurement - IC voltage regulators –LM78XX, LM79XX; Fixed voltage regulators its application as Linear power supply - LM317, 723 Variability voltage regulators, switching regulator- SMPS - ICL 8038 function generator IC.

TOTAL :45 PERIODS

COURSE OUTCOMES:

Upon successful completion of the course, the students will be able to:

- CO1 Explain monolithic IC fabrication process
- CO2 Explain the fabrication of diodes, capacitance, resistance, FETs and PV Cell.
- CO3 Analyze the characteristics and basic applications (inverting/non-inverting amplifier, summer, differentiator, integrator, V/I and I/V converter) of Op-Amp
- CO4 Explain circuit and applications of op-amp based instrumentation amplifier, log/antilog amplifier, analog multiplier /divider, active filters, comparators, waveform generators, A/D and D/A converters
- CO5 Explain Functional blocks, characteristics and applications of Timer, PLL, analog multiplier ICs.
- CO6 Explain the applications of ICs in Instrumentation amplifier, fixed and variable voltage regulator, SMPS and function generator

TEXT BOOKS:

1. David A. Bell, 'Op-amp & Linear ICs', Oxford, Third Edition, 2011
2. D. Roy Choudhary, Sheil B. Jani, 'Linear Integrated Circuits', , New Age, Fourth Edition, 2018.
3. Ramakant A. Gayakward, 'Op-amps and Linear Integrated Circuits', IV edition, Pearson Education, PHI 2021.

REFERENCES

1. Fiore, "Opamps & Linear Integrated Circuits Concepts & applications", Cengage, 2010.
2. Floyd ,Buchla, "Fundamentals of Analog Circuits, Pearson, 2013.
3. Jacob Millman, Christos C. Halkias, 'Integrated Electronics - Analog and Digital circuits system', McGraw Hill, 2nd Edition, 2017.
4. Robert F. Coughlin, Fredrick F. Driscoll, 'Op-amp and Linear ICs', Pearson, 6th edition, 2012.
5. Sergio Franco, 'Design with Operational Amplifiers and Analog Integrated Circuits', McGraw Hill,

2016 – Fourth Edition.

6. Muhammad H. Rashid,' Microelectronic Circuits Analysis and Design' Cengage Learning, 2nd Edition, 2012.

MAPPING OF COs WITH POs AND PSOs

COs	POs												PSOs		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PS01	PS02	PS03
CO1	2	2	3	2	2	-	-	1	-	-	-	1	3	2	1
CO2	2	2	3	2	2	-	-	1	-	-	-	1	3	2	1
CO3	2	2	3	2	2	-	-	1	-	-	-	1	3	2	1
CO4	2	2	3	2	2	-	-	1	-	-	-	1	3	2	1
CO5	2	2	3	2	2	-	-	1	-	-	-	1	3	2	1
Avg	2	2	3	2	2	-	-	1	-	-	-	1	3	2	1

EE3403

MEASUREMENTS AND INSTRUMENTATION

L T P C
3 0 0 3

COURSE OBJECTIVES

- To educate the fundamental concepts and characteristics of measurement and errors
- To impart the knowledge on the functional aspects of measuring instruments
- To infer the importance of various bridge circuits used with measuring instruments.
- To educate the fundamental working of sensors and transducers and their applications
- To summarize the overall measurement and instrumentation with the knowledge on digital instrumentation principles.

UNIT I CONCEPTS OF MEASUREMENTS

9

Instruments: classification, applications – Elements of a generalized measurement system - Static and dynamic characteristics - Errors in measurement -Statistical evaluation of measurement data.

UNIT II MEASUREMENT OF PARAMETERS IN ELECTRICAL SYSTEMS

9

Classification of instruments – moving coil and moving iron meters – Induction type, dynamometer type watt meters – Energy meter – Megger – Instrument transformers (CT & PT).

UNIT III AC/DC BRIDGES AND INSTRUMENTATION AMPLIFIERS

9

Wheatstone bridge, Kelvin double bridge - Maxwell, Hay, Wien and Schering bridges – Errors and compensation in A.C. bridges - Instrumentation Amplifiers.

UNIT IV TRANSDUCERS FOR MEASUREMENT OF NON- ELECTRICAL PARAMETERS

9

Classification of transducers – Measurement of pressure, temperature, displacement, flow, angular velocity – Digital transducers – Smart Sensors.

UNIT V DIGITAL INSTRUMENTATION

9

A/D converters: types and characteristics – Sampling, Errors- Measurement of voltage, Current, frequency and phase - D/A converters: types and characteristics- DSO- Data Loggers – Basics of PLC programming and Introduction to Virtual Instrumentation - Instrument standards.

COURSE OUTCOMES:

Upon successful completion of the course, the students should have the:

CO1: Ability to understand the fundamental art of measurement in engineering.

CO2: Ability to understand the structural elements of various instruments.

CO3: Ability to understand the importance of bridge circuits.

CO4: Ability to understand about various transducers and their characteristics by experiments.

CO5: Ability to understand the concept of digital instrumentation and virtual instrumentation by experiments.

TEXT BOOKS:

1. A.K. Sawhney, Puneet Sawhney 'A Course in Electrical & Electronic Measurements & Instrumentation', Dhanpat Rai and Co, New Delhi, Edition 2011.
2. H.S. Kalsi, 'Electronic Instrumentation', Tata McGraw-Hill, New Delhi, 2010

REFERENCES:

1. M.M.S. Anand, 'Electronics Instruments and Instrumentation Technology', Prentice Hall India, New Delhi, 2009
2. J.J. Carr, 'Elements of Electronic Instrumentation and Measurement', Pearson Education India, New Delhi, 2011
3. W.Bolton, Programmable Logic Controllers, 6th Edition, Elseiver, 2015.
4. R.B. Northrop, 'Introduction to Instrumentation and Measurements', Taylor & Francis, New Delhi, 3rd Edition 2014.
5. E. O. Doebelin and D. N. Manik, "Measurement Systems – Application and Design", Tata McGraw-Hill, New Delhi, 6th Edition 2017.
6. R. K. Rajput, "Electrical and Electronics Measurements and Instrumentation", Chand Pub, 2016

MAPPING OF COs WITH POs AND PSOs

COs	POs												PSOs		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PS01	PS02	PS03
CO1	3	2	3	-	3	2	-	2	-	-	-	3	3	3	3
CO2	3	2	3	2	-	-	-	-	-	3	-	3	3	3	3
CO3	3	2	3	-	3	2	-	-	-	-	-	3	3	3	3
CO4	3	2	3	-	-	-	-	2	-	-	-	-	3	3	3
CO5	3	2	3	2	3	-	-	-	-	3	-	3	3	3	3
Avg	3	2	3	2	3	2	-	2	-	3	-	3	3	3	3

EE3404**MICROPROCESSOR AND MICROCONTROLLER****L T P C
3 0 0 3****COURSE OBJECTIVES:**

- To study the addressing modes & instruction set of 8085 & 8051
- To develop skills in simple program writing in assembly languages
- To introduce commonly used peripheral/interfacing ICs.
- To study and understand typical applications of micro-processors.
- To study and understand the typical applications of micro-controllers

UNIT I**INTRODUCTION TO 8085 ARCHITECTURE****9**

Functional block diagram – Memory interfacing–I/O ports and data transfer concepts – Timing Diagram – Interrupt structure.

UNIT II 8085 INSTRUCTION SET AND PROGRAMMING 9

Instruction format and addressing modes — Assembly language format — Data transfer, data manipulation & control instructions – Programming: Loop structure with counting & Indexing - Look up table - Subroutine instructions, stack.

UNIT III INTERFACING BASICS AND ICS 9

Study of Architecture and programming of ICs: 8255 PPI, 8259PIC, 8251USART, 8279 Keyboard display controller and 8254 Timer/Counter – Interfacing with 8085 -A/D and D/A converter interfacing.

UNIT IV INTRODUCTION TO 8051 MICROCONTROLLER 9

Functional block diagram - Instruction format and addressing modes – Interrupt structure – Timer – I/O ports – Serial communication, Simple programming –keyboard and display interface – Temperature control system –stepper motor control - Usage of IDE for assembly language programming.

UNIT V INTRODUCTION TO RISC BASED ARCHITECTURE 9

PIC16 /18 architecture, Memory organization – Addressing modes – Instruction set - Programming techniques – Timers – I/O ports – Interrupt programming.

TOTAL: 45 PERIODS

COURSE OUTCOMES:

Upon successful completion of the course, the students should have the:

CO1: Ability to write assembly language program for microprocessor and microcontroller

CO2: Ability to design and implement interfacing of peripheral with microprocessor and microcontroller

CO3: Ability to analyze, comprehend, design and simulate microprocessor based systems used for control and monitoring.

CO4: Ability to analyze, comprehend, design and simulate microcontroller based systems used for control and monitoring.

CO5: Ability to understand and appreciate advanced architecture evolving microprocessor field

TEXTBOOKS:

1. Ramesh S. Gaonkar, 'Microprocessor Architecture Programming and Application', Penram International (P)ltd., Mumbai, 6th Edition, 2013.
2. Muhammad Ali Mazidi & Janice Gilli Mazidi, 'The 8051 Micro Controller and Embedded Systems', Pearson Education, Second Edition 2011.
3. Muhammad Ali Mazidi & Janice Gilli Mazidi, 'The PIC Micro Controller and Embedded Systems', 2010

REFERENCES:

1. Douglas V. Hall, "Micro-processors & Interfacing", Tata McGraw Hill 3rd Edition, 2017.
2. Krishna Kant, "Micro-processors & Micro-controllers", Prentice Hall of India, 2007.
3. Mike Predko, "8051 Micro-controllers", McGraw Hill, 2009
4. Kenneth Ayala, 'The 8051 Microcontroller', Thomson, 3rd Edition 2004.

MAPPING OF COs WITH POs AND PSOs

COs	POs												PSOs		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PS01	PS02	PS03
CO1	2	1	2	3	-	-	-	1	-	-	-	3	3	1	3
CO2	2	1	2	3	-	-	-	1	-	-	-	3	3	1	3
CO3	2	1	2	3	-	-	-	1	-	-	-	3	3	1	3
CO4	2	1	2	3	-	-	-	1	-	-	-	3	3	1	3
CO5	2	1	2	3	-	-	-	1	-	-	-	3	3	1	3
Avg	2	1	2	3	-	-	-	1	-	-	-	3	3	1	3

EE3405

ELECTRICAL MACHINES - II

**LT P C
3 0 0 3**

COURSE OBJECTIVES:

To impart knowledge on the following Topics

- Construction and performance of salient and non – salient type synchronous generators.
- Principle of operation and performance of synchronous motor.
- Construction, principle of operation and performance of induction machines.
- Starting and speed control of three-phase induction motors.
- Construction, principle of operation and performance of single phase induction motors and special machines.

UNIT I SYNCHRONOUS GENERATOR

9

Constructional details – Types of rotors –winding factors- EMF equation – Synchronous reactance – Armature reaction – Phasor diagrams of non-salient pole synchronous generator connected to infinite bus--Synchronizing and parallel operation – Synchronizing torque -Change of excitation and mechanical input- Voltage regulation – EMF, MMF, ZPF and A.S.A method – steady state power-angle characteristics– Two reaction theory –slip test -short circuit transients - Capability Curves.

UNIT II SYNCHRONOUS MOTOR

9

Principle of operation – Torque equation – Operation on infinite bus bars - V and Inverted V curves – Power input and power developed equations – Starting methods – Current loci for constant power input, constant excitation and constant power Developed-Hunting – natural frequency of oscillations – damper windings- synchronous condenser.

UNIT III THREE PHASE INDUCTION MOTOR

9

Constructional details – Types of rotors — Principle of operation – Slip –cogging and crawling-Equivalent circuit – Torque-Slip characteristics - Condition for maximum torque – Losses and efficiency – Load test - No load and blocked rotor tests - Circle diagram – Separation of losses – Double cage induction motors –Induction generators – Synchronous induction motor.

UNIT IV STARTING AND SPEED CONTROL OF THREE PHASE INDUCTION MOTOR

9

Need for starting – Types of starters – DOL, Rotor resistance, Autotransformer and Star delta starters – Speed control – Voltage control, Frequency control and pole changing – Cascaded Connection-V/f control – Slip power recovery Scheme-Braking of three phase induction motor: Plugging, dynamic braking and regenerative braking.

UNIT V SINGLE PHASE INDUCTION MOTORS AND SPECIAL MACHINES**9**

Constructional details of single phase induction motor – Double field revolving theory and operation – Equivalent circuit – No load and blocked rotor test – Performance analysis – Starting methods of single-phase induction motors – Capacitor-start capacitor run Induction motor- Shaded pole induction motor - Linear induction motor – Repulsion motor - Hysteresis motor - AC series motor- Servo motors- Stepper motors - introduction to magnetic levitation systems.

TOTAL: 45 PERIODS**COURSE OUTCOMES:**

Upon the successful completion of the course, students will have the:

CO1: Ability to understand the construction and working principle of Synchronous generator

CO2: Ability to understand the construction and working principle of Synchronous Motor

CO3: Ability to understand the construction and working principle of Three Phase Induction Motor

CO4: Acquire knowledge about the starting and speed control of induction motors.

CO5: To gain knowledge about the basic principles and working of Single phase induction motors and Special Electrical Machines.

TEXT BOOKS:

1. A.E. Fitzgerald, Charles Kingsley, Stephen. D. Umans, 'Electric Machinery', Mc Graw Hill publishing Company Ltd, 6th Edition 2017.
2. Stephen J. Chapman, 'Electric Machinery Fundamentals' 4th edition, McGraw Hill Education Pvt. Ltd, 4th Edition 2017.
3. D.P. Kothari and I.J. Nagrath, 'Electric Machines', McGraw Hill Publishing Company Ltd, 5th Edition 2017
4. P.S. Bhimbhra, 'Electrical Machinery', Khanna Publishers, edition 2, 2021.

REFERENCES

1. Vincent Del Toro, 'Basic Electric Machines' Pearson India Education, 2016.
2. M.N. Bandyopadhyay, Electrical Machines Theory and Practice, PHI Learning PVT LTD., New Delhi, 2011.
3. B.R.Gupta, 'Fundamental of Electric Machines' New age International Publishers, 3rd Edition, Reprint 2015.
4. Murugesh Kumar, 'Electric Machines', Vikas Publishing House Pvt. Ltd, First edition 2010.
5. Alexander S. Langsdorf, 'Theory of Alternating-Current Machinery', McGraw Hill Publications, 2001.

MAPPING OF COs WITH POs AND PSOs

COs	POs												PSOs		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PS01	PS02	PS03
CO1	3	3	2	3	3	-	-	1	-	-	-	-	3	3	2
CO2	3	3	2	3	3	-	-	1	-	-	-	-	3	3	2
CO3	3	3	2	3	3	-	-	1	-	-	-	-	3	3	2
CO4	3	3	2	3	3	-	-	1	-	-	-	-	3	3	2
CO5	3	3	1	1	2	-	-	1	-	-	-	-	3	3	2
CO6	3	3	1	1	2	-	-	1	-	-	-	-	3	3	2
Avg	3	3	1.6	2.3	2.6	-	-	1	-	-	-	-	3	3	2

NCC Credit Course Level 2*

NX3451 (ARMY WING) NCC Credit Course Level - II		L	T	P	C
		3	0	0	3
PERSONALITY DEVELOPMENT					9
PD 3	Group Discussion: Change your mindset, Time Management, Social Skills				6
PD 5	Public Speaking				3
LEADERSHIP					7
L 2	Case Studies: APJ Abdul Kalam, Deepa Malik, Maharana Pratap, N Narayan Murty, Ratan Tata, Rabindra Nath Tagore, Role of NCC cadets in 1965				7
DISASTER MANAGEMENT					13
DM 1	Disaster Management Capsule: Organisation, Types of Disasters, Essential Services, Assistance, Civil Defence Organisation				3
DM 2	Initiative Training, Organising Skills, Do's & Don't's, Natural Disasters, Man Made Disasters				9
DM 3	Fire Service & Fire Fighting				1
ENVIRONMENTAL AWARENESS & CONSERVATION					3
EA 1	Environmental Awareness and Conservation				3
GENERAL AWARENESS					4
GA 1	General Knowledge				4
ARMED FORCES					6
AF 1	Armed Forces, Army, CAPF, Police				6
ADVENTURE					1
AD 1	Introduction to Adventure Activities				1
BORDER & COASTAL AREAS					2
BCA 1	History, Geography & Topography of Border/Coastal areas				2

TOTAL: 45 PERIODS

NCC Credit Course Level 2*

NX3452 (NAVAL WING) NCC Credit Course Level - II		L	T	P	C
		3	0	0	3
PERSONALITY DEVELOPMENT					9
PD 3	Group Discussion: Change your mindset, Time Management, Social Skills				6
PD 5	Public Speaking				3
LEADERSHIP					7
L 2	Case Studies: APJ Abdul Kalam, Deepa Malik, Maharana Pratap, N Narayan Murty, Ratan Tata, Rabindra Nath Tagore, Role of NCC cadets in 1965				7
DISASTER MANAGEMENT					13
DM 1	Disaster Management Capsule: Organisation, Types of Disasters, Essential Services, Assistance, Civil Defence Organisation				3
DM 2	Initiative Training, Organising Skills, Do's & Don't's, Natural Disasters, Man Made Disasters				9
DM 3	Fire Service & Fire Fighting				1
ENVIRONMENTAL AWARENESS & CONSERVATION					3
EA 1	Environmental Awareness and Conservation				3
GENERAL AWARENESS					4
GA 1	General Knowledge				4
NAVAL ORIENTATION					6
AF 1	Armed Forces and Navy Capsule				3
EEZ 1	EEZ Maritime Security and ICG				3
ADVENTURE					1
AD 1	Introduction to Adventure Activities				1
BORDER & COASTAL AREAS					2
BCA 1	History, Geography & Topography of Border/Coastal areas				2

TOTAL : 45 PERIODS

NCC Credit Course Level 2*

NX3453 (AIR FORCE WING) NCC Credit Course Level - II		L	T	P	C
		3	0	0	3
PERSONALITY DEVELOPMENT					9
PD 3	Group Discussion: Change your mindset, Time Management, Social Skills				6
PD 5	Public Speaking				3
LEADERSHIP					7
L 2	Case Studies: APJ Abdul Kalam, Deepa Malik, Maharana Pratap, N Narayan Murty, Ratan Tata, Rabindra Nath Tagore, Role of NCC cadets in 1965				7
DISASTER MANAGEMENT					13
DM 1	Disaster Management Capsule: Organisation, Types of Disasters, Essential Services, Assistance, Civil Defence Organisation				3
DM 2	Initiative Training, Organising Skills, Do's & Don't's, Natural Disasters, Man Made Disasters				9
DM 3	Fire Service & Fire Fighting				1
ENVIRONMENTAL AWARENESS & CONSERVATION					3
EA 1	Environmental Awareness and Conservation				3
GENERAL AWARENESS					4
GA 1	General Knowledge				4
GENERAL SERVICE KNOWLEDGE					6
GSK 1	Armed Forces & IAF Capsule				2
GSK 2	Modes of Entry in IAF, Civil Aviation				2
GSK 3	Aircrafts - Types, Capabilities & Role				2
ADVENTURE					1
AD 1	Introduction to Adventure Activities				1
BORDER & COASTAL AREAS					2
BCA 1	History, Geography & Topography of Border/Coastal areas				2

TOTAL : 45 PERIODS

COURSE OBJECTIVES:

- To expose the students to the operation of synchronous machines and induction motors and give them experimental skill.

LIST OF EXPERIMENTS

- Regulation of three phase alternator by EMF and MMF methods.
- Regulation of three phase alternator by ZPF and ASA methods.
- Regulation of three phase salient pole alternator by slip test.
- Measurements of negative sequence and zero sequence impedance of alternators.
- V and Inverted V curves of Three Phase Synchronous Motor.
- Load test on three-phase induction motor.
- No load and blocked rotor tests on three-phase induction motor (Determination of equivalent circuit parameters).
- Separation of No-load losses of three-phase induction motor.
- Load test on single-phase induction motor.
- No load and blocked rotor test on single-phase induction motor.
- Study of Induction Motor Starters

TOTAL: 45 PERIODS**COURSE OUTCOMES:**

At the end of the course, the student should have the:

- CO1: Ability to understand and analyze EMF and MMF methods
 CO2: Ability to analyze the characteristics of V and Inverted V curves
 CO3: Acquire hands on experience of conducting various tests on alternators and obtaining their performance indices using standard analytical as well as graphical methods. to understand the importance of Synchronous machines
 CO4: Acquire hands on experience of conducting various tests on induction motors and obtaining their performance indices using standard analytical as well as graphical methods. to understand the importance of single and three phase Induction motors
 CO5: Ability to acquire knowledge on separation of losses

MAPPING OF COs WITH POs AND PSOs

COs	POs												PSOs		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PS01	PS02	PS03
CO1	3	3	1	1	-	-	-	1.5	1	-	-	3	3	3	2
CO2	3	3	1	1	-	-	-	1.5	1	-	-	3	3	3	2
CO3	3	3	1	1	-	-	-	1.5	1	-	-	3	3	3	1
CO4	3	3	1	1	-	-	-	1.5	1	-	-	3	3	3	1
CO5	3	3	1	1	-	-	-	1.5	1	-	-	2	3	3	2
Avg	3	3	1	1	-	-	-	1.5	1	-	-	2.8	3	3	1.6

COURSE OBJECTIVES:

- To learn design, testing and characterizing of circuit behavior with combinational logic gate ICs.
- To learn design, testing and characterizing of circuit behavior with register/ counter and sequential logic ICs.
- To learn design, testing and characterizing of circuit behavior with OPAMP ICs.
- To learn design, testing and characterizing of circuit behavior with analog ICs like 555 timer VCO and regulators.
- To learn design, testing and characterizing of circuit behavior with digital ICs like decoders, multiplexers.

LIST OF EXPERIMENTS

1. Implementation of Boolean Functions, Adder and Subtractor circuits.
2. Code converters: Excess-3 to BCD and Binary to Gray code converter and vice-versa.
3. Parity generator and parity checking.
4. Encoders and Decoders.
5. Counters: Design and implementation of 3-bit modulo counters as synchronous and Asynchronous types using FF IC's and specific counter IC.
6. Shift Registers: Design and implementation of 4-bit shift registers in SISO, SIPO, PISO, PIPO modes using suitability IC's.
7. Study of multiplexer and de multiplexer
8. Timer IC application: Study of NE/SE 555 timer in Astability, Monostability operation.
9. Application of Op-Amp: inverting and non-inverting amplifier, Adder, comparator, Integrator and Differentiator.
10. Voltage to frequency characteristics of NE/ SE 566 IC.
11. Variability Voltage Regulator using IC LM317.

TOTAL: 45 PERIODS**COURSE OUTCOMES:**

At the end of the course, the student should have the:

CO1: Ability to understand and implement Boolean Functions.

CO2: Ability to understand the importance of code conversion

CO3: Ability to Design and implement circuits with digital ICs like decoders, multiplexers, register.

CO4: Ability to acquire knowledge on Application of Op-Amp

CO5: Ability to Design and implement counters using analog ICs like timers, VCOs and digital ICs like Flip-flops and counters.

MAPPING OF COs WITH POs AND PSOs

COs	POs												PSOs		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PS01	PS02	PS03
CO1	-	-	-	3	-	-	-	1.5	-	-	3	3	2	1	2
CO2	-	-	3	3	-	-	-	1.5	-	-	3	3	2	1	2
CO3	-	3	2	3	3	-	-	1.5	-	-	3	3	2	1	2
CO4	-	3	3	3	3	-	-	1.5	-	-	3	3	2	1	2
CO5	-	-	-	-	-	-	-	1.5	-	-	-	3	-	-	-
Avg	-	3	1.6	3	3	-	-	1.5	-	-	3	3	2	1	2

COURSE OBJECTIVES:

- To perform simple arithmetic operations using assembly language program and study the addressing modes & instruction set of 8085 & 8051
- To develop skills in simple program writing in assembly languages
- To write an assembly language program to convert Analog input to Digital output and Digital input to Analog output.
- To perform interfacing experiments with $\mu P8085$
- To perform interfacing experiments with $\mu C8051$.

PROGRAMMING EXERCISES / EXPERIMENTS WITH $\mu P8085$:

1. Simple arithmetic operations: Multi precision addition / subtraction /multiplication / division.
2. Programming with control instructions: Increment / Decrement, Ascending / Descending order, Maximum / Minimum of numbers, Rotate instructions, Hex / ASCII / BCD code conversions.
3. Interface Experiments: A/D Interfacing. D/A Interfacing. Traffic light controller
4. Stepper motor controller interface.
5. Displaying a moving/ rolling message in the student trainer kit's output device.

PROGRAMMING EXERCISES / EXPERIMENTS WITH $\mu C8051$:

6. Simple arithmetic operations with 8051: Multi precision addition / subtraction / multiplication/ division.
7. Programming with control instructions: Increment / Decrement, Ascending / Descending order, Maximum / Minimum of numbers, Rotate instructions, Hex / ASCII / BCD code conversions.
8. Interface Experiments: A/D Interfacing. D/A Interfacing. Traffic light controller
9. Stepper motor controller interface.
10. Displaying a moving/ rolling message in the student trainer kit's output device.
11. Programming PIC architecture with software tools.

TOTAL :45 PERIODS**COURSE OUTCOMES:**

After studying the above subject, students should have the:

CO1: Ability to write assembly language program for microprocessor.

CO2: Ability to write assembly language program for microcontroller

CO3: Ability to design and implement interfacing of peripheral with microprocessor and microcontroller

CO4: Ability to analyze, comprehend, design and simulate microprocessor based systems used for control and monitoring..

CO5: Ability to analyze, comprehend, design and simulate microcontroller based systems used for control and monitoring.

MAPPING OF COs WITH POs AND PSOs

COs	POs												PSOs		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PS01	PS02	PS03
CO1	2	1	2	3	-	-	-	1.5	-	-	-	3	3	1	3
CO2	2	1	2	3	-	-	-	1.5	-	-	-	3	3	1	3
CO3	2	1	2	3	-	-	-	1.5	-	-	-	3	3	1	3
CO4	2	1	2	3	-	-	-	1.5	-	-	-	3	3	1	3
CO5	2	1	2	3	-	-	-	1.5	-	-	-	3	3	1	3
Avg	2	1	2	3	-	-	-	1.5	-	-	-	3	3	1	3

EE3501

POWER SYSTEM ANALYSIS

L T P C
3 0 0 3

COURSE OBJECTIVES:

- Impact knowledge on need for operational studies, and To model the power system under steady state operating condition.
- To understand and apply iterative techniques for power flow analysis.
- To model of carry out short circuit studies for power system during symmetrical fault.
- To model of carry out short circuit – studies during
- To study about the various methods for analyzing power system stability

UNIT I POWER SYSTEM

9

Need for system planning and operational studies - Power scenario in India - Power system components, Representation - Single line diagram - per unit quantities - p.u. impedance diagram - p.u. reactance diagram, Network graph Theory - Bus incidence matrices, Primitive parameters, Formation of bus admittance matrix – Direct inspection method – Singular Transformation method.

UNIT II POWER FLOW ANALYSIS

9

Bus classification - Formulation of Power Flow problem in polar coordinates - Power flow solution using Gauss Seidel method - Handling of Voltage controlled buses - Power Flow Solution by Newton Raphson method – Flow charts – Comparison of methods.

UNIT III SYMMETRICAL FAULT ANALYSIS

9

Assumptions in short circuit analysis - Symmetrical short circuit analysis using Thevenin's theorem - Bus Impedance matrix building algorithm (without mutual coupling) - Symmetrical fault analysis through bus impedance matrix - Post fault bus voltages - Fault level - Current limiting reactors.

UNIT IV UNSYMMETRICAL FAULT ANALYSIS

9

Symmetrical components - Sequence impedances - Sequence networks - Analysis of unsymmetrical faults at generator terminals: LG, LL and LLG - unsymmetrical fault occurring at any point in a power system.