

ANNAMACHARYA INSTITUTE OF TECHNOLOGY AND SCIENCES: RAJAMPET

(An Autonomous Institution)

Department of Electrical and Electronics Engineering

R23 Regulations B.Tech. Electrical and Electronics Engineering

III Year I Semester							
S. No.	Category	Code	Title	L	T	P	Credits
1	PC	23A0251T	Power Electronics	2	1	0	3
2	PC	23A0252T	Digital Circuits	2	1	0	3
3	PC	23A0253T	Power Systems-II	3	0	0	3
4	PC	23A0554T	Introduction to Quantum Technologies and Applications	3	0	0	3
5	PE	23A025AT 23A025BT 23A025CT 23A025DT	Professional Elective-I Signals and Systems Electrical safety and Risk Management Utilization of Electrical Energy High Voltage Engineering	3	0	0	3
6	OE		Open Elective-I	3	0	0	3
7	PC	23A0251L	Power Electronics and Simulation Lab	0	0	3	1.5
8	PC	23A0252L	Analog and Digital Circuits Lab	0	0	3	1.5
9	SEC	23AHS55L	Soft Skills	1	0	2	2
10	SEC	23A0254L	Tinkering Lab for Electrical Engineers	0	0	2	1
11	INTERN	23A0255I	Evaluation of Community Service Internship	0	0	0	2
Total				17	2	10	26

Category	Credits
Professional Core	15
Professional Elective	3
Open Elective	3
Skill Enhancement Courses	2
Engineering Sciences	1
Internship	2
Total Credits	26

Open Elective – I

S. No.	Course Code	Course Name	Offered by the Dept.
1	23A015DT	Green Buildings	Civil
2	23A015ET	Construction Technology and Management	
3	23A035FT	Sustainable Energy Technologies	Mech
4	23A045DT	Electronic Circuits	ECE
5	23A045ET	Communication Systems	
6	23A055ET	Java Programming	CSE & Allied/IT
7	23A055FT	Fundamentals of Artificial Intelligence	
8	23A055GT	Quantum Technologies and Applications	
9	23AHS51T	Mathematics for Machine Learning and AI	Mathematics
10	23AHS52T	Materials Characterization Techniques	Physics
11	23AHS53T	Chemistry of Energy Systems	Chemistry
12	23AHS54T	English for Competitive Examinations	Humanities
13	23AHS56T	Entrepreneurship and New Venture Creation	

III Year II Semester							
S. No.	Category	Code	Title	L	T	P	Credits
1	PC	23A0261T	Electrical Measurements and Instrumentation	3	0	0	3
2	PC	23A0262T	Microprocessors and Microcontrollers	3	0	0	3
3	PC	23A0263T	Power System Analysis	3	0	0	3
4	PE	23A026AT 23A026BT 23A026CT 23A026DT	Professional Elective-II AI&ML for Electrical Engineering Programmable Logic Controllers Switchgear and Protection Energy auditing and Demand side Management	3	0	0	3
5	PE	23A026ET 23A026FT 23A026GT 23A026HT	Professional Elective-III Smart Grid Electric Drives Renewable and Distributed Energy Technologies Embedded Systems	3	0	0	3
6	OE		Open Elective - II	3	0	0	3
7	PC	23A0261L	Electrical Measurements and Instrumentation Lab	0	0	3	1.5
8	PC	23A0262L	Microprocessors and Microcontrollers Lab	0	0	3	1.5
9	SEC	23A0263L	Skill Enhancement course Applications of Soft Computing Tools in Electrical Engineering	0	1	2	2
10	MC	23A0264T	Technical paper writing and IPR	2	0	0	0
Total				20	1	8	23
Mandatory Community Service Project Internship of 08 weeks duration during summer Vacation							

Category	Credits
Professional Core	12
Professional Elective	6
Open Elective	3
Skill Enhancement Courses	2
Total Credits	23

Open Elective – II

S. No.	Course Code	Course Name	Offered by the Dept.
1	23A016GT	Disaster Management	Civil
2	23A016HT	Sustainability In Engineering Practices	
3	23A036KT	Automation and Robotics	Mech
4	23A046HT	Transducers and Sensors	ECE
5	23A056IT	Operating Systems	CSE & Allied/IT
6	23A056JT	Introduction of Machine Learning	
7	23AHS61T	Optimization Techniques for Engineers	Mathematics
8	23AHS65T	Mathematical Foundation of Quantum Technologies	
9	23AHS62T	Physics of Electronic Materials and Devices	Physics
10	23AHS63T	Chemistry of Polymers and Applications	Chemistry
11	23AHS64T	Academic Writing and Public Speaking	Humanities

IV Year I Semester							
S. No.	Category	Code	Title	L	T	P	Credits
1	PC	23A0271T	Power System Operation and Control	3	0	0	3
2	HSSM	23AHS7AT 23AHS7BT 23AHS7CT	Management Elective Course- II Business Ethics and Corporate Governance E-Business Management Science	2	0	0	2
3	PE	23A027AT 23A027BT 23A027CT 23A027DT	Professional Elective-IV Digital Signal Processing Electric Vehicle Technology HVDC & FACTS Special Electrical Machines	3	0	0	3
4	PE	23A027ET 23A027FT 23A027GT 23A027HT	Professional Elective-V Modern Control Theory Switched Mode Power Conversion Electrical Distribution System Power Quality	3	0	0	3
5	OE		Open Elective - III	3	0	0	3
6	OE		Open Elective - IV	3	0	0	3
7	SEC	23A0271L	Skill Enhancement Course Power Systems and Simulation Lab	0	0	3	2
8	MC	23AHS79T	Gender Sensitization	2	0	0	0
9	INTERN	23A0272I	Evaluation of Industry Internship	0	0	0	2
Total				19	0	3	21

Category	Credits
Professional Core	3
Humanities and Social Science including Management	2
Professional Elective	6
Open Elective	6
Skill Enhancement Course	2
Internship	2
Total Credits	21

Open Elective – III

S. No.	Course Code	Course Name	Offered by the Dept.
1	23A017GT	Building Materials and Services	Civil
2	23A017HT	Environmental Impact Assessment	
3	23A037KT	3D Printing Technologies	Mech
4	23A047GT	Microprocessors and Microcontrollers	ECE
5	23A047HT	VLSI Design	
6	23A057IT	Data Base Management Systems	CSE & Allied/IT
7	23A057JT	Cyber Security	
8	23AHS71T	Wavelet transforms and its applications	Mathematics
9	23AHS72T	Smart Materials and Devices	Physics
10	23AHS7AT	Introduction to Quantum Mechanics	
11	23AHS73T	Green Chemistry and Catalysis for Sustainable Environment	Chemistry
12	23AHS74T	Employability Skills	Humanities

Open Elective – IV

S. No.	Course Code	Course Name	Offered by the Dept.
1	23A017IT	Geo-Spatial Technologies	Civil
2	23A017JT	Solid Waste Management	
3	23A037LT	Total Quality Management	Mech
4	23A047BT	Digital Electronics	ECE
5	23A057KT	Introduction to Computer Networks	CSE & Allied/IT
6	23A057LT	Internet of Things	
7	23A057MT	Introduction to Quantum Computing	
8	23AHS75T	Financial Mathematics	Mathematics
9	23AHS76T	Sensors And Actuators for Engineering Applications	Physics
10	23AHS77T	Chemistry of Nanomaterials and Applications	Chemistry
11	23AHS78T	Literary Vibes	Humanities

IV Year II Semester							
S. No.	Category	Code	Title	L	T	P	Credits
1	INTERN	23A0281I	Internship	0	0	24	4
2	PR	23A0282P	Project	0	0	0	8
Total				0	0	24	12

ANNAMACHARYA INSTITUTE OF TECHNOLOGY AND SCIENCES::RAJAMPET**(An Autonomous Institution)****Department of Electrical and Electronics Engineering****R23 Regulations Open Electives Offered by Department of Electrical and Electronics Engineering****Open Elective – I (Offered to the other departments)**

III Year I Semester							
S. No.	Category	Code	Title	L	T	P	Credits
1	OE	23A025ET	Electrical Safety Practices and Standards	3	0	0	3
2	OE	23A025FT	Instrumentation	3	0	0	3

Open Elective – II (Offered to the other departments)

III Year II Semester							
S. No.	Category	Code	Title	L	T	P	Credits
1	OE	23A026IT	Renewable Energy Sources	3	0	0	3
1	OE	23A026JT	Wind and Solar Energy	3	0	0	3

Open Elective – III (Offered to the other departments)

IV Year I Semester							
S. No.	Category	Code	Title	L	T	P	Credits
1	OE	23A027IT	Smart Grid Technologies	3	0	0	3
2	OE	23A027JT	Electric Vehicles	3	0	0	3

ANNAMACHARYA INSTITUTE OF TECHNOLOGY AND SCIENCES RAJAMPET
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Department of Electrical and Electronics Engineering

Title of the Course Power Electronics
Category: PC
Course Code: 23A0251T
Year : III
Semester I
Branch/es: EEE

Lecture Hours

2

Tutorial Hours

1

Practice Hours

0

Credits

3

Course Objectives:

1. To understand the construction, characteristics, and switching behaviour of power semiconductor devices such as SCR, MOSFET, IGBT, GaN, SiC.
2. To analyse the operation and performance of single-phase and three-phase controlled rectifiers, including their characteristics with R and RL Load.
3. To study the working principles, operation modes, and analysis of step-down (buck), step-up (boost), and buck-boost converters, enabling efficient DC voltage regulation
4. To examine the principles and control strategies of single-phase and three-phase inverters, focusing on PWM techniques, harmonic reduction, and inverter performance
5. To explore the operation of AC voltage controllers, cycloconverters, and matrix converters, and understand their applications in controlling AC power

Course Outcomes:

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

1. Understand the I-V Characteristics and Gate Drive Requirements of Power Devices
2. Design Single-Phase and Three-Phase Rectifiers with Different Load Conditions
3. Analyze steady state waveforms of Buck, Boost, and Buck-Boost Converters.
4. Explore the Operation of single phase and three phase Inverters
5. Analyze the operation of AC Voltage Controllers and Cycloconverters with Various Load Conditions and Commutation Techniques.

Unit 1 Power Switching Devices

12

Basic Structure and I-V Characteristics of Diode, Thyristor, MOSFET, IGBT; Turn on and Turn-off methods of SCR and their characteristics; Firing circuits and Commutation circuits for thyristor; Gate drive circuits for MOSFET, IGBT; Introduction to Gallium Nitride (GaN) and Silicon Carbide (SiC) Devices.

Unit 2 Rectifiers

10

Single-phase half-wave and full-wave rectifiers; Single-phase half controlled and fully controlled bridge thyristor rectifier with R and RL load with relevant waveforms; Three-phase half-wave and full-wave rectifiers; Three-phase half controlled and fully controlled bridge thyristor rectifier with R and RL load with relevant waveforms, Dual Converter, Applications of Rectifiers -Numerical problems.

Unit 3 DC-DC Converters

08

Introduction to chopper; classification of choppers; concepts of duty ratio; control strategies; Power circuit, analysis and waveforms at steady state and average output voltage of Buck, Boost and Buck-Boost Converters. Applications of DC-DC converter.

Unit 4 Inverters

10

Single phase Voltage Source inverters – operating principle – Voltage control techniques for inverters and Pulse width modulation techniques, single phase current source inverter with ideal switches, basic series inverter, single phase parallel inverter – basic principle of operation only, Three phase bridge inverters- VSI (180-degree mode) – Sinusoidal PWM - CSI - Applications of DC-DC Inverter. Numerical problems.

Unit 5 AC Voltage Controllers & Cycloconverters**10**

Single phase AC voltage controllers – operation- Single phase two SCRs in anti-parallel – With R and RL loads – RMS load voltage, current and power factor - wave forms – Numerical problems. Cycloconverters – Midpoint and Bridge connections - Single phase to single phase step-up and step-down cycloconverters with Resistive and inductive load, Principle of operation, Waveforms, output voltage equation, Applications of Cycloconverters.

Prescribed Textbooks:

1. M. H. Rashid, Power Electronics: Circuits, Devices and Applications, 2nd edition, Prentice Hall of India, 1998.
2. P.S. Bimbhra, Power Electronics, 4th Edition, Khanna Publishers, 2010

Reference Books:

1. Ned Mohan, Power Electronics, Wiley, 2011
2. M. D. Singh, Power Electronics, Tata Mc Graw Hill Publishing Company, 1998.
3. V. R. Murthy, Power Electronics, 1st Edition, Oxford University Press, 2005.
4. P. C. Sen, Power Electronics, Tata Mc Graw-Hill Education, 1987.
5. J. M. D. Murphy, Power Electronic Control of Alternating Current Motors.

Online Learning Resources:

<https://nptel.ac.in/courses/108102145>

<https://nptel.ac.in/courses/108/108/108108078>

CO-PO Mapping:

Course Outcomes	Engineering Knowledge	Problem Analysis	Design/Development of Solutions	Conduct Investigations of Complex Problems	Modern Tool Usage	The Engineer and Society	Environment And Sustainability	Ethics	Individual And Team Work	Communication	Project Management And Finance	Life-Long Learning	PSO1	PSO2
23A0251T.1	3	2	1	1	-	2	-	-	-	-	-	1	2	1
23A0251T.2	3	3	2	2	-	2	-	-	-	-	-	1	3	2
23A0251T.3	3	2	2	1	-	2	-	-	-	-	-	1	3	2
23A0251T.4	3	3	3	2	-	2	-	-	-	-	-	1	3	2
23A0251T.5	3	2	2	1	-	2	-	-	-	-	-	1	2	2

ANNAMACHARYA INSTITUTE OF TECHNOLOGY AND SCIENCES RAJAMPET

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Department of Electrical and Electronics Engineering

Title of the Digital Circuits
Category: PC
Couse Code: 23A0252T
Year : III
Semester I
Branch/es: EEE

Lecture Hours

2

Tutorial Hours

1

Practice Hours

0

Credits

3

Course Objectives:

1. To Learn Boolean algebra, logic simplification techniques, and combinational circuit design
2. To analyze combinational circuits like adders, subtractors, and code converters.
3. To explore combinational logic circuits and their applications in digital design.
4. To understand sequential logic circuits, including latches, flip-flops, counters, and shift registers.
5. To gain knowledge about programmable logic devices and digital IC's.

Course Outcomes:

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

1. Learn Boolean algebra, logic simplification techniques, and combinational circuit design. L1
2. Analyze combinational circuits like adders, subtractors, and code converters. L2
3. Explore combinational logic circuits and their applications in digital design. L3
4. Understand sequential logic circuits, including latches, flip-flops, counters, and shift registers. L1
5. Gain knowledge about programmable logic devices and digital IC's. L3

Unit 1 Logic Simplification and Combinational Logic Design:

9

Review of Boolean Algebra and De Morgan's Theorem, SOP & POS forms, Canonical forms, Introduction to Logic Gates, Ex-OR, Ex-NOR operations, Minimization of Switching Functions: Karnaugh map method, Logic function realization: AND-OR, ORAND and NAND/NOR realizations.

Unit 2 Introduction to Combinational Design 1:

9

Binary Adders, Subtractors and BCD adder, Code converters -Binary to Gray, Gray to Binary, BCD to excess3, BCD to Seven Segment display.

Unit 3 Combinational Logic Design 2:

9

Decoders, Encoders, Priority Encoder, Multiplexers, Demultiplexers, Comparators, Implementations of Logic Functions using Decoders and Multiplexers.

Unit 4 Sequential Logic Design:

9

Latches, Flip-flops, S-R, D, T, JK and Master-Slave JK FF, Edge triggered FF, set up and hold times, Ripple counters, Shift registers.

Unit 5 Programmable Logic Devices & Digital IC's:

9

Programmable Logic Devices: ROM, Programmable Logic Devices (PLA and PAL).

Digital IC's: Decoder (74x138), Priority Encoder (74x148), multiplexer (74x151) and de-multiplexer (74x155), comparator (74x85)

Prescribed Textbooks:

1. Digital Design, M.Morris Mano & Michel D. Ciletti, 5th Edition, Pearson Education, 1999
2. Switching theory and Finite Automata Theory, Zvi Kohavi and Nirah K.Jha, 2nd Edition, Tata McGraw Hill, 2005.

Reference Books:

1. Fundamentals of Logic Design, Charles H Roth,Jr., 5th Edition, Brooks/cole Cengage Learning, 2004.

Online Learning Resources:

1. https://onlinecourses.nptel.ac.in/noc21_ee75/preview
2. <https://www.nesoacademy.org/ee/05-digital-electronics>

CO-PO Mapping:

Course Outcomes	Engineering Knowledge	Problem Analysis	Design/Development of Solutions	Conduct Investigations of Complex Problems	Modern Tool Usage	The Engineer and Society	Environment And Sustainability	Ethics	Individual And Team Work	Communication	Project Management And Finance	Life-Long Learning	PSO1	PSO2
23A0252T.1	3	2	2	1	2	1	-	-	-	-	-	2	3	2
23A0252T.2	3	3	2	2	2	1	-	-	-	-	-	2	3	2
23A0252T.3	3	2	3	1	3	1	-	-	-	-	-	3	3	3
23A0252T.4	3	2	2	2	2	1	-	-	-	-	-	2	3	2
23A0252T.5	3	2	3	2	3	1	-	-	-	-	-	3	3	3

ANNAMACHARYA INSTITUTE OF TECHNOLOGY AND SCIENCES RAJAMPET

(An Autonomous Institution)

Department of Electrical and Electronics Engineering

Title of the Course: Power Systems-II

Category: PC

Couse Code: 23A0253T

Year : III

Semester I

Branch/es: EEE

Lecture Hours

3

Tutorial Hours

0

Practice Hours

0

Credits

3

Course Objectives:

1. To study the line parameters and constants
2. To study the performance of transmission lines
3. To know about overhead line insulators, corona, sag, and tension in transmission lines
4. To study symmetrical components and different types of faults in the power system.
5. To understand the concept of voltage control, compensation methods

Course Outcomes:

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

1. Analyse the transmission lines and obtain the transmission line parameters and constants.
2. Analyse transmission line performance
3. Design transmission lines to meet the day to day power requirements.
4. Understand and apply the Per Unit System for Fault Calculations
5. Apply load compensation techniques to control reactive power.

Unit 1 Transmission Line Parameters:

12

Types of Conductors - Calculation of Resistance for Solid Conductors, Bundle Conductors, Skin effect, Proximity effect, Concept of GMR & GMD- Transposition of Power lines- Calculation of inductance for single phase and three phase, Single and Double circuit lines, Symmetrical and asymmetrical conductor configurations with and without transposition. Calculation of Capacitance for 2 wire and 3 wire systems, effect of ground on Capacitance, Capacitance calculations for symmetrical and asymmetrical single and three phase, single and double circuit lines, Numerical Problems

Unit 2 Performance Of Transmission Lines:

10

Classification of Transmission Lines-Short, medium and long line and their models representation - Nominal-T, Nominal- π and A, B, C, D Constants for symmetrical networks, Numerical Problems and solutions for estimating regulation and efficiency of all types of lines. Ferranti effect and Charging Current

Unit 3 Overhead Line Insulators:

10

Types of Insulators- Pin type, Suspension type and Strain Type, String efficiency and Methods for improvement, – Voltage Distribution, Calculation of String efficiency, Capacitance Grading and Static Shielding, Numerical Problems.

Unit 4 Sag and Tension and sag:

10

Sag and Tension Calculations with equal and unequal heights of towers, Effect of wind and ice on weight of conductor, Stringing chart, Sag template and its applications, Vibration and Vibration dampers, Numerical Problems.

Corona: Corona- factors affecting corona, critical disruptive voltage, critical voltages and Power loss due to Corona. Radio Interference.

Unit 5 Voltage Control and Power Factor Improvement:**10**

Methods of voltage control, shunt and series capacitors / Inductors, tap changing transformers, synchronous phase modifiers, power factor improvement methods. Compensation in Power Systems: Concepts of Load compensation, Load ability characteristics of overhead lines – Uncompensated transmission line – Symmetrical line – Radial line with asynchronous load – Compensation of lines.

Prescribed Textbooks:

1. C.L. Wadhwa, Electrical Power Systems, New Age International Pub. Co, Third Edition, 2001.
2. D.P. Kothari and I.J. Nagrath, Modern Power System Analysis, Tata McGraw-Hill Pub. Co., New Delhi, 4th edition, 2011.
3. B.R. Gupta, Power System Analysis and Design, S. Chand Publishing, 1998.

Reference Books:

1. Chakrabarti, M.L. Soni, P.V. Gupta, U.S. Bhatnagar, —A Textbook on Power System Engineering||, Dhanpat Rai Publishing Company (P) Ltd, 2008.
2. John J. Grainger & W.D. Stevenson, —Power System Analysis, Mc Graw Hill International, 1994. 3. Hadi Sadat, —Power System Analysis, Tata Mc Graw Hill Pub. Co., 2002.
3. W.D. Stevenson, Elements of Power System Analysis, McGraw-Hill International Student Edition.

CO-PO Mapping:

Course Outcomes	Engineering Knowledge	Problem Analysis	Design/Development of Solutions	Conduct Investigations of Complex Problems	Modern Tool Usage	The Engineer and Society	Environment And Sustainability	Ethics	Individual And Team Work	Communication	Project Management And Finance	Life-Long Learning	PSO1	PSO2
23A0253T.1	3	3	2	2	-	1	-	-	-	-	-	-	3	1
23A0253T.2	3	3	2	2	-	1	-		-	-	-	-	3	-
23A0253T.3	3	2	2	2	-	1	-		-	-	-	-	3	1
23A0253T.4	3	2	2	2	-	1	-		-	-	-	-	3	1
23A0253T.5	3	2	2	2	-	1	-		-	-	-	-	3	-

ANNAMACHARYA INSTITUTE OF TECHNOLOGY AND SCIENCES RAJAMPET
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Department of Electrical and Electronics Engineering

Title of the	Introduction to Quantum Technologies and Applications
Category:	PE-I
Course Code:	23A0554T
Year :	III
Semester	I
Branch/es:	EEE

Lecture Hours

3

Tutorial Hours

0

Practice Hours

0

Credits

3

Course Objectives:

To understand the basic properties quantum concepts and quantum technologies.

1. Introduce fundamental quantum concepts like superposition and entanglement.
2. Understand theoretical structure of qubits and quantum information.
3. Explore conceptual challenges in building quantum computers.
4. Explain principles of quantum communication and computing.
5. Examine real-world applications and the future of quantum technologies

Course Outcomes:

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

1. Explain core quantum principles in a non-mathematical manner.
2. Compare classical and quantum information systems.
3. Identify theoretical issues in building quantum computers.
4. Discuss quantum communication and computing concepts.
5. Recognize applications, industry trends, and career paths in quantum technology.

Unit 1: Introduction to Quantum Theory and Technologies

The transition from classical to quantum physics, Fundamental principles explained conceptually: Superposition, Entanglement, Uncertainty Principle, Wave-particle duality, Classical vs Quantum mechanics – theoretical comparison, Quantum states and measurement: nature of observation, Overview of quantum systems: electrons, photons, atoms, The concept of quantization: discrete energy levels, Why quantum? Strategic, scientific, and technological significance, A snapshot of quantum technologies: Computing, Communication, and Sensing, National and global quantum missions: India's Quantum Mission, EU, USA, China

Unit 2: Theoretical Structure of Quantum Information Systems

What is a qubit? Conceptual understanding using spin and polarization, Comparison: classical bits vs quantum bits, Quantum systems: trapped ions, superconducting circuits, photons (non-engineering view), Quantum coherence and decoherence – intuitive explanation, Theoretical concepts: Hilbert spaces, quantum states, operators – only interpreted in abstract, The role of entanglement and non-locality in systems, Quantum information vs classical information: principles and differences, Philosophical implications: randomness, determinism, and observer role.

Unit 3: Building a Quantum Computer – Theoretical Challenges and Requirements

What is required to build a quantum computer (conceptual overview)? Fragility of quantum systems: decoherence, noise, and control, Conditions for a functional quantum system: Isolation, Error management, Scalability, Stability, Theoretical barriers:

Why maintaining entanglement is difficult, Error correction as a theoretical necessity, Quantum hardware platforms (brief conceptual comparison), Superconducting circuits, Trapped ions, Photonics, Vision vs reality: what's working and what remains elusive, The role of quantum software in managing theoretical complexities

Unit 4: Quantum Communication and Computing – Theoretical Perspective

Quantum vs Classical Information, Basics of Quantum Communication, Quantum Key Distribution (QKD), Role of Entanglement in Communication, The Idea of the Quantum Internet – Secure Global Networking, Introduction to Quantum Computing, Quantum Parallelism (Many States at Once), Classical vs Quantum Gates, Challenges: Decoherence and Error Correction, Real-World Importance and Future Potential.

Unit 5: Applications, Use Cases, and the Quantum Future

Real- world application domains: Healthcare (drug discovery), Material science, Logistics and optimization, Quantum sensing and precision timing, Industrial case studies: IBM, Google, Microsoft, Psi Quantum, Ethical, societal, and policy considerations, Challenges to adoption: cost, skills, standardization, Emerging careers in quantum: roles, skillsets, and preparation pathways, Educational and research landscape – India's opportunity in the global quantum race.

Textbooks:

1. Michael A. Nielsen, Isaac L. Chuang, Quantum Computation and Quantum Information, Cambridge University Press, 10th Anniversary Edition, 2010.
2. Eleanor Rieffel and Wolfgang Polak, Quantum Computing: A Gentle Introduction, MIT Press, 2011.
3. Chris Bernhardt, Quantum Computing for Everyone, MIT Press, 2019.

Reference Books:

1. David McMahon, Quantum Computing Explained, Wiley, 2008.
2. Phillip Kaye, Raymond Laflamme, Michele Mosca, An Introduction to Quantum Computing, Oxford University Press, 2007.
3. Scott Aaronson, Quantum Computing Since Democritus, Cambridge University Press, 2013.
4. Alastair I.M. Rae, Quantum Physics: A Beginner's Guide, Oneworld Publications, Revised Edition, 2005.
5. Eleanor G. Rieffel, Wolfgang H. Polak, Quantum Computing: A Gentle Introduction, MIT Press, 2011.
6. Leonard Susskind, Art Friedman, Quantum Mechanics: The Theoretical Minimum, Basic Books, 2014.
7. Bruce Rosenblum, Fred Kuttner, Quantum Enigma: Physics Encounters Consciousness, Oxford University Press, 2nd Edition, 2011.
8. Giuliano Benenti, Giulio Casati, Giuliano Strini, Principles of Quantum Computation and Information, Volume I: Basic Concepts, World Scientific Publishing, 2004.
9. K.B. Whaley et al., Quantum Technologies and Industrial Applications: European Roadmap and Strategy Document, Quantum Flagship, European Commission, 2020.
10. Department of Science & Technology (DST), Government of India, National Mission on Quantum Technologies & Applications – Official Reports and Whitepapers, MeitY/DST Publications, 2020.

Online Learning Resources:

1. IBM Quantum Experience and Qiskit Tutorials
2. Coursera – Quantum Mechanics and Quantum Computation by UC Berkeley
3. edX – The Quantum Internet and Quantum Computers
4. YouTube – Quantum Computing for the Determined by Michael Nielsen
5. Qiskit Textbook – IBM Quantum

ANNAMACHARYA INSTITUTE OF TECHNOLOGY AND SCIENCES RAJAMPET

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Department of Electrical and Electronics Engineering

Title of the Signals and Systems

Category: PE-I

Couse Code: 23A025AT

Year : III

Semester I

Branch/es: EEE

Lecture Hours

3

Tutorial Hours

0

Practice Hours

0

Credits

3

Course Objectives:

To understand the basic properties of signal & systems and LTI systems.

1. To learn Fourier series representation of periodic signals.
2. To study representation of signals in continuous and discrete time Fourier transform
3. To analyze the sampling theorem and characterize signals & systems in time & frequency domain.
4. To apply Laplace transform and Z transform to study about the stability of systems.

Course Outcomes:

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

1. Explain the basic properties of signal & systems and LTI systems. L2
2. Apply Fourier series to represent periodic signals. L3
3. Represent signals in continuous and discrete time Fourier transform. L2
4. Analyze the sampling theorem and characterize signals & systems in time & frequency domain. L3
5. Analyse the stability of systems by applying Laplace transform and Z transform . L3

UNIT I: Signals and Systems :

10

Continuous and Discrete Time Signals, Transformations of the Independent Variable, Elementary Signals- Unit Impulse, Unit Step Functions, Ramp Signal, Rectangular function, Signum Function, Sinc & Sa Function, Exponential and Sinusoidal Signals, Classification of Signals & Systems, Continuous and Discrete Time Systems, Basic System Properties, Linear Time Invariant (LTI) Systems, Discrete-Time LTI Systems, Convolution Sum, Continuous Time LTI Systems, Convolution Integral, Properties of LTI Systems, Causal LTI Systems described by Differential and Difference Equations, Singularity Functions.

UNIT II: Fourier series representation of periodic signals:

10

Response of LTI Systems to Complex Exponentials. Fourier Series Representation of Continuous Time Periodic Signals, Trigonometric, Polar, Exponential fourier Series & related problems, Convergence of the Fourier Series, Properties of Continuous Time Fourier Series, Fourier Series Representation of Discrete Time Periodic Signals, Properties of Discrete Time Fourier Series, Fourier Series and LTI Systems,

UNIT III: The Continuous-Time Fourier Transform:

10

Representation of aperiodic Signals, Continuous Time Fourier Transform, Fourier Transform for Periodic Signals, Properties of the Continuous Time Fourier Transform, Systems characterized by Linear constant coefficient differential equations, Discrete Time Fourier Transform - Representation of Aperiodic Signals, Discrete Time Fourier Transform, Frequency Response, Systems Characterized by Linear Constant-Coefficient Difference Equations.

UNIT IV: Time & Frequency Characterization of Signals and Systems :**10**

The Magnitude Phase Representation of the Fourier Transform, Magnitude Phase Representation of the Frequency Response of LTI Systems, Time-Domain Properties of Ideal Frequency Selective Filters, Time Domain and Frequency Domain Aspects of Non-ideal Filters, Examples of Continuous time filters and Discrete time filters described by differential equations, First-Order and Second-Order Continuous and Discrete-Time Systems, Examples of Time and Frequency Domain Analysis of Systems, Sampling: Representation of a Continuous Time Signal by Its Samples, Sampling Theorem, Reconstruction of a Signal from Its Samples Using Interpolation, Effect of under sampling: Aliasing, Discrete Time Processing of Continuous-Time Signals.

UNIT V: Laplace and Z-Transforms :**10**

The Laplace Transform, Region of Convergence for Laplace Transforms, Inverse Laplace Transform, Geometric Evaluation of the Fourier Transform from the Pole-Zero Plot, Properties of the Laplace Transform, Some Laplace Transform Pairs, Analysis and Characterization of LTI Systems Using the Laplace Transform, System Function Algebra and Block Diagram Representations, Unilateral Laplace Transform, Z-Transform - Region of Convergence for the z-Transform, Inverse z-Transform, Geometric Evaluation of the Fourier Transform from the Pole-Zero Plot, Properties of the z-Transform, Some Common z-Transform Pairs, Analysis and Characterization of LTI Systems Using z-Transforms, System Function Algebra and Block Diagram Representations, Unilateral z-Transforms.

TEXT BOOKS:

1. Signals and Systems, Alan V. Oppenheim, Alan S. Willsky, & S. Hamid, 2nd Edition, Pearson Higher Education, 1997.
2. Principles of Linear Systems and Signals, B.P. Lathi, 2nd Edition, Oxford University Press, 2011.

REFERENCE BOOKS:

1. Signals & Systems, Simon Haykin and B. Van Veen, 2nd Edition, John Wiley, 2003.
2. Signals and systems, Narayana Iyer and K Satya Prasad, 1st Edition, CENGAGE Learning, 2011.
3. Signals, Systems and Transforms, C. L. Philips, J. M. Parr and Eve A. Riskin, 4th Edition, Pearson education, 2008.

CO-PO Mapping:

Course Outcomes	Engineering Knowledge	Problem Analysis	Design/Development of Solutions	Conduct Investigations of Complex Problems	Modern Tool Usage	The Engineer and Society	Environment And Sustainability	Ethics	Individual And Team Work	Communication	Project Management And Finance	Life-Long Learning	PSO1	PSO2
23A025AT.1	3	3	2	1	-	2	-	-	-	-	-	1	3	2
23A025AT.2	3	3	3	2	-	2	-	-	-	-	-	1	3	2
23A025AT.3	3	3	2	1	-	1	-	-	-	-	-	1	3	2
23A025AT.4	3	3	2	2	-	1	-	-	-	-	-	1	3	2
23A025AT.5	2	3	2	2	-	1	-	-	-	-	-	1	3	2

ANNAMACHARYA INSTITUTE OF TECHNOLOGY AND SCIENCES RAJAMPET
(An Autonomous Institution)

Department of Electrical and Electronics Engineering

Title of the Electrical Safety and Risk Management
Category: PE-I
Course Code: 23A025BT
Year : III
Semester I
Branch/es: EEE

Lecture Hours

3

Tutorial Hours

0

Practice Hours

0

Credits

3

Course Objectives:

The student will be able to:

1. Understand Electrical Safety Principles
2. Apply Safety Measures during Electrical Installations
3. Assess Electrical Safety in Various Installations
4. Design Safety Protocols for Hazardous Environments
5. Implement Electrical Safety Management and Regulatory Compliance

Course Outcomes:

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

CO1: Explain the objectives and precautions of Electrical Safety, effects of Shocks and their Prevention. L2

CO2: Summarize the Safety aspects during Installation of Plant and Equipment. L2

CO3: Describe the electrical safety in residential, commercial and agricultural installations. L3

CO4: Describe the various Electrical Safety in Hazardous Areas, Equipment Earthing and System Neutral Earthing. L3

CO5: State the electrical systems safety management and IE rules. L2

Unit 1 Introduction to Electrical Safety, Shocks and Their Prevention 8

Terms and definitions, objectives of safety and security measures, Hazards associated with electric current and voltage, who is exposed, principles of electrical safety, Approaches to prevent Accidents, scope of subject electrical safety. Primary and secondary electrical shocks, possibilities of getting electrical shock and its severity, medical analysis of electric shocks and its effects, shocks due to flash/ Spark over's, prevention of shocks, safety precautions against contact shocks, flash shocks, burns, residential buildings and shops.

Unit 2 Safety During Installation of Plant and Equipment 8

Introduction, preliminary preparations, preconditions for start of installation work, during, risks during installation of electrical plant and equipment, safety aspects during installation, field quality and safety during erection, personal protective equipment for erection personnel, installation of a large oil immersed power transformer, installation of outdoor switchyard equipment, safety during installation of electrical rotating machines, drying out and insulation resistance measurement of rotating machines.

Unit 3 Safety in Residential, Commercial and Agricultural Installations 8

Wiring and fitting – Domestic appliances – water tap giving shock – shock from wet wall – fan firing shock – multi-storied building – Temporary installations – Agricultural pump installation – Do's and Don'ts for safety in the use of domestic electrical appliances.

Unit 4 Electrical Safety in Hazardous Areas 8

Hazardous zones – class 0,1 and 2 – spark, flashovers and corona discharge and functional requirements – Specifications of electrical plants, equipment's for hazardous locations – Classification of equipment enclosure for various hazardous gases and vapours– classification of equipment/enclosure for hazardous locations.

Equipment Earthing and System Neutral Earthing: Introduction, Distinction between system grounding and Equipment Grounding, Equipment Earthing, Functional Requirement of earthing system, description of a earthing system, neutral grounding (System Grounding), Types of Grounding, Methods of Earthing Generators Neutrals.

Unit 5 Safety Management of Electrical Systems

8

Principles of Safety Management, Management Safety Policy, Safety organization, safety auditing, Motivation to managers, supervisors, employees.

Review of IE Rules and Acts and Their Significance: Objective and scope – ground clearances and section clearances – standards on electrical safety - safe limits of current, voltage –Rules regarding first aid and firefighting facility. The Electricity Act, 2003, (Part1, 2, 3,4 & 5)

Prescribed Textbooks:

1. S. Rao, Prof. H.L. Saluja, —Electrical safety, fire safety Engineering and safety management, Khanna Publishers. New Delhi, 1988. (units-I to V)
2. www.apeasternpower.com/downloads/elecact2003.pdf (Part of unit-V)

Reference Books:

1. Pradeep Chaturvedi, “Energy management policy, planning and utilization”, Concept Publishing company, New Delhi, 1997.

CO-PO Mapping:

Course Outcomes	Engineering Knowledge	Problem Analysis	Design/Development of Solutions	Conduct Investigations of Complex Problems	Modern Tool Usage	The Engineer and Society	Environment And Sustainability	Ethics	Individual And Team Work	Communication	Project Management And Finance	Life-Long Learning	PSO1	PSO2
23A025BT.1	3	2	1	1	-	2	-	1	-	-	1	2	3	2
23A025BT.2	2	2	3	2	-	2	-	1	-	-	1	2	3	2
23A025BT.3	3	2	2	1	-	2	-	1	-	-	1	2	2	2
23A025BT.4	3	3	2	2	-	2	-	1	-	-	1	2	2	2
23A025BT.5	2	2	2	2	-	2	-	1	-	-	1	3	2	2

ANNAMACHARYA INSTITUTE OF TECHNOLOGY AND SCIENCES RAJAMPET

(An Autonomous Institution)

Department of Electrical and Electronics Engineering

Title of the Course: Utilization of Electrical Energy

Category: PE-I

Course Code: 23A025CT

Year : III

Semester I

Branch/es: EEE

Lecture Hours
3

Tutorial Hours
0

Practice Hours
0

Credits
3

Course Objectives:

1. To discuss different types of electric drives and its characteristics.
2. To discuss different types of electric heating and welding
3. To understand the fundamentals and various methods of Illumination.
4. To discuss the importance of electric traction.
5. To discuss about the electrolysis, extraction, and refining of metals

Course Outcomes:

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

1. Apply the appropriate electric drives for various industrial applications. (L4)
2. Understand the different types of heating and welding techniques. (L2)
3. Design an illumination system for the proper lighting system. (L5)
4. Understand the basic principle and different braking techniques of electric traction. (L2)
5. Understand the basic principle and applications of the electrolytic process. (L1)

Unit 1 Electric Drives:

10

Type of electric drives – rating and choice of motor - starting and running characteristics – particular applications of electric drives - types of industrial loads - Continuous - intermittent and variable loads.

Unit 2 Electric Heating & Welding:

10

Electric Heating- Advantages and methods of electric heating - resistance heating - induction heating and dielectric heating.

Electric Welding - Classification- resistance and arc welding - electric welding equipment - comparison between AC and DC Welding.

Unit 3 Illumination:

10

Introduction - terms used in illumination - laws of illumination - sources of light. Discharge lamps – mercury vapor and sodium vapor lamps–comparison between tungsten filament lamps and fluorescent tubes–compact fluorescent lamp–LED-Basic principles of light control-Types and design of good lighting system and practice - flood lighting.

Unit 4 Electric Traction:

12

Traction systems: System of electric traction and track electrification - Review of existing electric traction systems in India - Special features of traction motor - Speed-time curves for different services - methods of electric braking - plugging - rheostatic braking - regenerative braking. Introduction to Magnetic Levitation vehicles.

Unit 5 Electrolytic Process:

08

Introduction - Basic principles - Faradays laws of electrolysis - Energy efficiency – Electrodeposition - Factors governing deposition Processes - Deposition of Alloys – Extraction and refining of metals. Fuel Cells.

Prescribed Textbooks:

1. J. B. Gupta, "Utilization of Electrical Power and Electric Traction", 10th edition, S. K. Kataria and Sons, 2022.
2. S.Sivanagaraju, M.Balasubba Reddy, D.Srilatha, "Generation and Utilization of Electrical Energy" Pearson publishers, 2010.
3. C.L Wadhwa, "Generation Distribution and Utilization of Electrical Energy", New age International Publishers, New Delhi, 2005.

Reference Books:

1. Partab, "Art & Science of Utilization of electrical Energy", 2nd edition, Dhanpat Rai & Sons, New Delhi, 2007.
2. R.K.Rajput, "Utilization of Electrical Power", 1st edition, Laxmi Publications (P) Ltd., New Delhi. 2006.
3. G. C. Garg, "Utilization of Electrical Power & Electric traction", 8th edition, Khanna publishers, New Delhi, 2005.
4. N. V. Suryanarayana, "Utilization of Electrical Power including Electric drives and Electric traction", New Age International (P) Limited, Publishers, 1996.

Web Resources:

1. <https://nptel.ac.in/courses/108105060>
2. <https://nptel.ac.in/courses/112105221>
3. https://vssut.ac.in/lecture_notes/lecture1426861925.pdf
4. <https://vpmppee.wordpress.com/uee-3340903/>

CO-PO Mapping:

Course Outcomes	Engineering Knowledge	Problem Analysis	Design/Development of Solutions	Conduct Investigations of Complex Problems	Modern Tool Usage	The Engineer and Society	Environment And Sustainability	Ethics	Individual And Team Work	Communication	Project Management And Finance	Life-Long Learning	PSO1	PSO2
23A025CT.1	3	3	3	-	-	-	-	-	-	-	-	-	3	-
23A025CT.2	3	-	-	-	-	3	3	-	-	-	-	-	3	-
23A025CT.3	3	3	3	-	-	3	3	-	1	-	-	-	3	-
23A025CT.4	3	3	-	-	-	3	3	-	-	-	-	-	3	-
23A025CT.5	3		-	-	-	3	3	-	-	-	-	-	3	3

ANNAMACHARYA INSTITUTE OF TECHNOLOGY AND SCIENCES RAJAMPET
(An Autonomous Institution)

Department of Electrical and Electronics Engineering

Title of the Course	High Voltage Engineering
Category	PE-I
Course Code	23A025DT
Year	III
Semester	I
Branch	EEE

Lecture Hours	Tutorial Hours	Practice Hours	Credits
3	0	0	3

Course Objectives:

1. To discuss about the different applications of solid, liquid gas and vacuum insulating materials
2. To know about the concept of breakdown phenomenon behind the insulating materials
3. To familiar about the different type of high voltages and current generations includes measurements
4. To discuss the testing procedure of power apparatus and insulation co-ordinations

Course Outcomes:

At the end of the course, the student will be able to	Blooms Level of Learning
1. Describe the general aspects of electrical testing methods	L2
2. Describe the breakdown phenomenon of insulating materials	L2
3. Distinguish the different type of High voltage and current generations	L2
4. Demonstrate the significance of high voltage based testing procedures in electrical apparatus	L3
5. Discuss the need and procedures of insulation coordination	L2

Unit 1 Introduction to High Voltage Engineering 11
Electric field stresses. Gas/ Vacuum as insulator, Liquid dielectrics. Solids and composites, Surge voltages, their distribution and control, Applications of insulating materials in transformers, rotating machines, circuit breakers, cables, power capacitors.

Unit 2 Breakdown in Dielectric Materials 11
Gases as insulating media, collision process, Ionization process, Townsend's criteria of breakdown in gases, Paschen's law. Liquid as Insulator, pure and commercial liquids, breakdown in pure and commercial liquids. Intrinsic breakdown, electromechanical breakdown, thermal breakdown, breakdown of solid dielectrics in practice, Breakdown in composite dielectrics.

Unit 3 Generation & Measurement of High Voltages and Currents: 11
Generation of High Direct Current Voltages, Generation of High alternating voltages, Generation of Impulse Voltages, Generation of Impulse currents, Tripping and control of impulse generators. Measurement of High Direct Current voltages, Measurement of High Voltages alternating and impulse, Measurement of High Currents-direct, alternating and Impulse, Oscilloscope for impulse voltage and current measurements.

Unit 4 Over voltages and insulation Co-ordination 9
Natural causes for over voltages – Lightning phenomenon, Overvoltage due to switching surges, system faults and other abnormal conditions, Principles of Insulation Coordination on High voltage and Extra High Voltage power systems.

Unit 5 Testing of Materials & Electrical Apparatus 10
Measurement of D.C Resistivity, Measurement of Dielectric Constant and loss factor, Partial discharge measurements. Testing of Insulators and bushings, Testing of Isolators and circuit breakers, testing of cables, Testing of Transformers, Testing of Surge Arresters, Radio Interference measurements. IEEE safety recommendations for high voltage testing.

Prescribed Text Books:

- 1.High Voltage Engineering by M.S.Naidu and V. Kamaraju, TMH Publications. 6thed, 2020
- 2.High Voltage Engineering by C.L.Wadhwa, New Age Internationals (P) Ltd. 4thed, 2020
- 3.High Voltage Electrical Insulation Engineering by Ravindra Arora, Wolfgang New Age Internationals, 2011

Reference Books:

- 1.High Voltage Engineering: Fundamentals by E.Kuffel, W.S.Zaengl,by Elsevier.2nd ed, 2000
- 2.High Voltage Engineering, Theory and Practice Ahdan El-Morshedy, Morcel Dekkellnc, 2nd ed, 2000

Web Resources:

1. <https://nptel.ac.in/courses/108/104/108104048/>

CO-PO Mapping:

Course Outcomes	Engineering Knowledge	Problem Analysis	Design/Development of Solutions	Conduct Investigations of Complex Problems	Modern Tool Usage	The Engineer and Society	Environment And Sustainability	Ethics	Individual And Team Work	Communication	Project Management And Finance	Life-Long Learning	PSO1	PSO2
23A025DT.1	3	2	1	1	2	1	-	-	-	-	2	-	2	1
23A025DT.2	3	1	2	1	2	1	-	-	-	-	2	-	2	2
23A025DT.3	3	2	2	1	2	1	-	-	-	-	2	1	2	2
23A025DT.4	3	2	1	2	2	1	-	-	-	-	2	1	2	2
23A025DT.5	3	2	2	2	2	1	-	-	-	-	2	1	2	3

ANNAMACHARYA INSTITUTE OF TECHNOLOGY AND SCIENCES: RAJAMPET
(An Autonomous Institution)

Department of Electrical and Electronics Engineering

Title of the Course	Power Electronics and Simulation Lab
Category	PC
Couse Code	23A0251L
Year	III
Semester	I
Branch/es	EEE

Lecture Hours	Tutorial Hours	Practical	Credits
0	0	3	1.5

Course Objectives:

1. Understand the characteristics of power electronic devices.
2. Distinguish gate firing circuits & forced commutation techniques
3. Analyze the operation of phase-controlled converters, AC voltage controllers and Inverters
4. Simulate the different power electronics converters

Course Outcomes:

At the end of the course, the student will be able to	Blooms Level of Learning
1. Understand the characteristics of SCR, MOSFET & IGBT	L1
2. Analyze the firing circuits and commutation methods of SCRs	L2
3. Analyze the operation of AC/DC & DC/DC converters	L2
4. Analyze the operation of AC/AC & DC/AC converters	L2
5. Analyze the simulation circuits of various converters	L2

List of Experiments:

Perform any ten experiments out of the following

1. Study the Characteristics of SCR, MOSFET & IGBT
2. Gate Firing Circuits for SCR's (R, RC Triggering, UJT firing circuit).
3. Forced Commutation Circuits (Class A, Class B).
4. Single Phase Half Controlled Bridge Converter with R and RL loads.
5. Single Phase Fully Controlled Bridge Converter with R and RL loads.
6. Single Phase Dual Converter with RL load.
7. Single Phase Series Inverter with R and RL loads
8. Single Phase Parallel Inverter with R and RL loads.
9. Single of Phase AC Voltage Controller with R and RL Loads
10. Simulation of Single Phase Cyclo Converter with R and RL loads.
11. Simulation of Single-Phase Fully Controlled Rectifier with R, RL & RLE loads.
12. Simulation of Single-Phase Full Bridge Inverter with PWM control.
13. Simulation of Single-Phase Full Wave AC voltage controller with R&RL loads.
14. DC Jones Chopper with R and RL Loads.
15. Speed control of PMDC motor using MOSFET

Web Resources:

<https://www.nielit.gov.in/content/power-electronics-lab>

CO-PO Mapping:

Course Outcomes	Engineering Knowledge	Problem Analysis	Design/Development of Solutions	Conduct Investigations of Complex Problems	Modern Tool Usage	The Engineer and Society	Environment And Sustainability	Ethics	Individual And Team Work	Communication	Project Management And Finance	Life-Long Learning	PSO1	PSO2
23A0251L.1	3	-	-	-	-	-	1	-	-	1	-	1	3	-
23A0251L.2	3	3	-	2	-	-	1	-	-	3	-	1	3	-
23A0251L.3	3	3	2	2	2	-	2	-	-	1	-	1	3	2
23A0251L.4	3	3	2	2	2	-	2	-	-	1	-	1	3	2
23A0251L.5	3	3	2	3	3	-	2	-	1	1	1	2	3	3

ANNAMACHARYA INSTITUTE OF TECHNOLOGY AND SCIENCES RAJAMPET
(An Autonomous Institution)

Department of Electrical and Electronics Engineering

Title of the Course: Analog & Digital Circuits Lab
Category: PC
Course Code: 23A0252L
Year: III
Semester: I
Branch/es: EEE

Lecture Hours	Tutorial Hours	Practice Hours	Credits
0	0	3	1.5

Course Objectives:

1. To analysis of transistor-based amplifiers
2. To generate different types of non-sinusoidal signals
3. To verify the applications of Op-Amp
4. To analysis of various combinational and sequential logic circuits

Course Outcomes:

At the end of the course, the student will be able to Blooms Level of Learning

Blooms Level of
Learning

- | | |
|--|----|
| 1. Design of Amplifiers with its frequency response | L5 |
| 2. Design of oscillators with its frequency response | L5 |
| 3. Analysis of wave shaping circuits | L4 |
| 4. Discuss the applications of Op-Amp and Timer | L3 |
| 5. Analysis of various combinational and sequential logic circuits | L4 |

List of Experiments Perform any ten experiments

S.NO Name of Experiment

1. RC-Phase shift Oscillator
2. Hartley/ Colpitts Oscillator
3. CB & CE Characteristics
4. Design and realization of Comparator.
5. Non-Linear Wave Shaping-Clipper and Clampers
6. Design an Adder and Subtractor circuits
7. Op-Amp application- LPF, HPF (First order)
8. IC 555-Timer- Monostable / Astable operation circuit.
9. Generation of clock using NAND / NOR gates
10. Three-Bit DAC/ADC using Op-Amp
11. Design of Encoders
12. Design of Decoder
13. Design Multiplexer/Demultiplexer
14. Design of Flip-Flops

Reference Books:

1. Ramakant A.Gayakward, 'Op-amps and Linear Integrated Circuits', IV edition, Pearson Education, 2003
2. S.Salivaganan, L.S.Kanchana, "Linear Integrated Circuits", III edition, Mc. Graw Hill, 2018.

Website link:

1. <https://www.youtube.com/watch?v=jVQ9Jg46W74>
2. <https://www.youtube.com/watch?v=aQIF-9i3fAA>

CO-PO-PSO Mapping:

Course Outcomes	Engineering Knowledge	Problem Analysis	Design/Development of Solutions	Conduct Investigations of Complex Problems	Modern Tool Usage	The Engineer and Society	Environment And Sustainability	Ethics	Individual And Team Work	Communication	Project Management And Finance	Life-Long Learning	PSO1	PSO2
23A0252L.1	3	2	2	2	2	1	-	-	1	-	-	-	3	2
23A0252L.2	3	2	2	-	2	1	-	-	1	-	-	-	3	2
23A0252L.3	3	1	1	-	2	1	-	-	1	-	-	1	3	2
23A0252L.4	3	2	2	2	2	1	-	-	1	-	-	1	2	1
23A0252L.5	3	2	2	2	2	1	-	-	1	-	-	1	2	1

ANNAMACHARYA INSTITUTE OF TECHNOLOGY AND SCIENCES RAJAMPET

(An Autonomous Institution)

Department of Electrical and Electronics Engineering

Title of the Soft Skills
Category: SEC
Couse Code: 23AHS55L
Year III
Semester: I
Branch/es: EEE

Lecture Hours
0

Tutorial Hours
1

Practice Hours
2

Credits
2

Course Objectives:

To encourage all round development of the students by focusing on soft skills

1. To make the students aware of critical thinking and problem-solving skills
2. To enhance healthy relationship and understanding within and outside an organization
3. To function effectively with heterogeneous teams

Course Outcomes (CO):

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

Blooms Level
of Learning

- | | |
|---|--------|
| 1. List out various elements of soft skills | L1, L2 |
| 2. Describe methods for building professional image | L1, L2 |
| 3. Apply critical thinking skills in problem solving | L3 |
| 4. Analyze the needs of an individual and team for well-being | L4 |
| 5. Assess the situation and take necessary decisions | L5 |
| 6. Create a productive work place atmosphere using social and work-life skills ensuring personal and emotional well-being | L6 |

UNIT – I Soft Skills & Communication Skills

Soft Skills - Introduction, Need - Mastering Techniques of Soft Skills – Communication Skills - Significance, process, types - Barriers of communication - Improving techniques

Activities:

Intrapersonal Skills- Narration about self- strengths and weaknesses- clarity of thought – self- expression – articulating with felicity

(The facilitator can guide the participants before the activity citing examples from the lives of the great, anecdotes and literary sources)

Interpersonal Skills- Group Discussion – Debate – Team Tasks - Book and film Reviews by groups - Group leader presenting views (non- controversial and secular) on contemporary issues or on a given topic.

Verbal Communication- Oral Presentations- Extempore- brief addresses and speeches- convincing- negotiating- agreeing and disagreeing with professional grace.

Non-verbal communication – Public speaking – Mock interviews – presentations with an objective to identify non- verbal clues and remedy the lapses on observation

UNIT – II Critical Thinking

Active Listening – Observation – Curiosity – Introspection – Analytical Thinking – Open- mindedness – Creative Thinking - Positive thinking – Reflection

Activities:

Gathering information and statistics on a topic - sequencing – assorting – reasoning – critiquing issues –placing the problem – finding the root cause - seeking viable solution – judging with rationale – evaluating the views of others - Case Study, Story Analysis

UNIT – III Problem Solving & Decision Making

Meaning & features of Problem Solving – Managing Conflict – Conflict resolution – Team building - Effective decision making in teams – Methods & Styles

Activities:

Placing a problem which involves conflict of interests, choice and views – formulating the problem – exploring solutions by proper reasoning – Discussion on important professional, career and organizational decisions and initiate debate on the appropriateness of the decision.

Case Study & Group Discussion

UNIT – IV Emotional Intelligence & Stress Management

Managing Emotions – Thinking before Reacting – Empathy for Others – Self-awareness – Self- Regulation – Stress factors – Controlling Stress – Tips

Activities:

Providing situations for the participants to express emotions such as happiness, enthusiasm, gratitude, sympathy, and confidence, compassion in the form of written or oral presentations.

Providing opportunities for the participants to narrate certain crisis and stress –ridden situations caused by failure, anger, jealousy, resentment and frustration in the form of written and oral presentation,

Organizing Debates

UNIT – V Corporate Etiquette

Etiquette- Introduction, concept, significance - Corporate etiquette - meaning, modern etiquette, benefits - Global and local culture sensitivity - Gender Sensitivity - Etiquette in interaction- Cell phone etiquette - Dining etiquette - Netiquette - Job interview etiquette -Corporate grooming tips - Overcoming challenges

Activities

Providing situations to take part in the Role Plays where the students will learn about bad and good manners and etiquette - Group Activities to showcase gender sensitivity, dining etiquette etc. - Conducting mock job interviews - Case Study - Business Etiquette Games

NOTE:-

1. The facilitator can guide the participants before the activity citing examples from the lives of the great, anecdotes, epics, scriptures, autobiographies and literary sources which bear true relevance to the prescribed skill.
2. Case studies may be given wherever feasible for example for Decision Making- The decision of King Lear.

Prescribed Books:

1. Mitra Barun K, Personality Development and Soft Skills, Oxford University Press, Pap/Cdr edition 2012
2. Dr Shikha Kapoor, Personality Development and Soft Skills: Preparing for Tomorrow, International Publishing House, 2018

Reference Books

1. Sharma, Prashant, Soft Skills: Personality Development for Life Success, BPB Publications 2018.
2. Alex K, Soft Skills S.Chand & Co, 2012 (Revised edition)
3. Gajendra Singh Chauhan & Sangeetha Sharma, Soft Skills: An Integrated Approach to Maximise Personality Published by Wiley, 2013
4. Pillai, Sabina & Fernandez Agna, Soft Skills and Employability Skills, Cambridge University Press, 2018
5. Dr. Rajiv Kumar Jain, Dr. Usha Jain, Life Skills (Paperback English) Publisher : Vayu Education of India, 2014

Online Learning Resources:

1. https://youtu.be/DUIsNJtg2L8?list=PLLy_2iUCG87CQhELCyvXh0E_y-bOO1_q
2. https://youtu.be/xBaLgJZ0t6A?list=PLzf4HHIsQFwJZel_j2PUy0pwjVUgj7_KIJ
3. <https://youtu.be/-Y-R9hDI7IU>
4. <https://youtu.be/gkLsn4ddmTs>
5. <https://youtu.be/2bf9K2rRWwo>

ANNAMACHARYA INSTITUTE OF TECHNOLOGY AND SCIENCES RAJAMPET

(An Autonomous Institution)

Department of Electrical and Electronics Engineering

Title of the	Tinkering Lab for Electrical Engineers
Category:	ES
Couse Code:	23A0254L
year	III
Semester:	I
Branch/es	EEE

Lecture Hours

0

Tutorial Hours

0

Practice Hours

2

Credits

1

Course Objectives:

Encourage Innovation and Creativity

- Provide Hands-on Learning and Impart Skill Development
- Foster Collaboration and Teamwork
- Enable Inter disciplinary Learning, Prepare for Industry and Entrepreneurship
- Impart Problem-Solving mind-set

Course Outcomes: The students will be able to experiment, innovate, and solve real-world challenges. These labs bridge the gap between academia and industry, providing students with the practical experience. Some students may also develop entrepreneurial skills, potentially leading to start-ups or innovation-driven careers. Tinkering labs aim to cultivate the next generation of engineers by giving them the tools, space, and mind-set to experiment, innovate, and solve real-world challenges.

List of experiments:

- 1) Make your own parallel and series circuits using breadboard for any application of your choice.
- 2) Demonstrate a traffic light circuit using breadboard.
- 3) Build and demonstrate automatic Street Light using LDR.
- 4) Simulate the Arduino LED blinking activity in Tinkercad.
- 5) Build and demonstrate an Arduino LED blinking activity using Arduino IDE.
- 6) Interfacing IR Sensor and Servo Motor with Arduino.
- 7) Blink LED using ESP32.
- 8) LDR Interfacing with ESP32.
- 9) Control an LED using Mobile App.
- 10) Design and 3D print a Walking Robot
- 11) Design and 3D Print a Rocket.
- 12) Build a live soil moisture monitoring project, and monitor soil moisture levels of a remote plan in your computer dashboard.
- 13) Demonstrate all the steps in design thinking to redesign a motor bike.

Website link:

- 1) <https://aim.gov.in/pdf/equipment-manual-pdf.pdf>
- 2) <https://atl.aim.gov.in/ATL-Equipment-Manual/>
- 3) <https://aim.gov.in/pdf/Level-1.pdf>
- 4) <https://aim.gov.in/pdf/Level-2.pdf>
- 5) <https://aim.gov.in/pdf/Level-3.pdf>

CO-PO Mapping:

Course Outcomes	Engineering Knowledge	Problem Analysis	Design/Development of Solutions	Conduct Investigations of Complex Problems	Modern Tool Usage	The Engineer and Society	Environment And Sustainability	Ethics	Individual And Team Work	Communication	Project Management And Finance	Life-Long Learning	PSO1	PSO2
23A0254L.1	3	3	3	2	3	2	1	-	-	1	-	2	3	2
23A0254L.2	3	3	3	2	1	2	1	-	-	1	-	2	2	2
23A0254L.3	3	3	3	2	1	2	1	-	-	1	-	2	2	2
23A0254L.4	2	3	3	3	3	2	1	-	-	1	-	2	2	2
23A0254L.5	2	3	3	3	3	2	1	-	-	1	-	2	2	2

ANNAMACHARYA INSTITUTE OF TECHNOLOGY AND SCIENCES RAJAMPET
(An Autonomous Institution)

Department of Electrical and Electronics Engineering

Title of the Electrical Measurements and Instrumentation
Category: PC
Couse Code: 23A0261T
year: III
Semester: II
Branch/es EEE

Lecture Hours	Tutorial Hours	Practice Hours	Credits
3	0	0	3

Course Objectives:

The student will be able:

1. To study about the working principle of electrical measuring instruments
2. To study the performance of instrumental transformers, power factor, frequency and energy meters
3. To study the functioning of DC and AC bridges
4. To study the basics of digital volt meters and transducers
5. To understand the concept of sensors and data acquisition systems

Course Outcomes:

Blooms

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

Level

- | | |
|---|-----------|
| 1. Understand principle and working of electrical measuring instruments | L2 |
| 2. Understand the principle of operation of instrument transformers, energy meters and analog instruments | L2 |
| 3. Understand the principle and working of various DC and AC bridges for the measurement of Resistance, Inductance and Capacitance. | L2 |
| 4. Understand the principle and working of different digital voltmeters and transducers. | L2 |
| 5. Understand the working of various sensors and data acquisition systems. | L2 |

Unit 1 Measuring instruments & Digital Meters: 10

Fundamentals: True Value, Errors (Gross, Systematic, Random); Static Characteristic of Instruments (Accuracy, Precision, Sensitivity, Resolution & threshold); Error Analysis- Simple problems; Statistical treatment of data-Simple problems.

Indicating Instruments: Three forces in Electromechanical indicating instrument (Deflecting, controlling & damping forces); Moving iron type (attraction and repulsion), PMMC, Electrodynamometer Type instruments: Torque equation (Expression only, no derivation), shape of scale – simple problems on torque equations; Measurement of voltage and current - Extension of Range of ammeter and voltmeter – problems on extension of range of ammeter and voltmeter.

Unit 2 Measurement of Power, Power Factor and Energy: 10

Instrument transformers: Types, CT and PT – Ratio and phase angle errors; (Expression only, no derivation)

Measurement of power: Principle and Operation of Single-phase dynamometer wattmeter, expression (Expression only no derivation) for deflecting and control torques, errors and compensations. Measurement of power factor: Principle and operation of Single-phase Electrodynamometer Power factor meter.

Measurement of Frequency: Principle and Operation of single phase frequency meter- vibrating reed type, - Ferro dynamic type meter.

Measurement of Energy: Principle and Operation of Single phase induction type energy meter, driving and braking torques (expression only no derivation), errors and compensations, testing by phantom loading.

Unit 3 D.C & A.C Bridges:**10**

Measurement of Resistance: Methods of measuring low, medium and high resistances –Sensitivity of Whetstone's bridge– Kelvin's double bridge for Measuring low resistance, Megger for measurement of high resistance.

Measurement of Inductance: - Maxwell's bridge, Anderson's bridge.

Measurement of Capacitance: De Sauty bridge. Wien's bridge–Schering bridge–Numerical problems.

Unit 4 Digital Volt Meters and Transducers:**8**

Digital Voltmeters: Ramp type, Dual Slope integrating type, successive approximation, Potentiometric type DVMs.

Classification of transducers: Active/passive, analog/digital- Strain Gauge-gauge factor (Elementary treatment only)-applications of strain gauge, Q-Meter.

Unit 5 Transducers, Sensors and Data Acquisition:**10**

Definition of Transducers, Classification of Transducers, Advantages of Electrical Transducers, characteristics and Choice of Transducers; Principle Operation of Resistor, Inductor and Capacitive Transducers; LVDT and its Applications, Strain Gauge and Its Principle of Operation, Gauge Factor, Thermistors, Thermocouples, Piezo Electric Transducers, Photo electric Transducers, Hall effect, Photo Diodes. Optocoupler.

Silicon based micro sensors: Pressure sensor, Gyro sensor, Accelerometer, Flow sensor, Proximity sensor, Temperature sensor, Humidity sensor. (Elementary treatment only) Introduction to PLC and SCADA Systems: Data acquisition systems (DAS) and interfacing techniques.

Prescribed Textbooks:

1. Electrical & Electronic Measurement & Instruments by A.K. Sawhney Dhanpat Rai & Co. Publications, 2007.
2. Electrical Measurements and measuring Instruments–by E.W.Golding and F.C. Widdis, 5th Edition, Reem Publications, 2011.
3. Buckingham and Price, —Electrical Measurements||, Prentice – Hall

Reference Books:

1. Electronic Instrumentation by H.S.Kalsi, Tata Mcgrawhill, 3rd Edition, 2011.
2. Electrical Measurements: Fundamentals, Concepts, Applications–by Reissl and, M.U, New Age International (P) Limited, 2010.
3. Electrical & Electronic Measurement & Instrumentation by R.K.Rajput, 2nd Edition, S. Chand & Co., 2nd Edition, 2013.
4. Sensor Technology: Hand Book by JonS. Wilson, ELSEVIER publications,2005

Online Learning Resources:

1. https://onlinecourses.nptel.ac.in/noc22_ee112/preview

CO-PO Mapping:

Course Outcomes	Engineering Knowledge	Problem Analysis	Design/Development of Solutions	Conduct Investigations of Complex Problems	Modern Tool Usage	The Engineer and Society	Environment And Sustainability	Ethics	Individual And Team Work	Communication	Project Management And Finance	Life-Long Learning	PSO1	PSO2
23A0261T.1	3	2	1	2	2	-	-	-	-	-	-	1	3	2
23A0261T.2	3	2	1	2	2	-	-	-	-	-	-	1	2	2
23A0261T.3	3	2	1	2	2	-	-	-	-	-	-	1	2	1
23A0261T.4	3	2	1	2	2	-	-	-	-	-	-	1	2	1
23A0261T.5	3	2	1	2	-	-	-	-	-	-	-	1	2	2

Department of Electrical and Electronics Engineering

Title of the Course: Microprocessors and Microcontrollers
Category: PC
Course Code: 23A0262T
year: III
Semester: II
Branch/es EEE

Lecture Hours

3

Tutorial Hours

0

Practice Hours

0

Credits

3

Course Objectives:

1. To learn the fundamental architectural concepts of Microprocessors.
2. To gain knowledge about assembly language programming concepts.
3. To get familiar about 8086 interfacing.
4. To understand the fundamentals of the 8051 Microcontroller.
5. To learn interfacing with the 8051 Microcontroller.

Course Outcomes:

Blooms Level of Learning

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

1. Learn the fundamental architectural concepts of microprocessors.
2. Write the assembly language programs.
3. Interface various sensors, display devices and other ICs with 8086.
4. Comprehend the fundamentals of the 8051 Microcontroller.
5. Interface input and output devices with 8051 Microcontroller.

L2

L6

L3

L2

L6

Unit1 8086 Architecture

10

Main features, pin diagram/description, 8086 microprocessor family, internal architecture, bus interfacing unit, execution unit, interrupts and interrupt response, 8086 system timing, minimum mode and maximum mode configuration.

Unit 2 8086 Programming

13

Program development steps, instructions, addressing modes, assembler directives, writing simple programs with an assembler, assembly language program development tools.

Unit 3 8086 Interfacing

14

Semiconductor memories (RAM, ROM) - Intel 8255 Programmable Peripheral Interface, interfacing switches and LEDs, Seven segment displays, Stepper motor - A/D and D/A converter.

Intel 8251 USART architecture and interfacing - Need of DMA & 8257A DMA controller Architecture - 8259 Programmable Interrupt Controller Architecture and its Importance.

Unit 4 Microcontroller

10

Architecture of 8051 – Special Function Registers(SFRs) - I/O Pins Ports and Circuits - Instruction set - Addressing modes - Assembly language programming.

Unit 5 Interfacing of 8051 & Advanced Microcontrollers

12

Programming 8051 Timers - Serial Port Programming - Interrupts Programming – LCD & Keyboard Interfacing - The ARM Architecture, ARM7, ARM9 Features and applications of ARM - Comparison of Microprocessor, Microcontroller, PIC and ARM processors.

Prescribed Textbooks:

1. K M Bhurchandi, A K Ray, Advanced Microprocessors and Peripherals, 3rd edition, McGraw Hill Education, 2017.
2. Kenneth J. Ayala, The 8051Microcontroller, 3rd edition, Cengage Learning, 2007.

Reference Books:

1. Ramesh S Gaonkar, Microprocessor Architecture Programming and Applications with the 8085, 6th edition, Penram International Publishing, 2013.
2. RajKamal, Microcontrollers: Architecture, Programming, Interfacing and System Design, 2nd edition, Pearson, 2012.
3. Microprocessors and Interfacing–Programming and Hardware by Douglas V Hall SSSP Rao, Tata McGraw Hill Education Private Limited, 3rd Edition, 2017.

Online Learning Resources:

1. <https://nptel.ac.in/courses/108/105/108105102>
2. <https://www.classcentral.com/course/swayam-microprocessors-and-microcontrollers-9894>

CO-PO Mapping:

Course Outcomes	Engineering Knowledge	Problem Analysis	Design/Development of Solutions	Conduct Investigations of Complex Problems	Modern Tool Usage	The Engineer and Society	Environment And Sustainability	Ethics	Individual And Team Work	Communication	Project Management And Finance	Life-Long Learning	PSO1	PSO2
23A0262T.1	2	1	1	1	-	-	-	1	-	-	-	1	-	-
23A0262T.2	3	3	3	3	3	-	-	1	2	2	-	3	3	3
23A0262T.3	3	2	1	1	-	-	-	1	-	-	-	1	-	-
23A0262T.4	2	1	1	1	-	-	-	1	-	-	-	1	-	-
23A0262T.5	3	3	3	3	3	-	-	1	2	2	-	3	3	3

ANNAMACHARYA INSTITUTE OF TECHNOLOGY AND SCIENCES RAJAMPET

(An Autonomous Institution)

Department of Electrical and Electronics Engineering

Title of the Power System Analysis
Category: PC
Couse Code: 23A0263T
year: III
Semester: II
Branch/es EEE

Lecture Hours

3

Tutorial Hours

0

Practice Hours

0

Credits

3

Course Objectives:

1. To understand the use of per unit system and graph theory concepts, solving a problem using computer.
2. Formation of Ybus and Zbus of a Power System network by various methods.
3. To analyze various load flow problems and solution methods.
4. Different types of faults and power system analysis for symmetrical and also unsymmetrical faults.
5. To analyze of power system for steady state and transient stability and also methods to improve stability

Course Outcomes:

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

1. Remember and understand the concepts of per unit values, Ybus and Zbus formation L2
2. Apply the concepts of good algorithm for the given power system network and obtain the Zbus. L3
3. Solve load flow problems by various methods. L2
4. Analyze the symmetrical faults and unsymmetrical faults and do the fault calculations. L4
5. Analyze the stability of the system and improve the stability. L4

Unit-I Per-Unit System and Ybus Formation:

9

Per-Unit representation of Power system elements - Per-Unit equivalent reactance network of a three phase Power System - Graph Theory: Definitions, Bus Incidence Matrix, Ybus formation by Direct and Singular Transformation Methods, Numerical Problems.

Unit-II Formation of Zbus:

9

Formation of Zbus: Partial network, Algorithm for the Modification of Zbus Matrix for addition element for the following cases: Addition of element from a new bus to reference, Addition of element from a new bus to an old bus, Addition of element between an old bus to reference and Addition of element between two old buses - Modification of Zbus for the changes in network.

Unit-III Power Flow Analysis:

9

Static load flow equations – Load flow solutions using Gauss Seidel Method: Algorithm and Flowchart. Acceleration Factor, Load flow Solution for Simple Power Systems (Max. 3-Buses): Newton Raphson Method in Polar Co-Ordinates Form: Load Flow Solution- Jacobian Elements, Algorithm and Flowchart. Decoupled and Fast Decoupled Methods.- Comparison of Different Methods.

Unit-IV Short Circuit Studies:

9

Short Circuit Current and MVA Calculations, Fault levels, Application of Series Reactors. Symmetrical Component Theory: Positive, Negative and Zero sequence components, Positive, Negative and Zero sequence Networks. Symmetrical Fault Analysis: LLLG faults with and without fault impedance, Unsymmetrical Fault Analysis: LG, LL and LLG faults with and without fault impedance, Numerical Problems.

Unit-V Stability Analysis:

9

Elementary concepts of Steady State, Dynamic and Transient Stabilities. Derivation of Swing Equation, Power Angle Curve and Determination of Steady State Stability. Determination of Transient Stability by Equal Area Criterion, Application of Equal Area Criterion, Critical Clearing Angle Calculation. Numerical methods for solution of swing equation - Methods to improve Stability - Application of Auto Reclosing and Fast Operating Circuit Breakers.

Prescribed Textbooks:

1. Computer Methods in Power System Analysis by G.W.Stagg and A.H.El-Abiad, Mc Graw-Hill, 2006.
2. Modern Power system Analysis by I.J.Nagrath & D.P.Kothari, Tata McGraw-Hill Publishing Company, 4th Edition, 2011.

Reference Books:

1. Power System Analysis by Grainger and Stevenson, McGraw Hill, 1994.
2. Power System Analysis by Hadi Saadat, McGraw Hill, 1998.
3. Power System Analysis and Design by B.R.Gupta, S. Chand & Company, 2005.

Online Learning Resources:

1. https://onlinecourses.nptel.ac.in/noc22_ee120/preview
2. <https://www.coursera.org/learn/industrial-power-system-analysis-and-stability>
3. <https://www.udemy.com/course/power-system-analysis>

CO-PO Mapping:

Course Outcomes	Engineering Knowledge	Problem Analysis	Design/Development of Solutions	Conduct Investigations of Complex Problems	Modern Tool Usage	The Engineer and Society	Environment And Sustainability	Ethics	Individual And Team Work	Communication	Project Management And Finance	Life-Long Learning	PSO1	PSO2
23A0263T.1	2	1	1	1	-	-	-	1	-	-	-	1	-	-
23A0263T.2	3	3	3	3	3	-	-	1	2	2	-	3	3	3
23A0263T.3	3	2	1	1	-	-	-	1	-	-	-	1	-	-
23A0263T.4	2	1	1	1	-	-	-	1	-	-	-	1	-	-
23A0263T.5	3	3	3	3	3	-	-	1	2	2	-	3	3	3

ANNAMACHARYA INSTITUTE OF TECHNOLOGY AND SCIENCES RAJAMPET
(An Autonomous Institution)

Department of Electrical and Electronics Engineering

Title of the AI & ML for Electrical Engineering
Category: PE-II
Course Code: 23A026AT
year: III
Semester: II
Branch/es EEE

Lecture Hours

3

Tutorial Hours

0

Practice Hours

0

Credits

3

Course Objectives:

1. To impart knowledge in Artificial Intelligence core concepts.
2. To impart knowledge in Machine Learning core concepts.
3. To provide Knowledge in Artificial Neural Networks.
4. To provide Knowledge differences between Classical Sets and fuzzy sets.
5. To aware the knowledge of AI Applications in Electrical Engineering.

Course Outcomes:

**Blooms
Level**

- | | |
|---|----|
| 1. At the end of the course, the student will be able to.... | |
| 2. Understanding the Basics and Architecture of Artificial Intelligence | L2 |
| 3. Understanding the Basic concepts of Machine Learning (ML). | L2 |
| 4. Analyzing and Applying Artificial Neural Networks (ANN) Concepts. | L3 |
| 5. Understanding and Analyzing the Fuzzy Logic Concepts. | L2 |
| 6. Designing and implementing of AI & Fuzzy Logic Applications in Electrical Engineering. | L5 |

Unit 1 Introduction to Artificial Intelligence: 8

Introduction and motivation - Approaches to AI - Architectures of AI - Symbolic Reasoning System - Rule based Systems - Knowledge Representation - Expert Systems.

Unit 2 Overview of Machine Learning: 10

The Motivation & Applications of Machine Learning: Learning Associations, Classification, Regression; Supervised Learning; Unsupervised Learning; Reinforcement Learning; Gradient Descent: Batch Gradient Descent, Stochastic Gradient Descent; Data pre-processing; Under fitting and Overfitting issues (Topics limited to Concepts & Examples only)

Unit 3 Artificial Neural Networks: 10

Basics of ANN - Comparison between Artificial and Biological Neural Networks - Basic Building Blocks of ANN - Artificial Neural Network Terminologies - McCulloch Pitts Neuron Model - Learning Rules - ADALINE and MADALINE Models - Perceptron Networks (Continuous and Discrete) – Perceptron Convergence Theorem - Back Propagation Neural Networks - Associative Memories – BAM and Hopfield networks. (Topics limited to Concepts & Examples only)

Unit 4 Fuzzy Logic 8

Classical Sets - Fuzzy Sets - Fuzzy Properties, Operations and relations - Simple Problems -Fuzzy Logic System - Fuzzification - Defuzzification - Membership Functions - Fuzzy Rule base - Fuzzy Logic Controller Design.

Applications of AI Techniques: Load forecasting, Load flow studies, Economic load dispatch, Speed control of DC Motor, Speed Control of Induction Motors

Prescribed Textbooks:

1. Introduction to Neural Networks using MATLAB, S. N. Sivanandam, S. Sumathi and S. N. Deepa, " McGraw Hill Edition, 2006.
2. Fuzzy Logic with Engineering Applications", Timothy J. Ross, Third Edition, WILEY India Edition, 2012.
3. Introduction to Machine Learning, Ethem Alpaydin, MIT Press, 3rd edition, 2014
4. Artificial Intelligence - A Modern Approach, Russell. S and Norvig. P, 4th edition, Pearson, 2022

Reference Books:

1. Introduction to Fuzzy Logic using MATLAB, S. N. Sivanandam, S. Sumathi and S. N. Deepa, Springer International Edition, 2013.
2. Intelligent System - Modeling, Optimization & Control, Yung C. Shin and Chengying Xu, CRC Press, 2009.
3. Kevin P. Murphy, —Machine Learning: A Probabilistic Perspective||, MIT Press, 2012

Online Learning Resources:

1. https://onlinecourses.nptel.ac.in/noc25_mm37/preview
2. https://onlinecourses.nptel.ac.in/noc25_ge55/preview

CO-PO Mapping:

Course Outcomes	Engineering Knowledge	Problem Analysis	Design/Development of Solutions	Conduct Investigations of Complex Problems	Modern Tool Usage	The Engineer and Society	Environment And Sustainability	Ethics	Individual And Team Work	Communication	Project Management And Finance	Life-Long Learning	PSO1	PSO2
23A026AT.1	2	3	3	2	-	-	-	-	-	-	-	2	1	1
23A026AT.2	2	3	3	2	-	1	-	-	-	-	-	2	1	1
23A026AT.3	2	3	3	2	-	1	-	-	-	-	-	2	1	1
23A026AT.4	2	3	3	2	-	1	-	-	-	-	-	2	1	1
23A026AT.5	3	3	3	2	-	1	-	-	-	-	-	2	2	2

Department of Electrical and Electronics Engineering

Title of the Programmable Logic Controllers
Category: PE-II
Course Code: 23A026BT
year: III
Semester: II
Branch/es EEE

Lecture Hours

3

Tutorial Hours

0

Practice Hours

0

Credits

3

Course Objectives:

The student will be able to:

1. Understand the basic functions and types of PLCs, Easy Veep software, its applications
2. Understand Classification of PLCs and applications
3. Design PLC Programming for various applications
4. Analyze PLC Troubleshooting aspects

Course Outcomes:

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

CO1: Understand different types of PLCs, Its classification and the usage of Easy Veep software- L2

CO2: Analyze the hardware details of Allen Bradley PLC -L3

CO3: Design PLC Programming for various applications – L5

CO4: Apply PLC programming concepts in different fields of Science and Technology -L4

CO5: Develop Instruction using ADD and SUB functions, UP and Down counters – L5

Unit 1 Introduction to PLCs:

8

Basic functions of PLCs, Mechanical relays versus PLC, Different types of PLC's – Allen-Bradley – Micrologix: ML1000, ML1100, SLC500, Compact Logix, Mitsubishi FX series, HMI's, Processor and I/O cards

Unit 2 PLC Computational Tool:

10

Introduction to Easy Veep software, Link between mechanical, electrical and programming documentation, Logic diagrams, Flip-Flop Logic, M8000, M8001 internal bits interpretation, Binary code, data table, manipulation and search engine in Mitsubishi environment Communication between PC and PLC, Communication between PC and HMI, PLC and HMI Serial Local network, Introduction to SLC500

Unit 3 PLC Development:

8

PLC software and applications, Boolean algebra – understanding binary code, ADD and SUB functions, UP and Down Counters, Introduction to k1Y0, MOV function, CPR and ZCP functions, SHWT and SHRD instructions, Introduction to Absolutely Drum Instruction. Allen Bradley PLC: Introduction to Rockwell Software, Hardware focus, Hardware considerations (Field wiring, Master Control Relay, VFD), Basic programming and applications, Cascade control – subroutine, Different programs.

Unit 4 PLC Programming:

8

Programming instructions: Instructions and binary interpretation, Bit Instruction, Timers and counters, Comparison instructions, Programming Instructions - Math instructions, Move and Logical Instructions, Discussions of programming, communications for PLC-Robotic arm, Exercise of setup and monitoring

Unit 5 Applications

8

Analog and Digital parameters by using SLC5/03-VFD-Panel Mate series 1700, Practical Troubleshooting, troubleshooting technique, Control system stability and tuning basics. Applications: Process to rewind, test, and integrate with extrusion process for wiring and fibre optic industries, Food industry – yeast, flour distribution and control. Process Medical equipment Industry – Gas analyzer, Leak tester (using CO2), plastic wrapping machines etc.

Prescribed Textbooks:

1. Automating manufacturing systems with PLCs by Hugh Jack, 2010.

2. PLC Hand Book (Automationdirect Siemens)

Reference Books:

1. Programmable Logic Controllers by R. Bliesener, F Ebel, Festo. Didactic publishers, 2002.
2. Programmable Logic Controllers by W. Bolton, 4th Edition, Newnes, 2006.
3. Introduction to PLCs by Jay F. Hooper, 2nd Edition, Carolina Academic Press, 2006.

Online Learning Resources:

<https://nptel.ac.in/courses/108105088>

CO-PO Mapping:

Course Outcomes	Engineering Knowledge	Problem Analysis	Design/Development of Solutions	Conduct Investigations of Complex Problems	Modern Tool Usage	The Engineer and Society	Environment And Sustainability	Ethics	Individual And Team Work	Communication	Project Management And Finance	Life-Long Learning	PSO1	PSO2
23A026BT.1	3	2	1	2	2	-	-	-	-	-	-	1	3	3
23A026BT.2	3	2	1	2	2	-	-	-	-	-	-	1	2	3
23A026BT.3	3	2	1	2	2	-	-	-	-	-	-	1	3	2
23A026BT.4	3	2	1	2	2	-	-	-	-	-	-	1	2	2
23A026BT.5	3	2	1	2	-	-	-	-	-	-	-	1	2	2

ANNAMACHARYA INSTITUTE OF TECHNOLOGY AND SCIENCES RAJAMPET
(An Autonomous Institution)

Department of Electrical and Electronics Engineering

Title of the Course: Switchgear and Protection

Category: PE-II

Course Code: 23A026CT
year: III
Semester: II
Branch/es EEE

Lecture Hours	Tutorial Hours	Practice Hours	Credits
3	0	0	3

Course Objectives:

1. To study different circuit breakers and relays.
2. To study the protection of Generators and Transformers.
3. To discuss the causes of abnormal operating conditions (faults, lightning and switching surges) of the apparatus and system.
4. To discuss the protection of various feeder bus bars from abnormal conditions and over voltages & importance on neutral grounding for overall protection.

Course Outcomes:

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

1. Understand the operation of different circuit breakers and their specifications. (L2)
2. Analyze the concepts of different relays which are used in real time power system operation. (L3)
3. Apply various protective schemes for Transformers, Rotating machines. (L4)
4. Explain different protective schemes used for Bus bars and Feeders. (L3)
5. Understand the methods of protection against over voltages and importance of neutral grounding .(L2)

Unit 1 **Circuit Breakers:** 10

Circuit Breakers: Elementary principles of arc interruption, Recovery, Restriking Voltage and Recovery voltages - Restriking Phenomenon, Average, Max. RRRV, Current Chopping and Resistance Switching - CB ratings and Specifications, Selection of CB: Types and Numerical Problems. – Auto reclosures. Description and Operation of- Minimum Oil Circuit breakers, Air Blast Circuit Breakers, Vacuum and SF6 circuit breakers.

Unit 2 **Electromagnetic, Static and Numerical Relays:** 12

Basic Requirements of Relays – Primary and Backup protection - Construction details of – Attracted armature, balanced beam, inductor type and differential relays – Universal Torque equation – Characteristics of over current, Direction and distance relays. Static Relays – Advantages and Disadvantages – Definite time, Inverse and IDMT static relays – Comparators – Amplitude and Phase comparators. Microprocessor based relays – Advantages and Disadvantages – Block diagram for over current (Definite, Inverse and IDMT), Distance Relays, Impedance Relays and Reactance Relays with their Flow Charts.

Unit 3 **Protection of Generators and Transformers:** 10

Protection of generators: Protection of generators against Stator faults, Rotor faults, and Abnormal Conditions. Restricted Earth fault and Inter-turn fault Protection. Numerical Problems on percentage winding unprotected. Protection of transformers: Percentage Differential Protection, Numerical Problem on Design of CTs Ratio, Buchholtz relay Protection.

Unit 4 **Protection of Feeders, Transmission Lines and Busbars:** 08

Protection of Feeders (Radial & Ring main) using over current Relays. Protection of Transmission lines – 3 Zone protection using Distance Relays. Carrier current protection. Protection of Bus bars - Differential protection, Differential Pilot wire protection.

Unit 5 **Protection Against Over Voltages:** 10

Generation of Over Voltages in Power Systems. -Protection against Lightning Over Voltages - Valve type and Zinc-Oxide Lighting Arresters - Insulation Coordination –BIL. Neutral Grounding, Grounded and Ungrounded Neutral Systems. - Effects of Ungrounded Neutral on system performance. Methods

of Neutral Grounding: Solid, Resistance, Reactance – Arcing Grounds and Grounding Practices.

Prescribed Textbooks:

1. Sunil S Rao, "Switchgear and Protection", Khanna Publishers, 14th edition, 2025.
2. Badari Ram, D.N Viswakarma, "Power System Protection and Switchgear", TMH Publications, 3rd edition, 2022.

Reference Books:

1. Protective Relaying Principles and Applications – J Lewis Blackburn, CRC Press
2. Numerical Protective Relays, Final Report 2004 – 1009704 EPRI, USA.
3. Protective Relaying Theory and Applications - Walter A Elmore, Marcel Dekker.
4. Transmission network Protection by Y.G. Paithankar, Taylor and Francis, 2009.
5. Power System Protection- P. M. Anderson, Wiley Publishers.

Web Resources:

1. https://onlinecourses.nptel.ac.in/noc22_ee101/preview
2. <https://www.youtube.com/watch?v=JRv2RVyYtM>
3. https://onlinecourses.nptel.ac.in/noc25_ee101/preview

CO-PO Mapping:

Course Outcomes	Engineering Knowledge	Problem Analysis	Design/Development of Solutions	Conduct Investigations of Complex Problems	Modern Tool Usage	The Engineer and Society	Environment And Sustainability	Ethics	Individual And Team Work	Communication	Project Management And Finance	Life-Long Learning	PSO1	PSO2
23A026CT.1	3	3	3	-	-	-	-	-	-	-	-	3	3	-
23A026CT.2	3	-	3	3	3	1	-	-	-	-	-	-	3	-
23A026CT.3	3	3	3	3	3	3	3	-	-	-	-	-	3	3
23A026CT.4	3	2	3	2	3	1	1	-	-	-	-	-	3	3
23A026CT.5	1	3	3	3	3	3	3	-	-	-	-	-	3	3

ANNAMACHARYA INSTITUTE OF TECHNOLOGY AND SCIENCES RAJAMPET
(An Autonomous Institution)

Department of Electrical and Electronics Engineering

Title of the Course: Energy Auditing and Demand Side Management

Category: PE-II

Course Code: 23A026DT
Year : III
Semester II
Branch/es: EEE

Lecture Hours	Tutorial Hours	Practice Hours	Credits
3	0	0	3

Course Objectives:

1. To summarize the students to achieve a clear conceptual understanding of technical and commercial aspects of energy conservation and energy auditing.
2. To Review the Management skills and communications of Energy manager/ Energy Auditor
3. Illustrate the techniques, procedures, evaluation and energy audit reporting
4. To estimate/calculate power factor of systems and designing of energy efficient Motors.
5. To calculate life cycle costing analysis and return on investment on energy efficient technologies.

Course Outcomes:

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

	Blooms Level of Learning
1. Analyze Energy Management and conservation related to environmental issues.	L4
2. Analyze the significance and procedure for Energy Audit.	L2
3. Quantify the different types of demand-side management measures and their suitability to various energy users.	L2
4. Evaluate the methods of improving energy efficiency in different electrical systems and Improvement in Power Factor	L2
5. Evaluate pay back periods for energy savings equipment	L5

Unit 1 Energy Conservation, Management and Environmental Issues 10

History of Energy Management, Definition and Objective of Energy Management and its importance. Need of energy management, Environmental issues, Global Warming, Climate Change Problem and, Depletion of ozone layer, Importance of Energy conservation and different schemes- Management and organization of energy conservation awareness programs. Energy Conservation in Buildings, Energy Efficiency Ratings & ECBC (Energy Conservation Building Code. Energy index, cost index, Representation of pie charts, Sankey diagrams, and load profiles.

Unit 2 Energy Audit 10

Energy audit concepts, Definition, Need and Types of energy audit. Energy Audit Approach and Methodology. Systematic procedure for technical audit. Understanding energy audit costs. Duties and responsibilities of energy auditors. Energy audit instruments and their usage for auditing. Energy Instruments-wattmeter, data loggers, thermocouples, pyrometers, luxmeters, tongue testers, PLCs and applications , Report-writing, preparations and presentations of energy audit reports.

Unit 3 Demand Side Management 08

Concept and Scope of Demand Side Management, Evolution of Demand Side Management, DSM Strategy, Planning, Implementation and its application, time of day pricing, multi utility power exchange model, and time of day models for planning. Load management, load priority technique, peak clipping, peak shifting, valley filling, strategic conservation, Usage of energy efficient equipment.

Unit 4 Improvement of Power factor and Energy efficient design – A Practical Approach. 10

Power factor – methods of improvement, selection and location of capacitors, PF with non-linear loads, effect of harmonics on power factor, power factor motor controllers- Good lighting system design and practice, lighting control, lighting energy audit

Energy efficient motors, factors affecting efficiency, loss distribution, constructional details, characteristics - variable speed, variable duty cycle systems, RMS hp- voltage variation-voltage unbalance- over motoring

Unit 5 Economic Analysis methods 09

Economic analysis methods-cash flow model, time value of money, Evaluation of proposals, Simple and Discount pay-back method-average rate of return method, internal rate of return method, present value method, future value method discount rate, Savings with the Power factor correction Equipment- numerical problems.

Prescribed Text Books:

1. Amlan Chakrabarti, Energy Engineering and Management, PHI, Eastern Economy Edition, 2nd edition, 2018
2. Craig B. Smith, Kelly E. Parmenter, Energy Management Principles, Pergamon Press, New York, 2nd edition, 2015
3. Hamies, Energy Auditing and Conservation; Methods, Measurements, Management & Case study, Hemisphere, Washington, 1st edition (Reprint 2013)
4. Umesh Rathore, Energy management, S.K. Kataria & Sons, 2nd edition, 1st edition (reprint 2014)
5. Amlan Chakrabarti, Energy Engineering and Management, PHI, Eastern Economy Edition, 2nd edition, 2018

Reference Books:

1. W.R. Murphy, G. McKay, Energy Management, Butterworths, (reprint edition) 2009
2. Anil Kumar, Prakash, Prashant, Samsher, Energy Management Conservation and Audits, CRC Press, 1st edition, 2020
3. Archie, W Culp, Principles of Energy Conservation, McGraw Hill, 1st edition
4. Ramesh Bhatia; Mohan Munasinghe; Ashok V Desai, Energy Demand: Analysis, Management and Conservation, Wiley Eastern Ltd., New Delhi, 1st edition.
5. A. J. McMichael, D. H. Campbell-Lendrum, C. F. Corvalan, K. L. Ebi, A. Githeko, J. D. Scheraga, A. Woodward, Climate Change and Human Health Risks and Responses, 1st edition 2003

Web Resources:

1. <https://nptel.ac.in/courses/109/106/109106161/>
2. <https://beeindia.gov.in/>

CO-PO Mapping:

Course Outcomes	Engineering Knowledge	Problem Analysis	Design/Development of Solutions	Conduct Investigations of Complex Problems	Modern Tool Usage	The Engineer and Society	Environment And Sustainability	Ethics	Individual And Team Work	Communication	Project Management And Finance	Life-Long Learning	PSO1	PSO2
23A026DT.1	3	3	3	1	2	3	3	-	-	-	3	3	3	3
23A026DT.2	3	3	3	-	2	3	2	-	-	1	3	3	3	3
23A026DT.3	3	3	3	1	2	3	1	1	-	-	2	3	2	3
23A026DT.4	3	3	3	1	1	3	1	1	-	-	3	3	3	2
23A026DT.5	3	3	3	1	1	3	-	-	-	-	3	3	3	3

Category	PE-III
Couse Code	23A026ET
Year	III
Semester	II
Branch	EEE

Lecture Hours	Tutorial Hours	Practice Hours	Credits
3	0	0	3

Course Objectives:

- To describe concept of smart grid and its advantages over conventional grid
- To discuss smart metering techniques and intelligent Electronic Devices
- To explain wide area measurement techniques
- To describe the problems associated with integration of distributed generation & its solution through smart grid.

Course Outcomes:

At the end of the course, the student will be able to	Blooms Level of Learning
1.Appreciate the difference between smart grid & conventional grid	L2
2.Apply smart metering concepts to industrial and commercial installations	L3
3.Formulate solutions in the areas of smart substations, distributed generation and wide area measurements	L3
4.Diagnose the power quality issues and auditing related to smart grid.	L4
5.Apply the modern technologies to smart grid solutions	L3

Unit 1 Introduction to Smart Grid and Smart Meters 10

Introduction to Smart Grid, Evolution of Electric Grid, Concept of Smart Grid, Definitions, Need of Smart Grid, Concept of Robust & Self-Healing, smart Grid Present development & International policies in Smart Grid.

Introduction to Smart Meters, Smart Appliances, Automatic Meter Reading (AMR) Outage Management System (OMS) Plug in Hybrid Electric Vehicles (PHEV), Vehicle to Grid, Smart Sensors.

Unit 2 Intelligent Electronic Devices (IED) 10

Geographic Information System (GIS), Intelligent Electronic Devices (IED) & their application for monitoring & protection, Pumped Hydro, Compressed Air Energy Storage, Wide Area Measurement System (WAMS), Phasor Measurement Unit (PMU).

Unit 3 Integration of Micro Grid with Alternative Solar Cells. 10

Concept of micro-grid, need & applications of micro-grid, formation of micro-grid, Issues of interconnection, protection & control of micro-grid, Plastic & Organic solar cells, thin film solar cells, Variable speed wind generators, micro-turbines, Captive power plants, Integration of renewable energy sources.

Unit 4 Types of Electrical Energy Storage Systems 10

Electrical storage systems, Double-layer capacitors (DLC), Superconducting magnetic energy storage (SMES), Thermal storage systems, Standards for EES, Technical comparison of EES technologies.

Unit 5 Communication Technologies in Smart Grid 10

Advanced Metering Infrastructure (AMI), Home Area Network (HAN), Neighborhood Area Network (NAN), Wide Area Network (WAN), Bluetooth, ZigBee, GPS, Wi-Fi, Wi-Max based communication, Wireless Mesh Network, Basics of CLOUD Computing & Cyber Security for Smart Grid, Broadband

over Power line (BPL), IP based protocols.

Prescribed Text Books:

1. Ali Keyhani, "Design Of Smart Power Grid Renewable Energy Systems", Wiley IEEE, 2011
2. Clark W. Gellings, "The Smart Grid: Enabling Energy Efficiency and Demand Response", CRC Press, 2009.
3. Janaka Ekanayake, Nick Jenkins, Kithsiri Liyanage, "Smart Grid: Technology and Applications", Wiley 2012

Reference Books:

1. Stuart Borlase, "Smart Grid: Infrastructure, Technology and solutions "CRC Press
2. A.G. Phadke, "Synchronized Phasor Measurement and their Applications", Springer

Web Resources:

1. <https://berc.co.in/images/pdf/meetings-workshop/Smart-Grid-Meters.pdf>
2. https://www.researchgate.net/publication/305298788_Intelligent_Electronic_Devices_in_Smart_Grid_Applications
3. <https://electrical-engineering-portal.com/ied-intelligent-electronic-device-advanced-functions>
4. <https://www.slideshare.net/Shahabkhan/microgrid-presentation>
5. https://www.ripublication.com/irph/ijeee_spl/ijeeev7n10_05.pdf
6. <https://www.slideshare.net/eesrikanthkonda/smart-grid-communications>

CO-PO Mapping:

Course Outcomes	Engineering Knowledge	Problem Analysis	Design/Development of Solutions	Conduct Investigations of Complex Problems	Modern Tool Usage	The Engineer and Society	Environment And Sustainability	Ethics	Individual And Team Work	Communication	Project Management And Finance	Life-Long Learning	PSO1	PSO2
23A026ET.1	3	1	2	3	2	-	3	-	-	-	-	3	3	3
23A026ET.2	3	1	1	2	3	-	3	-	-	-	3	3	3	3
23A026ET.3	3	-	1	3	-	-	3	-	-	-	1	3	3	3
23A026ET.4	3	1	1	3	3	-	3	-	-	-	-	3	3	3
23A026ET.5	3	-	2	2	3	-	3	-	-	-	3	3	3	3

ANNAMACHARYA INSTITUTE OF TECHNOLOGY AND SCIENCES RAJAMPET
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Department of Electrical and Electronics Engineering

Title of the Course Electric Drives
Category: PE-III

Couse Code: 23A026FT
year: III
Semester: II
Branch/es EEE

Lecture Hours	Tutorial Hours	Practice Hours	Credits
3	0	0	3

Course Objectives:

1. To understand the fundamental concepts, types, and modes of operation of electric drives
2. To analyze the control and performance of DC drives powered by single-phase and three-phase converter circuits under various conduction modes.
3. To study the operation and control of DC drives using chopper.
4. To explore the speed control strategies for three-phase induction motor drives using voltage control, frequency control, and slip power recovery methods.
5. To evaluate the operational principles and control techniques of synchronous motor, stepper motor drives for industrial applications.

Course Outcomes:

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

1. Evaluate the characteristics and operational aspects of drives operating in different modes.
2. Analyze the performance of controlled rectifier-fed DC drives in different operating modes.
3. Explore the performance of controlled chopper-fed DC drives in different operating modes.
4. Investigate the performance of asynchronous motor drives in different operating modes.
5. Explore the performance of synchronous and stepper motor drives in different modes.

Unit 1 Introduction To Electric Drives

12

Electrical drives — block diagram, advantages of electric drive, parts of electric drives, choice of electrical drives, the status of DC and AC drives. Electric braking methods — regenerative, dynamic and plugging.

Unit 2 Single-Phase and Three Phase Converter Fed DC Drives

12

Control of DC separately excited motor by single-phase and three-phase half and full bridged converters — voltage and current waveforms for continuous and discontinuous conduction, speed-torque expressions and characteristics. Single phase half-controlled rectifier fed DC series motor — voltage and current waveforms for continuous and discontinuous conduction, speed-torque expressions and characteristics. Dual converter fed DC motor drives. Closed loop control of rectifier fed DC motor drives

Unit 3 DC Chopper Fed Drives

8

Chopper Control of DC separately excited motor by one, two and four quadrant choppers - voltage and current waveforms for continuous conduction (motoring, regenerative and dynamic braking), speed-torque expressions and characteristics. Chopper control of DC series motor—operation, speed-torque expressions and characteristics. Closed loop chopper control of DC motor drives (Block diagram only).

Unit 4 Induction Motor Drives

8

Three phase induction motors — Introduction, Stator variable voltage control — speed-torque characteristics, AC voltage controllers and efficiency of induction motor under voltage control. Stator variable voltage and variable frequency control — slip speed control, torque-power limitations and modes of operation. Voltage Source Inverters (VSIs) and Current Source Inverters (CSIs) fed induction motor and closed loop operation of induction motor drives (Block diagram only). Comparison of VSI and CSI fed drives. Static rotor resistance control, slip power recovery schemes – static scherbius and kramer drive, speed-torque characteristics.

10

Prescribed Textbooks:

- ### Reference Books:

- ### Online Learning Resources:

- CO-PO Mapping:**

[illegible]

ANNAMACHARYA INSTITUTE OF TECHNOLOGY AND SCIENCES RAJAMPET
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Department of Electrical and Electronics Engineering

Title of the Course: Renewable & Distributed Energy Technologies
Category: PE-III
Course code 23A026GT
Year : III
Semester II
Branch/es: EEE

Lecture Hours	Tutorial Hours	Practice Hours	Credits
3	0	0	3

Course Objectives:

1. This course explores each of the principle renewable energy sources in turn Each technology is examined in terms of the relevant physical principles; the main technologies involved; environmental impact; the size of the potential renewable resource; and the future prospects of green energy.
2. This Distributed Generation course is intended to provide knowledge of the benefits of renewable energy generation, availability of distributed generation technology, electricity generation technologies, issues related to grid interconnection, and methods of analyzing the technical and economic feasibility.

Course Outcomes:

Blooms level of learning

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

- | | |
|---|----|
| 1. Comprehend the renewable energy scenario, anticipate future energy demand and to understand the abstraction concept of electrical energy from Solar Energy | L3 |
| 2. Understand the abstraction concept of electrical energy from wind, bio-mass and Tidal energy sources | L2 |
| 3. Understand electrical energy storage along with working of Green Energy | L2 |
| 4. Exemplify rudimentary idea of Distributed Generation | L3 |
| 5. Comprehend the technical impact, control, and economic aspects of Distributed Generation | L4 |

Unit 1 Energy Scenario and Solar Energy

10

Introduction: Fundamentals of renewable energy sources, Types of energy, Renewable and Non-renewable energy, SWOT analysis, Global warming and climate change, World energy transformation by 2050, Prospects of renewable energy in the world, Renewable energy availability in India.

Solar Energy Fundamentals: Solar Spectrum, propagation of solar radiation from the sun to earth; solar radiation geometry: sun-earth geometry, extra-terrestrial and terrestrial radiation.

Solar Thermal: Solar Collectors, Solar parabolic trough, Solar tower, Solar cooker, Solar water heater, Solar dryer, Solar Pond

Solar Electric Power Generation: A Generic PV Cell, PV Materials, Equivalent Circuits for PV Cells, Modules and Arrays; I-V Curve under Standard Testing Conditions; Impact of Temperature and Insolation on I-V curves; Shading Impacts on I-V curves; Maximum Power Point Trackers (MPPT).

Unit 2 Wind and Other Energy Systems

10

Wind Energy: Air, Wind, Global and Local Wind, availability of wind energy in India, wind velocity and power from wind; major problems associated with wind power, Classification of wind energy conversion system (WECS)- Horizontal axis- single, double and multiblade system. Vertical axis- Savonius and darrieus types.

Biomass Energy: Introduction; Photosynthesis Process; Biofuels; Biomass Resources; Biomass conversion technologies-fixed dome; Urban waste to energy conversion; Biomass gasification (Downdraft).

Tidal Power: fundamental characteristics of tidal power, harnessing tidal energy, advantages, and limitations

Unit 3 Green Energy and Energy Storage 10

Green Energy: Types of Fuel Cells, Basic Operation of a Fuel Cell, Operating principles of Hydrogen energy, Benefits of hydrogen energy, hydrogen production technologies (electrolysis method only), hydrogen energy storage, applications of hydrogen energy, problem associated with hydrogen energy
Energy Storage: Stationary Battery Storage – Basics of Lead-Acid batteries, Battery Storage Capacity, Coulomb efficiency instead of energy efficiency, Battery Sizing. Different Battery storage technologies and comparison of their performance. Introduction to Super capacitors.

Unit 4 Introduction to DG and its Grid Integration 10

Introduction: Need for Distributed generation, renewable sources in distributed generation, current scenario in Distributed Generation, and Planning of DGs – Siting and sizing of DGs – optimal placement of DG sources in distribution systems.

Grid integration of DGs: Different types of interfaces - Inverter based DGs and rotating machine-based interfaces - Aggregation of multiple DG units. Energy storage elements: Batteries, ultra capacitors, flywheels.

Unit 5 Technical Impact, Economic and Control aspects of DG 10

Technical impacts of DGs: Transmission systems, Distribution systems, De-regulation – Impact of DGs upon protective relaying – Impact of DGs upon transient and dynamic stability of existing distribution systems.

Economic and control aspects of DGs: Market facts, issues, and challenges - Limitations of DGs. Voltage control techniques, Reactive power control, Harmonics, Power quality issues. Reliability of DG based systems – Steady-state and Dynamic analysis.

Prescribed Textbooks:

1. Muhammad Kamran, Muhammad Rayyan Fazal, "Renewable Energy Conversion Systems", First Edition, Elsevier Academic Press, 2021.
2. G. D. Rai, Non-Conventional Sources of Energy, Khanna Publisher, 2004

Reference Books:

1. G N Tiwari, Solar Energy: Fundamentals, Design, Modeling and Applications, Narosa, 2002.
2. Mukund R Patel, Wind and Solar Power Systems: Design, Analysis, and Operation, 2nd Edition, Taylor & Francis, 2006.
3. H. Lee Willis, Walter G. Scott, —Distributed Power Generation – Planning and Evaluation||, Marcel Decker Press, 2000
4. Gilbert M. Masters, —Renewable and Efficient Electric Power Systems||, 2nd Edition. IEEE Press, Wiley, 2013.
5. N. Jenkins, J.B. Ekanayake and G. Strbac, —Distributed Generation||, 1st Edition, The Institution of Engineering and Technology, London, 2010

Web Resources:

1. <https://archive.nptel.ac.in/courses/121/106/121106014/#>
2. https://onlinecourses.nptel.ac.in/noc22_ch27/preview
3. <https://www.nptelvideos.com/lecture.php?id=8517>

CO-PO-PSO Mapping:

Course Outcomes	Engineering Knowledge	Problem Analysis	Design/Development of Solutions	Conduct Investigations of Complex Problems	Modern Tool Usage	The Engineer and Society	Environment And Sustainability	Ethics	Individual And Team Work	Communication	Project Management And Finance	Life-Long Learning	PSO1	PSO2
23A026GT.1	3	-	2	-	2	-	3	-	-	-	-	1	2	3
23A026GT.2	3	-	-	-	-	-	3	-	-	-	-	2	2	3
23A026GT.3	3	-	-	-	2	-	3	-	-	-	-	1	2	3
23A026GT.4	3	2	2	-	2	2	3	-	-	-	-	1	3	3
23A026GT.5	3	3	2	2	3	2	3	-	-	-	-	2	3	3

ANNAMACHARYA INSTITUTE OF TECHNOLOGY AND SCIENCES RAJAMPET**(An Autonomous Institution)****Department of Electrical and Electronics Engineering**

Title of the Course	Embedded Systems
Category	PE-III
Couse Code	23A026HT
Year	III
Semester	II
Branch	EEE

Lecture Hours	Tutorial Hours	Practice Hours	Credits
3	0	0	3

Course Objectives:

- To describe the concepts of embedded systems.
- To apply the knowledge acquired on the design considerations

Course Outcomes:

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

1. Summarize the basics of microcontrollers and their interfacing
2. Describe the basic concepts to design embedded applications
3. Recognize different programming models and their suitable Application areas.
4. Analyze the operation of I/O ports and different communication Protocols.
5. Illustrate different embedded applications

Blooms Level of
Learning

L2
L2
L2
L4
L3

Unit 1 Microcontroller & Interfacing 8051 10

Introduction, Architecture, Register Organization, Internal and External Memory, Pin diagram, I/O port structure, addressing modes, Instruction Set, simple programs. On-Chip Peripherals-8051 Interrupt Structure, Timer/Counter features, modes and programming. MSP 430 Low power Micro Controller (A Quantitative study only). Applications- Interfacing with switches, display – LED, LCD, Stepper motor interfacing, Handling External Interrupts.

Unit 2 Introduction To Embedded Systems 10

System – Embedded Definition, Embedded Systems Vs General Computing Systems, History of Embedded Systems, Application Areas. Overview of embedded system architecture, specialties: reliability, performance, power consumption cost, size, user interface, recent trends: processor, power, memory, operating system, communication interface, programming languages, development tools, programmable hardware.

Unit 3 Architecture Of Embedded Systems 10

Hardware Architecture – CPU, Memory, Clock Circuitry, watch dog Timer/Reset Circuitry, chip select, I/O devices, Debug Port, Communication Interfaces, Power supply Unit. Software Architecture – Services provided by an operating System, Architecture and categories of Embedded Operating Systems, Application Software, Communication software, Process of generating Executable image.

Unit 4 Communication Interfaces 10

Need for Communication interface, RS232/UART, RS 422/RS 485, USB, IEEE 1394 fire wire, IEEE 802.11, Blue tooth, I2C and CAN Bus.

Unit 5 Real Time Operating System 10

Architecture of Kernel, Types of Operating Systems, Tasks and Task Scheduler, Interrupt Service Routines, Inter process Communication (IPC)– Semaphores, mutex, message queues, mailboxes, pipes, signals, event registers and timers. Off the Shelf Operating Systems Embedded Operating Systems, Real Time Operating Systems, And Handheld Operating Systems.

ANNAMACHARYA INSTITUTE OF TECHNOLOGY AND SCIENCES RAJAMPET
(An Autonomous Institution)

Department of Electrical and Electronics Engineering

Title of the Course:	Electrical Measurements and Instrumentation Lab
Category:	PC
Course Code:	23A0261L
Year :	III
Semester	II
Branch/es:	EEE

Lecture Hours

0

Tutorial Hours

0

Practice Hours

3

Credits

1.5

Course Objectives:

1. To develop a foundational understanding of measurement techniques using bridge circuits for resistance, inductance, and capacitance in electrical systems.
2. To calibrate and performance evaluation of energy meters and power factor meters, using both direct and phantom loading methods.
3. To measurement the electrical power and energy in single-phase and three-phase circuits through conventional instruments and simulation tools.
4. To provide hands-on experience with sensors and transducers for measuring physical quantities using RTDs, thermocouples, LVDTs, and strain gauges.
5. To familiarize in modern electronic instruments such as CROs and DSOs for signal analysis, waveform capture, and data interpretation in electrical measurements.

Course Outcomes:

Blooms

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

Level

- | | |
|--|--------|
| 1. Determine resistance, inductance, and capacitance using ac bridges | L3 |
| 2. Calibrate single-phase energy meter, wattmeter, and power factor meter. | L3 |
| 3. Compute real and reactive power in single-phase and three-phase circuit. | L3, L4 |
| 4. Demonstrate extension of range of ammeters and voltmeters, and measure physical quantities using LVDT, RTD, thermocouples, and strain gauges. | L3 |
| 5. Demonstrate the use of CROs, DSOs, Megger, and analyze waveform data to determine RMS values and dielectric strength. | L3, L4 |

List of Experiments:

Any 10 of the following experiments are to be conducted:

1. Measurement of resistance using Wheatstone bridge and Kelvin's Double Bridge.
2. Measurement of inductance using Anderson bridge and capacitance using Schering Bridge.
3. Calibration of single-phase energy meter.
4. Calibration of watt meter using Phantom loading.
5. Measurement of power using 3-Voltmeter and 3-Ammeter method.
6. Measurement of reactive power in a three-phase circuit.
7. Extension of range of given Ammeter and Voltmeter.
8. Measurement of displacement using LVDT.
9. Measurement of different ranges of temperatures using i) RTD ii) Thermocouple
10. Measurement of strain with the help of strain gauge transducers.
11. Calibration of dynamometer type power factor meter.
12. Measurement of Insulation resistance using Megger.
13. Measurement of three phase active power using simulation.
14. Simulation of Maxwell's bridge and De-Sauty's bridge.
15. Study of CRO: Measurement of amplitude, time period, frequency and phase shift using Lissajous patterns.
16. Download of one-cycle data of a periodic waveform from a DSO and use values to compute the RMS value.

Prescribed Textbooks:

1. Electrical & Electronic Measurement & Instruments by A.K. Sawhney Dhanpat Rai & Co. Publications, 2021.

Reference Books:

1. Electronic Instrumentation by H.S.Kalsi, Tata Mcgrawhill, 3rd Edition, 2017.
2. Electrical Measurements: Fundamentals, Concepts, Applications–by Reissl and, M.U, New Age International (P) Limited, 2010.
3. Electrical & Electronic Measurement & Instrumentation by R.K.Rajput, 2nd Edition, S. Chand & Co., 2nd Edition, 2016.

Web Resources:

1. <https://www.youtube.com/watch?v=TikITHPa1js&pp=ygUnRWxlY3RyaWNhbCBNZWFzdXJlbWVudHMgTGFiEV4cGVyaW1lbnRz>
2. <https://www.youtube.com/watch?v=GfNeGi8xKg&pp=ygUnRWxlY3RyaWNhbCBNZWFzdXJlbWVudHMgTGFiEV4cGVyaW1lbnRz>
3. <https://www.youtube.com/watch?v=rDPcBqtn6yE&pp=ygUnRWxlY3RyaWNhbCBNZWFzdXJlbWVudHMgTGFiEV4cGVyaW1lbnRz0gcJCd4JAYcqIYzv>
4. <https://www.youtube.com/watch?v=Huu3p4k25DM&pp=ygUnRWxlY3RyaWNhbCBNZWFzdXJlbWVudHMgTGFiEV4cGVyaW1lbnRz>
5. <https://www.youtube.com/watch?v=NXuRrOBJ8sY&pp=ygUnRWxlY3RyaWNhbCBNZWFzdXJlbWVudHMgTGFiEV4cGVyaW1lbnRz>

CO-PO Mapping:

Course Outcomes	Engineering Knowledge	Problem Analysis	Design/Development of Solutions	Conduct Investigations of Complex Problems	Modern Tool Usage	The Engineer and Society	Environment And Sustainability	Ethics	Individual And Team Work	Communication	Project Management And Finance	Life-Long Learning	PSO1	PSO2
23A0261L.1	3	2	–	2	2	–	–	–	2	–	–	2	3	2
23A0261L.2	3	2	–	2	2	1	–	–	2	2	–	2	3	2
23A0261L.3	3	2	2	2	3	1	2	–	2	–	–	2	3	3
23A0261L.4	3	2	2	2	3	1	1	1	3	–	–	2	3	3
23A0261L.5	3	2	–	3	3	–	–	1	2	–	–	3	3	2

ANNAMACHARY INSTITUTE OF TECHNOLOGY AND SCIENCES RAJAMPET
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Department of Electrical and Electronics Engineering

Title of the Course: Microprocessors and Microcontrollers Lab
Category: PC
Course Code: 23A0262L
Year : III
Semester II
Branch/es: EEE

Lecture Hours	Tutorial Hours	Practice Hours	Credits
0	0	3	1.5

Course Objectives:

1. To become skilled in 8086 Assembly Language programming.
2. To understand the detailed software and hardware structure of the microprocessor.
3. Train their practical knowledge through laboratory experiments.
4. To understand and learn 8051 Microcontroller.
5. To acquire knowledge on microprocessors and microcontrollers, interfacing various peripherals, and configuring.

Course Outcomes:

**Blooms
Level**

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

- | | |
|---|----|
| 1. Formulate a program and implement algorithms using Assembly language. | L2 |
| 2. Describe an Assembly language program for the 8086 Microprocessor. | L6 |
| 3. Develop programs for different applications in the 8086 Microprocessor. | L3 |
| 4. Interface peripheral devices with 8086 and 8051. | L6 |
| 5. Use an Assembly/Embedded C programming approach for solving real-world problems. | L3 |

List of Experiments: (Any TEN of the experiments are to be conducted)

EXP 1 Programs for 16 Bit Arithmetic Operations (Using various addressing modes)

- a) Write an ALP to Perform Addition and Subtraction of Multi-byte numbers.
- b) Write an ALP to Perform Multiplication and division of signed and unsigned Hexadecimal numbers.
- c) Write an ALP to find square, cube and factorial of a given number.

EXP 2 Programs Involving Bit Manipulation Instructions

- a) Write an ALP to find the given data is positive or negative.
- b) Write an ALP to find the given data is odd or even.
- c) Write an ALP to find Logical ones and zeros in a given data.

EXP 3 Programs on Arrays for 8086

- a) Write an ALP to find Addition/subtraction of N numbers.
- b) Write an ALP for finding largest/smallest no.
- c) Write an ALP to sort given array in Ascending/descending order.

EXP 4 Programs on String Manipulations for 8086

- a) Write an ALP to find String length.
- b) Write an ALP for Displaying the given String.
- c) Write an ALP for Comparing two Strings.
- d) Write an ALP to reverse String and Checking for palindrome.

EXP 5 Programs for Digital Clock Design Using 8086

- a) Write an ALP for Designing clock using INT 21H Interrupt.
- b) Write an ALP for Designing clock using DOS Interrupt Functions.
- c) Write an ALP for Designing clock by reading system time.

EXP 6 Interfacing Stepper Motor with 8086

- a) Write an ALP to 8086 processor to Interface a stepper motor and operate it in clockwise by choosing variable step-size.
- b) Write an ALP to 8086 processor to Interface a stepper motor and operate it in Anti-clockwise by choosing variable step-size.

EXP 7 Interfacing ADC/DAC with 8086

- a) Write an ALP to 8086 processor to Interface ADC.
- b) Write an ALP to 8086 processor to Interface DAC and generate Square Wave/Triangular Wave/Step signal.

EXP 8 Communication between Two Microprocessors

- a) Write an ALP to have Parallel communication between two microprocessors using 8255
- b) Write an ALP to have Serial communication between two microprocessor kits using 8251.

EXP 9 Programs using Arithmetic and Logical Instructions for 8051

- a) Write an ALP to 8051 Microcontroller to perform Arithmetic operations like addition, subtraction,
- b) Multiplication and Division.
- c) Write an ALP to 8051 Microcontroller to perform Logical operations like AND, OR and XOR.
- d) Programs related to Register Banks.

EXP 10 Programs to Verify Timers/Counters of 8051

- a) Write a program to create a delay of 25msec using Timer0 in mode 1 and blink all the Pins of P0.
- b) Write a program to create a delay of 50 μ sec using Timer1 in mode 0 and blink all the Pins of P2.
- c) Write a program to create a delay of 75msec using counter0 in mode 2 and blink all the Pins of P1.
- d) Write a program to create a delay of 80 μ sec using counter1 in mode 1 and blink all the Pins of P3.

EXP 11 UART Operation in 8051

- a) Write a program to transfer a character serially with a baud rate of 9600 using UART.
- b) Write a program to transfer a character serially with a baud rate of 4800 using UART.
- c) Write a program to transfer a character serially with a baud rate of 2400 using UART.

EXP 12 Interfacing LCD with 8051

- a) Develop and execute the program to interface 16*2 LCD to 8051.
- b) Develop and execute the program to interface LCD to 8051 in 4-bit or 8-bit mode.

EXP 13 8051 Port Reading & Writing

- a) Write an ALP to Perform Reading data from Port,
- b) Write an ALP to Perform Writing data to Port.

EXP 14 Programs ASCII Arithmetic Operations

- a) Write an ALP to Perform Addition and Subtraction of two ASCII numbers.
- b) Write an ALP to Perform Multiplication and division of two ASCII numbers.

Reference Books:

1. Kenneth.J.Ayala. The 8051 microcontroller, 3rd edition, Cengage learning,2010.
2. Advanced microprocessors and peripherals-A.K ray and K.M.Bhurchandani, TMH, 2nd edition2006.
3. The 8051 Microcontroller and Embedded Systems: Using Assembly and C by Muhammad AliMazidi, Janice Gillispie Mazidi, Second Edition.

CO-PO Mapping:

Course Outcomes	Engineering Knowledge	Problem Analysis	Design/Development of Solutions	Conduct Investigations of Complex Problems	Modern Tool Usage	The Engineer and Society	Environment And Sustainability	Ethics	Individual And Team Work	Communication	Project Management And Finance	Life-Long Learning	PSO1	PSO2
23A0262L.1	2	1	1	1	-	-	-	1	2	-	-	1	1	2
23A0262L.2	3	3	3	3	-	-	-	1	2	-	-	1	2	2
23A0262L.3	3	2	1	1	3	-	-	1	2	2	-	1	2	2
23A0262L.4	3	3	3	3	-	-	-	1	2	-	-	1	2	2
23A0262L.5	3	2	1	1	3	-	-	1	2	2	2	1	2	2

ANNAMACHARYAINSTITUTE OF TECHNOLOGY AND SCIENCES RAJAMPET
(An Autonomous Institution)

Department of Electrical and Electronics Engineering

Title of the Course: Applications of soft computing tools in Electrical Engineering
Category: SEC-II
Course Code: 23A0263L
Year : III
Semester II
Branch/es: EEE

Lecture Hours

0

Tutorial Hours

1

Practice Hours

2

Credits

2

Course Objectives:

The objectives of this course include:

1. Understand the basic concepts of Electrical Engineering.
2. Apply the concepts to design MATLAB models.
3. Analyze various Electrical engineering applications through MATLAB.
4. Develop real time models using MATLAB.

Course Outcomes:

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

1. CO1: Understand the basic concepts of Electrical Engineering. -L2
2. CO2: Apply the concepts to design MATLAB models. -L4
3. CO3: Analyze various Electrical engineering applications through MATLAB. L3
4. CO4: Develop real time models using MATLAB. -L5
5. CO5: Design virtual PMU -L5

Theory:

MATLAB-Introduction, different tool boxes, creation of program files, creation of Simulink files, GUI, commonly used blocks, Simpower system toolbox, control system toolbox, Sim Drive lines, Creation of functions, Project implementation through MATLAB

CHOOSE ANY TEN FROM THE FOLLOWING LIST:

1. Transient analysis of given electrical network
2. Simulation of 1-phase and 3-phase transformers
3. Study of the dynamics of second order system
4. Implementation of buck and boost dc-dc converters
5. Study on the design of PI controllers and stability analysis for a DC-DC buck Converter
6. Sine-PWM techniques for single-phase half-bridge, full-bridge and three-phase inverters
7. Economic Load Dispatch of (i) Thermal Units and (ii) Thermal Plants using Conventional method
8. Transient Stability Analysis of Power Systems using Equal Area Criterion (EAC)
9. Reactive Power Control in a transmission system (Ferranti effect, Effect of shunt Inductor)
10. Fault studies using Zbus matrix
11. Design of virtual PMU
12. Wide area control of Two area Kundur system

Online Learning Resources/Virtual Labs:

1. <http://vem-iitg.vlabs.ac.in/>
2. <https://vp-dei.vlabs.ac.in/Dreamweaver/>

CO-PO Mapping:

Course Outcomes	Engineering Knowledge	Problem Analysis	Design/Development of Solutions	Conduct Investigations of Complex Problems	Modern Tool Usage	The Engineer and Society	Environment And Sustainability	Ethics	Individual And Team Work	Communication	Project Management And Finance	Life-Long Learning	PSO1	PSO2
23A0263L.1	2	3	1	1	2	2	1	-	-	-	-	1	3	3
23A0263L.2	3	3	3	1	3	1	1	-	-	-	-	1	2	3
23A0263L.3	3	3	1	3	2	1	1	-	-	-	-	1	2	2
23A0263L.4	3	1	3	1	3	2	1	-	-	-	-	1	3	2
23A0263L.5	3	1	3	1	3	2	1	-	-	-	-	3	2	2

ANNAMACHARYAINSTITUTE OF TECHNOLOGY AND SCIENCES RAJAMPET

(An Autonomous Institution)

Department of Electrical and Electronics Engineering

Title of the Course: Technical Paper writing & IPR

Category: MC

Course Code: 23A0264T

Year : III

Semester II

Branch/es: EEE

Lecture Hours

2

Tutorial Hours

0

Practice Hours

0

Credits

0

Course Objectives: -

1. To enable the students to practice the basic skills of research paper writing
2. To make the students understand the importance of IP and to educate them on the basic concepts of Intellectual Property Rights.
3. To practice the basic skills of performing quality literature review
4. To help them in knowing the significance of real-life practice and procedure of Patents.
5. To enable them learn the procedure of obtaining Patents, Copyrights, & Trade Marks

COURSE OUTCOMES: At the end of the course, students will be able to Blooms Level

1. Identify key secondary literature related to them propose technical paper writing L1, L2
2. Explain various principles and styles in technical writing L1, L2
3. Use the acquired knowledge in writing a research /technical paper L3
4. Analyze rights and responsibilities of holder of Patent, Copyright, Trademark, International Trademark etc. L4
5. Evaluate different forms of IPR available at national & international level L5
6. Develop skill of making search of various forms of IPR by using modern tools and techniques. L3, L6

UNIT – I:

Principles of Technical Writing: styles in technical writing; clarity, precision, coherence and logical sequence in writing-avoiding ambiguity- repetition, and vague language -highlighting your findings-discussing your limitations -hedging and criticizing -plagiarism and paraphrasing.

UNIT – II:

Technical Research Paper Writing: Abstract- Objectives-Limitations-Review of Literature- Problems and Framing Research Questions- Synopsis.

UNIT – III:

Process of research: publication mechanism: types of journals- indexing-seminars- conferences- proof reading –plagiarism style; seminar & conference paper writing; Methodology-discussion-results- citation rules.

UNIT – IV:

Introduction to Intellectual property: Introduction, types of intellectual property, international organizations, ncies and treaties, importance of intellectual property rights trade Marks: Purpose and function of trademarks, acquisition of trade mark rights, protectable matter, selecting evaluating trade mark, trade mark registration processes.

UNIT – V:

Law of copy rights: Fundamentals of copy right law, originality of material, rights of reproduction, rights to perform the work publicly, copy right ownership issues, copy right registration, notice of copy right, international copy right law

Law of patents: Foundation of patent law, patent searching process, ownership rights and transfer. Patent law, intellectual property audits.

Textbooks:

- Deborah. E. Bouchoux, Intellectual Property Rights, Cengage Learning India, 2013
- Meenakshi Raman, Sangeeta Sharma. Technical Communication: Principles and practices. Oxford.

Reference Books:

1. R.Myneni, Law of Intellectual Property, 9th Ed, Asia law House, 2019.
2. Prabuddha Ganguli, Intellectual Property Rights Tata Mcgraw Hill, 2001
3. P.Naryan, Intellectual Property Law, 3rd Ed, Eastern Law House, 2007.
4. Adrian Wallwork. English for Writing Research Papers Second Edition. Springer Cham Heidelberg New York ,2016
5. Dan Jones, Sam Dragga, Technical Writing Style

Online Resources

1. <https://theconceptwriters.com.pk/principles-of-technical-writing/>
2. <https://www.ewh.ieee.org/soc/emcs/acstrial/newsletters/summer10/TechPaperWriting.html>
3. <https://www.ewh.ieee.org/soc/emcs/acstrial/newsletters/summer10/TechPaperWriting.html>
4. <https://www.manuscriptedit.com/scholar-hangout/process-publishing-research-paper-journal/>
5. <https://www.icsi.edu/media/website/IntellectualPropertyRightLaws&Practice.pdf>
6. <https://lawbhoomi.com/intellectual-property-rights-notes/>
7. <https://www.extension.purdue.edu/extmedia/ec/ec-723.pdf>

ANNAMACHARYA INSTITUTE OF TECHNOLOGY AND SCIENCES RAJAMPET
(An Autonomous Institution)

Department of Electrical and Electronics Engineering

Title of the Power System Operation and Control
Category: PC
Couse Code: 23A0271T
Year : IV
Semester I
Branch/es: EEE

Lecture Hours

3

Tutorial Hours

0

Practice Hours

0

Credits

3

Course Objectives:

1. Optimal Operation of Thermal Power Stations.
2. Hydrothermal Scheduling.
3. Modelling of Turbines and Generators.
4. Load frequency control of Single Area and Two Area Systems.
5. The Shunt and Series Reactive Power Compensations in Power Systems.

Course Outcomes:

Blooms Level

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

- | | |
|---|----|
| 1. To Understand the Thermal Station Characteristics and Economic Dispatch Problem of Thermal Units and Understand the Optimal Scheduling of Hydro-Thermal Station with minimization of cost of Thermal station | L3 |
| 2. To Develop the First Order Models of Turbine, Governor and Generator Load Model | L4 |
| 3. To Evaluate the Steady State & Dynamic Analysis of Single Area and Two Area Load Frequency Control | L3 |
| 4. To Analyze the Series & Shunt Reactive Power Compensation in Transmission and Load Systems | L3 |
| 5. To Understand the Aspects of Power System Deregulation | L2 |

Unit 1 Optimum Operation Thermal Power Station: 10

Optimum Operation of Thermal Power Station: Heat Rate Curve – Cost Curve – Incremental Fuel Rate – Incremental Fuel Cost and Production Cost, Input – Output Characteristics of Thermal Power Stations and Hydro Power Stations. Optimum Generation Allocation of Thermal Units without Transmission Line Losses and Optimum Generation Allocation with effect of Transmission Line Losses. Transmission Line Loss Formula, Loss coefficients, Numerical Problems.

Unit 2 Economic Operation of Hydro – Thermal Scheduling: 08

Optimum Operation of Hydrothermal Power Stations:

Hydrothermal Coordination Methods – Optimal power flow problem formulation for loss and cost minimization, Solution of optimal power flow problem using Newton's method and Linear Programming technique – Numerical problems.

Unit 3 Load Frequency Control: 08

Modelling of Turbine & Governor:

The first order Turbine model, Block Diagram representation of Steam Turbines and approximate Linear models, Mathematical Modelling of Speed Governing Systems – Derivation of small Signal Transfer function – Block Diagram.

Single Area Load Frequency Control: 10

Necessity of Keeping Frequency constant, Definition of Control Area – Single Area Control – Block Diagram representation of an Isolated Power System – Steady State Analysis – Dynamic Response – Controlled & Uncontrolled case.

Two Area Load Frequency Control:

Load Frequency control of Two Area system – Controlled and Uncontrolled case, Tie – Line Bias Control. Proportional Plus Integral Control of Single Area and Its Block Diagram Representation, Steady State Response – Load Frequency Control and Economic Dispatch Control.

Unit 4 Reactive Power Control:**08**

Overview of Reactive Power Control – Reactive Power Compensation in Transmission Systems – Advantages and Disadvantages of Different Types of Compensating Equipment for Transmission Systems; Load Compensation – Specifications of Load Compensator, Uncompensated and Compensated Transmission Lines: Shunt and Series Compensation.

Unit 5 Power System Deregulation:**08**

Principle of economics, utility functions, power exchanges, electricity market models, market power indices, ancillary services, transmission and distribution charges, principles of transmission charges, transmission pricing methods, demand-side management, regulatory framework – Numerical problems.

Prescribed Text Books:

1. Modern Power System Analysis, D.P.Kothari and I.J.Nagrath, Tata McGraw Hill Publishing Company Ltd.,
2. Electric Energy Systems Theory: An Introduction, Olle I. Elgerd, TMH Publishing Company Ltd., New Delhi, 2nd edition, 1983.

Reference Books:

1. Power Generation, Operation and Control, Allen J. Wood and Bruce F. Wollenberg, John Wiley & Sons, Inc., New York, 2nd edition, 1996.
2. Reactive Power Control in Electric Systems, T J E Miller, John Wiley & Sons, New York, 1982.
3. Power System Analysis Operation and Control, Abhijit Chakrabarti and Sunita Halder, PHI Learning Pvt. Ltd., 3rd Edition, 2010.

Online Learning Resources:

1. <https://archive.nptel.ac.in/courses/108/104/108104052/>
2. <http://kcl.digimat.in/nptel/courses/video/108104191/L01.html>

CO-PO Mapping:

Course Outcomes	Engineering Knowledge	Problem Analysis	Design/Development of Solutions	Conduct Investigations of Complex Problems	Modern Tool Usage	The Engineer and Society	Environment And Sustainability	Ethics	Individual And Team Work	Communication	Project Management And Finance	Life-Long Learning	PSO1	PSO2
23A0271T.1	3	3	3	2	-	1	-	-	-	-	-	-	3	-
23A0271T.2	3	3	3	1	-	1	-	-	-	-	-	-	3	1
23A0271T.3	3	3	3	3	-	1	-	-	-	-	-	-	3	2
23A0271T.4	3	3	3	-	-	1	-	-	-	-	-	-	3	-
23A0271T.5	3	-	2	-	2	1	-	-	-	-	-	-	3	-

ANNAMACHARYA INSTITUTE OF TECHNOLOGY AND SCIENCES RAJAMPET
(An Autonomous Institution)

Department of Electrical and Electronics Engineering

Title of the Course: Business Ethics and Corporate Governance
Category: HSMC
Couse Code: 23AHS7AT
Year IV
Semester: I
Branch/es EEE

Lecture Hours

3

Tutorial Hours

0

Practice Hours

0

Credits

3

COURSE OBJECTIVES : The objectives of this course are

1. To make the student understand the principles of business ethics
2. To enable them in knowing about the ethics in management
3. To facilitate the student' role in corporate culture
4. To impart knowledge about the fair-trade practices
5. To encourage the student in knowing about the corporate governance

COURSE OUTCOMES: At the end of the course, students will be able to

1. Understand the Ethics and different types of Ethics. L2
2. Understand business ethics and ethical practices in management L2
3. Understand the role of ethics in management L2
4. Apply the knowledge of professional ethics & technical ethicsL3
5. Analyze corporate law, ethics, codes & principles L4
6. Evaluate corporate governance & corporate scams L5

UNIT-I: Ethics

10

Introduction – Meaning – Nature, Scope, significance, Loyalty, and ethical behavior. Value systems - Business Ethics - Types, Characteristics, Factors, Contradictions and Ethical Practices in Management Corporate Social Responsibility – Issues of Management – Crisis Management.

UNIT-II: Ethics In Management

10

Introduction- Ethics in production, finance, Human resource management and Marketing Management - The Ethical Value System – Universalism, Utilitarianism, Distributive Justice, Social Contracts, individual Freedom of Choice, Professional Codes; Culture and Ethics – Ethical Values in different Cultures - Culture and Individual Ethics – professional ethics and technical ethics.

UNIT-III : Corporate Culture

10

Introduction - Meaning, definition, Nature, and significance – Key elements of corporate culture, shared values, beliefs and norms, rituals, symbols and language - Types of corporate culture, hierarchical culture, market driven culture – Organization leadership and corporate culture, leadership styles and their impact on culture, transformational leadership and culture change

UNIT- IV: Legal Frame Work

10

Law and Ethics -Agencies enforcing Ethical Business Behavior - Legal Impact – Environmental Protection, Fair Trade Practices, legal Compliances, Safeguarding Health and wellbeing of Customers – Corporate law, Securities and financial regulations, corporate governance codes and principles.

UNIT -V: Corporate Governance

10

Introduction - Meaning – Corporate governance code, transparency & disclosure -Role of auditors, board of directors and shareholders. Global issues, accounting and regulatory frame work - Corporate scams - Committees in India and abroad, corporate social responsibility. BoDs composition, Cadbury Committee - Various committees - Reports - Benefits and Limitations.

Text books.

1. Murthy CSV: Business Ethics and Corporate Governance, HPH July 2017
2. Bholananth Dutta, S.K. Podder – Corporation Governance, VBH. June 2010

Reference books

1. Dr. K. Nirmala, Karunakara Readdy. Business Ethics and Corporate Governance, HPH
2. H.R.Machiraju: Corporate Governance, HPH, 2013
3. K. Venkataramana, Corporate Governance, SHBP.
4. N.M.Khandelwal. Indian Ethos and Values for Managers

Online Resources:

1. https://onlinecourses.nptel.ac.in/noc21_mg46/
2. <https://archive.nptel.ac.in/courses/110/105/110105138/>
3. https://onlinecourses.nptel.ac.in/noc21_mg54/
4. https://onlinecourses.nptel.ac.in/noc22_mg54/

ANNAMACHARYA INSTITUTE OF TECHNOLOGY AND SCIENCES RAJAMPET

(An Autonomous Institution)

Department of Electrical and Electronics Engineering

Title of the Course: E-Business
Category: HSMC
Couse Code: 23AHS7BT
Year IV
Semester: I
Branch/es EEE

Lecture Hours

3

Tutorial Hours

0

Practice Hours

0

Credits

3

Course Objectives: The Objectives of this course are

- 1 To provide knowledge on emerging concept on E-Business related aspect.
- 2 To understand various electronic markets & business models.
- 3 To impart the information about electronic payment systems & banking.
- 4 To create awareness on security risks and challenges in E-commerce.
- 5 To the students aware on different e-marketing channels & strategies.

COURSE OUTCOMES: At the end of the course student will be able to BTL

1. CO1 Remember E-Business & its nature, scope and functions. L1
2. CO2 Understand E-market-Models which are practicing by the organizations L2
3. CO3 Apply the concepts of E-Commerce in the present globalized world. L3
4. CO4 Analyze the various E-payment systems & importance of net banking. L4
5. CO5 Evaluate market research strategies & E-advertisements. L5
6. CO6 Understand importance of E-security & control L2

Unit-I: Electronic Business

10

Introduction – Nature, meaning, significance, functions and advantages - Definition of Electronic Business - Functions of Electronic Commerce (EC)-Advantages & Disadvantages of E-Commerce – ECommerce and E-Business, Internet Services, Online Shopping- E-Commerce Opportunities for Industries.

Unit-II: Electronic Markets and Business Models

10

Introduction –E-Shops-E-Malls E-Groceries - Portals - Vertical Portals-Horizontal Portals - Advantages of Portals - Business Models- Business to Business (B2B)-Business to Customers(B2C) - Business to Government(B2G)-Auctions- B2B Portals in India

Unit-III: Electronic Payment Systems:

10

Introduction to electronic payment systems (EPS) -Types of electronic payments - Credit/debit cards, ewallets, UPI, and crypto currencies -Smart cards and digital wallets: Features and usage -Electronic Fund Transfer (EFT): Role in business transactions -Infrastructure requirements and regulatory aspects of e-payments

Unit-IV: E-Security

10

Security risks and challenges in electronic commerce - Cyber threats - Phishing, hacking, identity theft, and malware - Digital Signatures & Certificates - Security protocols over public networks (HTTP, SSL, TLS) -Firewalls in securing e- business platforms.

Unit-V: E-Marketing:

10

Introduction – Online Marketing – Advantages of Online Marketing – Internet Advertisement – Advertisement Methods – Conducting Online Market Research– – E-marketing planning: Online branding, social media marketing, and email marketing - E-business strategies: Digital advertising, content marketing, and analytics – E-Customer Relationship Management (eCRM) E-supply chain management (e-SCM)

Text Books:

1. Arati Oturkar & Sunil Khilari. E-Business. Everest Publishing House, 2022
2. P.T.S Joseph. E-Commerce, Fourth Edition, Prentice Hall of India, 2011

References:

1. Debjani, Kamallesh K Bajaj. E-Commerce, Second Edition Tata McGraw-Hill's, 2005
2. Dave Chaffey. E-Commerce E-Management, Second Edition, Pearson, 2012.
3. Henry Chan. E-Commerce Fundamentals and Application, Raymond Leatham Wiley India 2007
4. S. Jaiswal. E-Commerce Galgotia Publication Pvt Ltd., 2003.

Online Resources:

<https://www.slideshare.net/fatimahAlkreem/e-businessppt-67935771>
<https://www.slideshare.net/VikramNani/e-commerce-business-models>
<https://www.slideshare.net/RiteshGoyal/electronic-payment-system>
<https://www.slideshare.net/WelingkarDLP/electronic-security>

ANNAMACHARYA INSTITUTE OF TECHNOLOGY AND SCIENCES RAJAMPET
(An Autonomous Institution)

Department of Electrical and Electronics Engineering

Title of the Course: Management Science
Category: HSMC
Course Code: 23AHS7CT
Year IV
Semester: I
Branch/es EEE

Lecture Hours

3

Tutorial Hours

0

Practice Hours

0

Credits

3

COURSE OBJECTIVES:

- 1 To provide fundamental knowledge on Management, Administration, Organization & its concepts.
- 2 To make the students understand the role of management in Production
- 3 To impart the concept of HRM in order to have an idea on Recruitment, Selection, Training & Development, job evaluation and Merit rating concepts
- 4 To create awareness on identify Strategic Management areas & the PERT/CPM for better Project Management
- 5 To make the students aware of the contemporary issues in modern management

COURSE OUTCOMES: At the end of the course, students will be able to BTL

- CO1 Remember the concepts & principles of management and designs of organization in a practical world L1
- CO2 Understand the knowledge of Work-study principles & Quality Control techniques in industry L2
- CO3 Apply the process of Recruitment & Selection in organization. L3
- CO4 Analyze the concepts of HRM & different training methods. L4
- CO5 Evaluate PERT/CPM Techniques for projects of an enterprise and estimate time & cost of project & to analyze the business through SWOT. L5
- CO6 Create awareness on contemporary issues in modern management & technology. L3

UNIT- I Introduction to Management

10

Management - Concept and meaning - Nature-Functions - Management as a Science and Art and both. Schools of Management Thought - Taylor's Scientific Theory-Henry Fayol's principles - Elton Mayo's Human relations - Organizational Designs - Line organization - Line & Staff Organization - Functional Organization - Matrix Organization -Project Organization - Committee form of Organization - Social responsibilities of Management.

UNIT - II Operations Management

10

Principles and Types of Plant Layout - Methods of Production (Job, batch and Mass Production), Work Study - Statistical Quality Control- Material Management - Objectives - Inventory-Functions - Types, Inventory Techniques - EOQ-ABC Analysis - Marketing Management - Concept - Meaning – Nature Functions of Marketing - Marketing Mix - Channels of Distribution - Advertisement and Sales Promotion - Marketing Strategies based on Product Life Cycle.

UNIT - III Human Resources Management (HRM)

10

HRM - Definition and Meaning – Nature - Managerial and Operative functions - Job Analysis - Human Resource Planning (HRP) - Employee Recruitment-Sources of Recruitment - Employee Selection - Process - Employee Training and Development - methods - Performance Appraisal Concept - Methods of Performance Appraisal – Placement - Employee Induction - Wage and Salary Administration

UNIT - IV Strategic & Project Management

10

Definition & Meaning - Setting of Vision - Mission - Goals - Corporate Planning Process - Environmental Scanning - Steps in Strategy Formulation and Implementation - SWOT Analysis - Project Management - Network Analysis - Programme Evaluation and Review Technique (PERT) - Critical Path Method (CPM) Identifying Critical Path - Probability of Completing the project within given time - Project Cost- Analysis - Project Crashing (Simple problems).

UNIT - V Contemporary Issues In Management**10**

Customer Relations Management (CRM) - Total Quality Management (TQM) - Six Sigma Concept - Supply Chain Management (SCM) - Enterprise Resource Planning (ERP) - Performance Management – employee engagement and retention - Business Process Re-engineering and Bench Marking - Knowledge Management – change management – sustainability and corporate social responsibility

Text Books:

1. Frederick S. Hillier, Mark S. Hillier. Introduction to Management Science, October 26, 2023
2. A.R Aryasri, Management Science, TMH, 2019

References:

1. Stoner, Freeman, Gilbert. Management, Pearson Education, New Delhi, 2019.
2. Koontz & Weihrich, Essentials of Management, 6/e, TMH, 2005.
3. Thomas N.Duening & John M.Ivancevich, Management Principles and Guidelines, Biztantra.
4. Kanishka Bedi, Production and Operations Management, Oxford University Press, 2004.
5. Samuel C.Certo, Modern Management, 9/e, PHI, 2005

Online Resources:

1. <https://www.slideshare.net/slideshow/introduction-to-management-and-marganization231308043/231308043>
2. <https://nptel.ac.in/courses/112107238>
3. <https://archive.nptel.ac.in/courses/110/104/110104068/>
4. <https://archive.nptel.ac.in/courses/110/105/110105069>

ANNAMACHARYA INSTITUTE OF TECHNOLOGY AND SCIENCES RAJAMPET
(An Autonomous Institution)

Department of Electrical and Electronics Engineering

Title of the Course: Digital Signal Processing
Category: PE-IV
Course Code: 23A027AT
Year IV
Semester: I
Branch/es EEE

Lecture Hours

3

Tutorial Hours

0

Practice Hours

0

Credits

3

Course Objectives:

1. To get familiar with the properties of discrete time signals, systems and z-transform.
2. To learn the importance of FFT algorithm for computation of Discrete Fourier Transform and Fast Fourier Transform with decimations.
3. To understand the implementations of digital filter structures.
4. To analyze the FIR filter design using Fourier series and windowing methods.
5. To gain the knowledge on Programmable DSP Devices.

Course Outcomes:

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

CO1: Familiar with the properties of discrete time signals, systems and z-transform. **L2**

CO2: Learn the importance of FFT algorithm for computation of Discrete Fourier Transform and Fast Fourier Transform with decimations. **L3**

CO3: Understand the implementations of digital filter structures. **L1**

CO4: Analyze the FIR filter design using Fourier series and windowing methods. **L3**

CO5: Gain the knowledge on Programmable DSP Devices. **L2**

Unit 1 10

Introduction to discrete time signals and systems: Introduction to digital signal processing, Review of discrete-time signals and systems, Analysis of discrete-time linear time invariant systems, frequency domain representation of discrete time signals and systems.

Z-Transform: Definition, ROC, Properties, Poles and Zeros in Z-plane, the inverse Z-Transform, System analysis, Transfer function, BIBO stability, System Response to standard signals, Solution of difference equations with initial conditions, Illustrative Problems, analysis of linear time-invariant systems in the z-domain, pole-zero stability.

Unit 2 8

Discrete Fourier Transform : Introduction, Discrete Fourier Series, properties of DFS, Discrete Fourier Transform, Inverse DFT, properties of DFT, Linear and Circular convolution, convolution using DFT.

Fast Fourier Transform: Introduction, Fast Fourier Transform, Radix-2 Decimation in time and Decimation in frequency FFT, Inverse FFT (Radix-2).

Unit 3 8

IIR Filters: Analog filter approximations-Butterworth and Chebyshev, design of digital filters from analog filters. IIR Structures- Direct form –I , Direct form- II, Transposed Structure, Cascade form.

Unit 4 8

FIR Filters: Characteristics of FIR digital filters, frequency response. Design of FIR digital filters using window techniques, frequency sampling technique and Fourier method, comparison of IIR and FIR filters.

Architectures for Programmable DSP Devices: Architecture of TMS320C5X: Introduction, Bus Structure, Central Arithmetic Logic Unit, Auxiliary Register ALU, Index Register, Block Move Address Register, Parallel Logic Unit, Memory mapped registers, program controller, some flags in the status registers, On- chip memory, On-chip peripherals.

Prescribed Textbooks:

1. Digital signal processing, principles, Algorithms and applications: John G. Proakis, Dimitris G. Manolakis, Pearson Education/PHI, 4th ed., 2014
2. Digital Signal Processing, A computer base approach- Sanjit K Mitra, Tata McGraw, 4th ed., 2012

Reference Books:

1. S.K.Mitra, Digital Signal Processing – A practical approach, 2nd Edition, Pearson Education, New Delhi, 2004.
2. MH Hayes, Digital Signal Processing, Schaum's Outline series, TATA Mc-Graw Hill, 2007.
3. Robert J. Schilling, Sandra L. Harris, Fundamentals of Digital Signal Processing using Matlab, Thomson, 2007.
4. Discrete Time Signal Processing-A.V. Oppenheim and R.W. Schaffer, 2nd ed., PHI.
5. Digital Signal Processing- P. Ramesh Babu, 4th Ed. SciTech Publications.
6. SenM.Kuo, Woonsen S. Gan, "Digital Signal Processors, Architecture, Implementations

Web Resources:

1. <https://nptel.ac.in/courses/117/102/117102060/>
2. <https://nptel.ac.in/courses/108/101/108101174/>
3. https://onlinecourses.nptel.ac.in/noc21_ee20/preview
4. https://onlinecourses.nptel.ac.in/noc22_ee99/preview,
5. <https://nptel.ac.in/courses/108105055>

CO-PO Mapping:

Course Outcomes	Engineering Knowledge	Problem Analysis	Design/Development of Solutions	Conduct Investigations of Complex Problems	Modern Tool Usage	The Engineer and Society	Environment And Sustainability	Ethics	Individual And Team Work	Communication	Project Management And Finance	Life-Long Learning	PSO1	PSO2
23A027AT.1	3	3	3	-	-	-	-	-	-	3	3	3	3	3
23A027AT.2	1	1	1	-	-	-	-	-	-	1	1	3	1	1
23A027AT.3	3	3	-	3	-	-	-	-	-	3	3	3	3	3
23A027AT.4	3	3	-	3	-	-	-	-	-	3	3	3	3	3
23A027AT.5	3	3	3	-	-	-	-	-	2	3	3	3	3	3

ANNAMACHARYA INSTITUTE OF TECHNOLOGY AND SCIENCES RAJAMPET**(An Autonomous Institution)****Department of Electrical and Electronics Engineering****Title of the Course:** Electric Vehicle Technology**Category:** PE-IV**Couse Code:** 23A027BT**Year :** IV**Semester** I**Branch/es:** EEE**Lecture Hours**

3

Tutorial Hours

0

Practice Hours

0

Credits

3

Course Objectives:

This course provides a comprehensive understanding of battery fundamentals, types, and key performance parameters critical to electric vehicles. It covers advanced battery modeling techniques for capacity estimation and state-of-charge prediction. Students will explore the design and standards of EV charging infrastructure, including communication protocols and battery management systems. Additionally, the course delves into modern charging methods and power electronics essential for efficient and grid-friendly EV charging.

Course Outcomes:**Blooms
Taxonomy**

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

- | | |
|---|----|
| 1. Understanding Battery Basics and Key Parameters. | L2 |
| 2. Analyzing Battery Modeling Techniques and Capacity Estimation. | L4 |
| 3. Exploring Charging Infrastructure and Regulatory Frameworks. | L3 |
| 4. Evaluating Battery Charging Techniques and Performance. | L5 |
| 5. Understanding Power Electronics in EV Charging Systems. | L2 |

Unit 1 Battery Basics

12

Battery parameters- Cell and Battery Voltages, Charge (or Amp hour) Capacity, Energy Stored, Specific Energy, Energy Density, Specific Power, Amp hour (or Charge) Efficiency, Energy Efficiency, Self-discharge Rates, Battery Geometry, Battery Temperature, Heating and Cooling Needs, Battery Life and Number of Deep Cycles, Types of batteries- lead-acid, nickel based sodium based, lithium batteries, metal-air batteries. Refilled Batteries.

Unit 2 Battery Modeling

10

The Purpose of Battery Modelling, Electrochemical model, black box model, equivalent circuit model - Battery Equivalent Circuit, Modelling Battery Capacity, Simulating a Battery at a Set Power, Calculating the Peukert Coefficient, Approximate Battery Sizing, Battery state of charge estimation.

Unit 3 Charging Infrastructure

8

EV supply equipment, charging standards, classification of charging infrastructure, connecting EVs to the electricity grid, regulatory framework for EV charging connections, communication protocols for smart charging, Battery Management System.

Unit 4 Battery Charging Techniques

10

Basic Terms for Evaluating Charging Performances, Charging Algorithms for Li-Ion Batteries, Optimal Charging Current Profiles for Lithium-Ion battery, Lithium Titanate Oxide Battery with Extreme Fast Charging Capability, Super Capacitors for battery charging.

Unit 5 Power Electronics in EV Charging

10

Active front end rectifiers - Forward converters, half and full bridge DC-DC converters, power factor correction converters, decreasing impact on the grid and switches, bidirectional battery chargers, wireless charging.

Prescribed Textbooks:

1. James Larminie, John Lowry, —Electric Vehicle Technology Explained, Wiley, 2nd Edition, 2012.
2. Rui Xiong, Weixiang Shen, —Advanced Battery management Technologies for Electric Vehicle||, Wiley, 2019

Reference Books:

1. Handbook of Electric Vehicle Charging Infrastructure Implementation, NITI Aayog, Government of India.
2. Chris Mi, M. AbulMasrur, Hybrid Electric Vehicles: Principles and Applications with Practical Perspectives, Wiley, 2nd Edition, 2017.
3. Bruno Scrosati, Jurgen Garche, Werner Tillmetz, Advances in Battery Technologies for Electric Vehicles, Wood head Publishing Series in Energy, 2015.
4. Sheldon S. Williamson , Energy Management Strategies for Electric and Plug-in Hybrid Electric Vehicles, Springer, 2013.

Web Resources:

1. <https://nptel.ac.in/courses/112/104/112104145/>
2. <https://www.coursera.org/learn/electric-vehicles>
3. <https://www.sae.org/browse/?keyword=electric%20vehicle>
4. <https://ocw.mit.edu/courses/mechanical-engineering/2-671-electric-vehicles-fall-2010/>

CO-PO Mapping:

Course Outcomes	Engineering Knowledge	Problem Analysis	Design/Development of Solutions	Conduct Investigations of Complex Problems	Modern Tool Usage	The Engineer and Society	Environment And Sustainability	Ethics	Individual And Team Work	Communication	Project Management And Finance	Life-Long Learning	PSO1	PSO2
23A027BT.1	3	2	1	1	2	1	2	1	1	1	1	2	3	2
23A027BT.2	3	3	2	2	2	1	2	1	1	1	1	3	3	3
23A027BT.3	2	2	3	2	3	2	3	1	1	2	2	2	2	3
23A027BT.4	2	2	3	3	3	2	3	1	2	1	2	2	2	3
23A027BT.5	2	1	3	2	3	1	2	1	1	1	2	2	3	2

ANNAMACHARYA INSTITUTE OF TECHNOLOGY AND SCIENCES RAJAMPET
(An Autonomous Institution)

Department of Electrical and Electronics Engineering

Title of the Course: HVDC & FACTS
Category: PE-IV
Course Code: 23A027CT
Year : IV
Semester I
Branch/es: EEE

Lecture Hours

3

Tutorial Hours

0

Practice Hours

0

Credits

3

Course Objectives:

1. To introduce the concept of HVDC Transmission system and FACTS.
2. To familiarize with operation of HVDC converters and their control.
3. To distinguish series & shunt compensation.

Course Outcomes:

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

1. Analyze the Economical & Technical aspects of AC & DC Transmission
2. Analyze the Converter control characteristics & Filters for harmonics elimination.
3. Identify the basic types of FACTS controllers
4. Distinguish series and shunt compensation
5. Analyze the operation of UPFC, IPFC and various damping schemes

Unit 1 Introduction:

10

Comparison of AC and DC Transmission systems, Applications of D.C. Transmission, Types of DC links, Typical layout of a HVDC converter station. HVDC converters, Analysis of 3-phase Bridge circuit without overlap.

Unit 2 Converter and HVDC Control:

10

Principle of DC link control, Converter control characteristics, System control Hierarchy, Firing angle control, Current and Extinction Angle control.

Harmonics, Filters and Sources of Reactive Power: Introduction of Harmonics, Generation of Harmonics, AC and DC Filters, Sources of Reactive power. Modeling of DC/AC converters, Converter controller equations, Solutions of AC/DC load flow- Simultaneous approach and Sequential approach.

Unit 3 Introduction to FACTS Concepts:

10

FACTS concepts, Flow of power in AC parallel paths and meshed systems, Basic types of FACTS controllers, Brief description and Definitions of FACTS controllers.

Unit 4 Static Shunt & Series Compensators:

10

Objectives of shunt compensation, Methods of controllable VAR generation, Static VAR compensators, SVC and STATCOM comparison. Objectives of series compensation, Variable impedance type- Thyristor Switched Series Capacitors (TSSC), and Switching Converter type Series Compensators – Static Series Synchronous Compensator (SSSC).

Unit 5 Combined Compensators and Application of FACTS Devices:

10

Unified power flow controller (UPFC), Basic operating principle, Independent real and reactive power flow controller, Interline Power Flow Controller (IPFC) – Principle of operation and Characteristics, Sub-synchronous resonance, Types Sub-synchronous resonance, Various damping schemes: Static Blocking Filter, By-pass damping filter, NGH damping scheme and Dynamic stabilizer. Transient stability and voltage stability.

1. Padiyar, K. R., "HVDC transmission systems", Wiley Eastern Ltd., 2010.
2. Narain Hingorani & Lazzlo Gyugi, "Understanding FACTS. Concepts & Technology of FACTS", Standard publishers & distributors, 2011.
3. Hingorani ,L.Gyugyi, "Concepts and Technology of Flexible AC Transmission System", IEEE Press New York, 2000 ISBN –078033 4588.

1. Padiyar K. R., "FACTS controllers for Transmission and Distribution systems", New Age International Publishers, 1st Edition, 2007.
2. Enrique Acha, Claudio R. Fuerte-Esquivel, Hugo Ambriz-Pérez, "FACTS: Modelling and Simulation in Power Networks", John Wiley, 2011
3. Mohan Mathur R. and Rajiv K. Varma, "Thyristor – based FACTS controllers for Electrical Transmission systems", IEEE press, Wiley Inter science, 2002.

1. <http://www.nptelvideos.in/2012/11/high-voltage-dc-transmission.html>
2. <http://nptel.ac.in/courses/108104013/>
3. <https://nptel.ac.in/courses/108/107/108107114/>

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ANNAMACHARYA INSTITUTE OF TECHNOLOGY AND SCIENCES RAJAMPET
(An Autonomous Institution)

Department of Electrical and Electronics Engineering

Title of the Course: Special Electrical Machines
Category: PE-IV
Course Code: 23A027DT
Year: IV
Semester I
Branch/es EEE

Lecture Hours	Tutorial Hours	Practice Hours	Credits
3	0	0	3

Course Objectives:

- To describe the construction, operation and performance of Special Electrical Machines.

Course Outcomes:

At the end of the course, the student will be able to	Blooms Level of Learning
1. Describe the construction, operation and to sketch the characteristics of Syn. Rel. motors.	L2 & L3
2. Describe the construction, operation and to sketch the characteristics of Sw. Rel. motors.	L2 & L3
3. Describe the construction, operation and to sketch the characteristics of Stepper motors.	L2 & L3
4. Describe the construction, operation and to sketch the characteristics of PMBLDC motors.	L2 & L3
5. Describe the construction, operation and to sketch the characteristics of PMSM motors.	L2 & L3

Unit 1 Synchronous Reluctance Motors 10

Constructional features of Synchronous Reluctance motor - Types - Axial and radial air gap motors - Operating principle - Reluctance - Phasor diagram – Characteristics - Vernier motor.

Unit 2 Switched Reluctance Motors 10

Constructional features of Switched Reluctance motor - Principle of operation - Torque prediction - Power controllers - Non-linear analysis - Microprocessor based control - Characteristics - Computer control.

Unit 3 Stepper Motors 10

Constructional features - Principle of operation - Variable reluctance motor - Hybrid motor - Single and multi-stack configurations - Theory of torque predictions - Linear and non-linear analysis - Characteristics - Drive circuits.

Unit 4 Permanent Magnet BLDC Motors (PMBLDC) 10

Constructional features - principle of operation of PMBLDC - Types - Magnetic circuit analysis - EMF and torque equations - Power controllers - Motor characteristics and control.

Unit 5 Permanent Magnet Synchronous Motors (PMSM) 10

Constructional features - principle of operation of PMSM - EMF and torque equations - Reactance - Phasor diagram - Power controllers - Converter - Volt-ampere requirements - Torque speed characteristics - Microprocessor based control.

Prescribed Text Books:

1. T.J.E. Miller. Brushless Permanent Magnet and Reluctance Motor Drives. Clarendon Press, Oxford, 1989.
2. P.P.Aearnley. Stepping Motors – A Guide to Motor Theory and Practice. Peter Perengrinus. London, 2002.

Reference Books:

1. M.G.Say & E.O.Taylor, DC Machines, 2nd Edition, EBL.
2. T. Kenjo. Stepping Motors and Their Microprocessor Controls. Clarendon Press London, 1990.
3. T. Kenjo and S. Nagamori, Permanent Magnet and Brushless DC Motors, Clarendon Press, London, 1990.

Web Resources:

1. <https://www.mdpi.com/2071-1050/13/2/729/pdf>
2. <https://www.ti.com/lit/pdf/slvaen9>
3. <https://www.monolithicpower.com/en/stepper-motors-basics-types-uses>
4. <https://www.renesas.com/us/en/support/engineer-school/brushless-dc-motor-01-overview>
5. <https://www.embitel.com/blog/embedded-blog/brushless-dc-motor-vs-pmsm-how-these-motors-and-motor-control-solutions-work>

CO-PO Mapping:

Course Outcomes	Engineering Knowledge	Problem Analysis	Design/Development of Solutions	Conduct Investigations of Complex Problems	Modern Tool Usage	The Engineer and Society	Environment And Sustainability	Ethics	Individual And Team Work	Communication	Project Management And Finance	Life-Long Learning	PSO1	PSO2
23A027DT.1	3	3	2	2	2	3	-	-	-	-	-	-	3	3
23A027DT.2	3	3	2	2	2	3	-	-	-	-	-	-	3	3
23A027DT.3	3	3	-	-	-	3	-	-	-	-	-	-	3	3
23A027DT.4	3	3	-	-	-	3	-	-	-	-	-	-	3	-
23A027DT.5	3	3	-	-	-	3	-	-	-	-	-	-	3	-

ANNAMACHARYA INSTITUTE OF TECHNOLOGY AND SCIENCES RAJAMPET
(An Autonomous Institution)

Department of Electrical and Electronics Engineering

Title of the Course: Modern Control Theory

Category: PE-V

Course Code: 23A027ET

Year : IV

Semester I

Branch/es: EEE

Lecture Hours

3

Tutorial Hours

0

Practice Hours

0

Credits

3

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

1. To introduce the concept of state-space modeling and enable students to represent linear systems using state variables.
2. To develop the ability to derive transfer functions from state models and analyze system dynamics using eigenvalues and diagonalization techniques.
3. To provide methods for solving state equations, including Laplace transforms, power series, and the Cayley-Hamilton theorem.
4. To impart knowledge on system controllability and observability, and design state feedback controllers and observers using pole placement techniques.
5. To analyze the behavior and stability of nonlinear systems using phase plane methods and Lyapunov's direct method.

Course Outcomes:

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

1. Develop state-space models of linear systems using physical, phase, and canonical variables, and derive transfer functions from state representations. L3
2. Solve state equations using Laplace transforms, power series, and the Cayley-Hamilton method and determine controllability and observability. L4
3. Design state feedback controllers and state observers using pole placement techniques, and assess the system performance. L6
4. Examine the behavior of nonlinear systems using phase plane methods and interpret the impact of physical nonlinearities. L4
5. Evaluate system stability using Lyapunov's direct method and apply Hurwitz and Krasovskii's criteria to linear and nonlinear systems. L5

Unit 1 Introduction

10

Introduction, concept of state, state variables and state model, state modeling of linear systems, linearization of state equations. State space representation using physical variables, phase variables & canonical variables.

Derivation of transfer function from state model Derivation of transfer function from state model, diagonalization, Eigen values, Eigen vectors, generalized Eigen vectors.

Unit 2 Solution of state equation

10

Solution of state equation, state transition matrix and its properties, computation using Laplace transformation, power series method, Cayley- Hamilton method, concept of controllability & observability, methods of determining the same.

Unit 3 Pole Placement Techniques

10

Stability improvements by state feedback, necessary & sufficient conditions for arbitrary pole placement, state regulator design, and design of state observer, Controllers- P,PI, PID.

Unit 4 Non-linear systems

10

Introduction, behavior of non-linear system, common physical non linearity- saturation, friction, backlash, dead zone, relay, multi variable non-linearity.

Phase plane method 7 hours Phase plane method, singular points, stability of nonlinear system, limit cycles, construction of phase trajectories

Prescribed Textbooks:

- ### Reference Books:

- ### Web Resources:

- ### Co-Po Mapping:

[illegible]

ANNAMACHARYA INSTITUTE OF TECHNOLOGY AND SCIENCES RAJAMPET
(An Autonomous Institution)

Department of Electrical and Electronics Engineering

Title of the Course: Switched Mode Power Conversion
Category: PE-V
Course Code: 23A027FT
Year : IV
Semester I
Branch/es: EEE

Lecture Hours
3

Tutorial Hours
0

Practice Hours
0

Credits
3

Course Outcomes:

Blooms Level

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

1. Remember basic concepts of various converters. L1
2. Understand the problems and to design of various DC-DC converters, advanced converters of SMPCs L2
3. Evaluate the performance of resonant converters L3
4. Analyze the performance characteristics of 1- ϕ and 3- ϕ inverters with single/multi levels, power conditioners, UPS and filters L3
5. Design various applications of the above in Power Systems, EVE, Renewable Energy Systems, etc. L5

Unit 1 DC-DC Converters:

10

Principles of step-down and step-up converters – Analysis and state space modelling of Buck, Boost, Buck- Boost and SEPIC converters – Numerical Examples

Unit 2 Switching Mode Power Converters:

10

Analysis and state space modelling of flyback, Forward, Luo, Half bridge and full bridge converters- control circuits and PWM techniques – Numerical Examples

Unit 3 Resonant Converters:

10

Introduction- classification- basic concepts- Resonant switch- Load Resonant converters- ZVS, Clamped voltage topologies- DC link inverters with Zero Voltage Switching- Series and parallel Resonant inverters- Voltage control – Numerical Examples

Unit 4 DC-AC Converters:

10

Single phase and three phase inverters, control using various (sine PWM, SVPWM and advanced modulation) techniques, various harmonic elimination techniques- Multilevel inverters- Concepts - Types: Diode clamped- Flying capacitor- Cascaded types- Applications.

Unit 5 Power Conditioners, UPS & Filters:

10

Introduction- Power line disturbances- Power conditioners –UPS: offline UPS, Online UPS, Applications – Filters: Voltage filters, Series-parallel resonant filters, filter without series capacitors, filter for PWM VSI, current filter, DC filters – Design of inductor and transformer for PE applications – Selection of capacitors.

Prescribed Textbooks:

1. M.H. Rashid – Power Electronics handbook, Elsevier Publication, 2001.
2. V. Ramanarayanan Course Material on Switched Mode Power Conversion, Department of Electrical Engineering, Indian Institute of Science, Bangalore 560012.

Reference Books:

1. M.H. Rashid, Power Electronics circuits, devices and applications, 3rd Edition Prentice Hall of India New Delhi, 2007.
2. Ned Mohan, Tore.M.Undeland, William.P.Robbins, Power Electronics converters, Applications and design, 3rd Edition, John Wiley and Sons, 2006

3. Middlebrook, R. D.(Robert David), and Slobodan Cuk, *Advances in Switched-Mode Power Conversion*, Volumes I and II, 2nd Edition, TESLA Co, 1983.

Web Resources:

1. <https://archive.nptel.ac.in/courses/108/108/108108036/>
2. <http://minchu.ee.iisc.ernet.in/new/people/faculty/vr/book.pdf>

CO-PO Mapping:

[illegible]

ANNAMACHARYA INSTITUTE OF TECHNOLOGY AND SCIENCES RAJAMPET
(An Autonomous Institution)

Department of Electrical and Electronics Engineering

Title of the Electrical Distribution System
Category: PE-V
Course Code: 23A02GT
Year : IV
Semester I
Branch/es: EEE

Lecture Hours	Tutorial Hours	Practice Hours	Credits
3	0	0	3

Course Objectives:

1. To know about fundamental aspects of distribution system, principle of distribution substations.
2. To know about classification of various loads.
3. To understand difference between conventional load flow studies of power system and distribution system load flow.
4. To know about evaluation of voltage droop and power loss calculations, distribution automation and management system, SCADA.

Course Outcomes:

At the end of the course, the student will be able to	BLOOMS LEVEL
1. Understand fundamental aspects of distribution system and various factors affecting the distribution systems	L2
2. Analysis of substations and modelling of loads	L3
3. Understand difference between conventional load flow studies of power system and distribution system load flow.	L2
4. Evaluation of voltage drop and power loss calculations and capacitor location and cost analysis	L3
5. analyze the concepts of SCADA, Automation distribution system and management	L3

Unit 1 Distribution System Fundamentals

7

Brief description about electrical power transmission and distribution systems, Different types of distribution sub-transmission systems, Substation bus schemes, Factors effecting the substation location, Factors effecting the primary feeder rating, types of primary feeders, Factors affecting the primary feeder voltage level, Factors effecting the primary feeder loading.

Unit 2 Distribution System Substations and Loads

7

Substations: Rating of a distribution substation for square and hexagonal shaped distribution substation, Service area with —n primary feeders, K constant, Radial feeder with uniformly and non-uniformly distributed loading. Benefits derived through optimal location of substations. Loads: Various types of loads, Definitions of various terms related to system loading, Distribution transformer loading, feeder loading, Relationship between the Load Factor and Loss Factor, Modelling of star and delta connected loads.

Unit 3 Distribution System Load Flow

7

Exact line segment model, Modified line model, approximate line segment model, Step-Voltage Regulators, Line drop compensator, Forward/Backward sweep distribution load flow algorithm – Numerical problems

Unit 4 Voltage Drop and Power Loss Calculation:

7

Analysis of non-three phase primary lines, concepts of four-wire multi-grounded common-neutral distribution system, Percent power loss calculation, Distribution feeder cost calculation methods, Capacitor installation types, Series and Shunt Capacitors, Types of three-phase capacitor-bank connections, Procedure for best capacitor location, Economic justification for capacitors – Numerical problems.

Unit 5 Distribution Automation:

7

Distribution automation, distribution management systems, distribution automation system functions, Basic SCADA system, Consumer Information Service (CIS) – Geographical Information System (GIS) – Automatic Meter Reading (AMR), Outage management, decision support applications, substation automation, control feeder automation.

Prescribed Text books:

1. Distribution System Modelling and Analysis, William H. Kersting, CRC Press, Newyork, 2002.
2. Electric Power Distribution System Engineering, TuranGonen, McGraw-Hill Inc., New Delhi, 1986.

Reference Books:

1. Control and automation of electrical power distribution systems, James Northcote-Green and Robert Wilson, CRC Press (Taylor & Francis), New York, 2007.
2. Biswarup Das, Power distribution Automation, IET publication, 2016.
3. Dr. M. K. Khedkar, Dr. G.M. Dhole, Electric Power Distribution Automation, Laxmi Publications, First edition, 2017.

CO-PO Mapping:

Course Outcomes	Engineering Knowledge	Problem Analysis	Design/Development of Solutions	Conduct Investigations of Complex Problems	Modern Tool Usage	The Engineer and Society	Environment And Sustainability	Ethics	Individual And Team Work	Communication	Project Management And Finance	Life-Long Learning	PSO1	PSO2
23A02GT.1	3	2	1	1	2	1	1	1	1	1	1	2	3	3
23A02GT.2	3	3	2	2	2	1	-	-	1	1	-	2	3	3
23A02GT.3	3	2	2	1	3	-	-	-	1	1	-	2	3	3
23A02GT.4	3	3	3	2	3	1	1	-	1	1	1	2	3	3
23A02GT.5	3	2	2	2	3	2	2	1	2	2	1	3	3	3

ANNAMACHARYA INSTITUTE OF TECHNOLOGY AND SCIENCES RAJAMPET
(An Autonomous Institution)

Department of Electrical and Electronics Engineering

Title of the Power Quality
Category: PE-V
Couse Code: 23A027HT
Year : IV
Semester I
Branch/es: EEE

Lecture Hours

3

Tutorial Hours

0

Practice Hours

0

Credits

3

Course Objectives:

1. Power quality terminology, power quality issues, classification reliability.
2. Different sources of power quality disturbances.
3. Harmonic distortion; Principles for controlling harmonics.
4. Power quality measuring equipment; Power quality monitoring standards.
5. Impact of distributed generation on power quality.

Course Outcomes:

Blooms Level

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

- | | |
|--|----|
| 1. Demonstrate knowledge on sources of power quality disturbances and issues, power quality monitoring and measuring instruments, power quality standards, effect of distributed generation on power quality | L1 |
| 2. Analyze various power quality issues. | L3 |
| 3. Design a suitable harmonic filter for commercial and industrial loads | L4 |
| 4. Investigate various power quality issues and provide feasible solutions for improvement of power quality. | L5 |
| 5. Select and use an appropriate equipment for monitoring and measurement of power quality. | L4 |

Unit 1 Introduction to Power Quality

9

Power Quality- definition, terminology, issues, evaluation procedure, responsibilities of the Suppliers and users of electric power, power quality standards, and CBEMA and ITI curves.

Unit 2 Power Quality Disturbances

10

General classes of power quality problems- Impulsive and oscillatory transients. Long duration Voltage variations - over voltage, under voltage, sustained interruption. Short duration voltage variations- interruption, sag, swell and outage. Sources of sags and interruptions, estimating voltage sag performance overview of mitigation methods.

Unit 3 Fundamentals of Harmonics

10

Harmonic distortion, voltage versus current distortion, harmonics versus transients, power system Quantities under non-sinusoidal conditions, harmonic indices. Harmonic sources from commercial and industrial loads. Effects of harmonic distortion. Applied harmonics - harmonic distortion evaluation, principles of controlling harmonics, and devices for controlling harmonic distortion. Harmonic filter design and standards on harmonics.

Unit 4 Power Quality Monitoring

9

Power quality benchmarking, monitoring considerations, choosing monitoring locations, permanent power quality monitoring equipment, historical perspective of power quality measuring instruments. Power quality measurement equipment-types of instruments, assessment of power quality measurement data, power quality monitoring standards

Unit 5 Distributed Generation and Grid Interconnection**9**

Distributed generation -connection requirements and impacts on the network. Interaction and optimal location of DG- Eigen analysis and voltage interaction. Power quality in DG-Mitigation of voltage dip during motor start, harmonic effects with DG, voltage flicker and fluctuation. Islanding issues, distribution line compensation-heavy Load and Light load condition, real generation, protection issues for distributed generation, technologies for distributed generation, power quality impact from different DG types.

Prescribed Text Books:

1. Roger C. Dugan, Mark F. Mc Granaghan, Surya Santoso, H. Wayne Beaty, Electrical Power Systems Quality, 3rd edition, TMH Education Pvt. Ltd., 2012.
2. Arindam Ghosh, Gerard Ledwich, Power quality enhancement using custom power devices, Kluwer academic publishers, 2002

Reference Books:

1. G.T. Heydt, Electric Power Quality, Stars in a circle Publications, 2nd edition 1991. USA.
2. Surajit Chattopadhyaya, Madhuchhanda Mitra, Samarjit Senugupta, Electrical Power Quality, Springer Dordrecht Heidelberg London New York.2011
3. Math H. J. Bollen, Understanding Power quality problems, IEEE Press, 2007.

Online Learning Resources:

3. <https://electrical-engineering-portal.com>
4. <https://ieeexplore.ieee.org>
5. <https://www.powerstandards.com>

CO-PO Mapping:

Course Outcomes	Engineering Knowledge	Problem Analysis	Design/Development of Solutions	Conduct Investigations of Complex Problems	Modern Tool Usage	The Engineer and Society	Environment And Sustainability	Ethics	Individual And Team Work	Communication	Project Management And Finance	Life-Long Learning	PSO1	PSO2
23A027HT.1	2	-	-	-	-	-	-	-	-	-	-	-	2	-
23A027HT.2	3	3	-	-	-	-	-	-	-	-	-	-	3	-
23A027HT.3	3	3	3	-	-	-	-	-	-	-	-	-	3	-
23A027HT.4	2	2	-	-	2	-	-	-	-	-	-	-	-	2
23A027HT.5	3	3	-	-	3	-	-	-	-	-	-	-	-	3

Department of Electrical and Electronics Engineering

Title of the Course: Power Systems and Simulation Lab
Category: SEC-III
Course Code: 23A0271L
Year : IV
Semester I
Branch/es EEE

Lecture Hours

0

Tutorial Hours

0

Practice Hours

4

Credits

2

Course Objectives:

1. To do the experiments on various power system concepts like determination of sequence impedance, fault analysis, finding of sub transient reactance's.
2. To draw the equivalent circuit of three winding transformer by conducting a suitable experiment.
3. To develop the MATLAB program for formation of Y and Z buses.
4. To develop the MATLAB programs for Gauss-Seidel and fast decoupled load flow studies.
5. To develop the SIMULINK model for single area load frequency problem.

Course Outcomes:

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

- | | Blooms
level |
|---|-----------------|
| 1. Analyze and determine the sequence impedances of both cylindrical rotor and salient pole synchronous machines to understand their behavior under various fault conditions. | L3 |
| 2. Conduct fault analysis (LG, LL, LLG, and LLLG) on synchronous machines and interpret the impact of these faults on system stability and performance. | L2 |
| 3. Develop and simulate load flow analysis using various methods (Gauss-Seidel, Newton-Raphson, Fast Decoupled) and formulate the YBus and ZBus for power system networks. | L5 |
| 4. Model load frequency control problems for single and two-area systems, employing both uncontrolled and PI-controlled approaches to evaluate system performance. | L4 |
| 5. Simulate load frequency control problems for single and two-area systems, employing both uncontrolled and PI-controlled approaches to evaluate system performance. | L6 |

CHOOSE ANY TEN FROM THE FOLLOWING LIST:

- 1 Determination of Sequence Impedances of Cylindrical Rotor Synchronous Machine
- 2 Determination of Sequence Impedances of salient pole Synchronous Machine
- 3 LG Fault Analysis on an un loaded alternator
- 4 LL Fault Analysis on conventional phases
- 5 LLG Fault Analysis
- 6 LLLG Fault Analysis
- 7 Determination of Sub transient reactance of salient pole synchronous machine
- 8 Equivalent circuit of three winding transformer.
- 9 Y_{Bus} formation using Soft Tools
- 10 Z_{Bus} formation using Soft Tools
- 11 Gauss-Seidel load flow analysis using Soft Tools
- 12 Newton-Raphson load flow analysis using Soft Tools
- 13 Fast decoupled load flow analysis using Soft Tools
- 14 Solve the Swing equation and Plot the swing curve
- 15 Develop a model for a uncontrolled single area load frequency control problem and simulate the same using Soft Tools.
- 16 Develop a model for PI controlled single area load frequency control problem and simulate the same using Soft Tools.
- 17 Develop a model for a uncontrolled two area load frequency control problem and simulate the same using Soft Tools.

- 18 Develop a model for PI controlled two area load frequency control problem and simulate the same using Soft Tools.

Online Learning Resource:

1. <https://www.ee.iitb.ac.in/~vlabsync/template/vlab/index.html#>
2. <https://vp-dei.vlabs.ac.in/Dreamweaver/>
3. <https://www.ee.iitb.ac.in/~vlabsync/template/vlab/index.html>

CO-PO Mapping:

Course Outcomes	Engineering Knowledge	Problem Analysis	Design/Development of Solutions	Conduct Investigations of Complex Problems	Modern Tool Usage	The Engineer and Society	Environment And Sustainability	Ethics	Individual And Team Work	Communication	Project Management And Finance	Life-Long Learning	PSO1	PSO2
23A0271L.1	3	3	2	3	3	2	1	1	1	1	1	1	3	3
23A0271L.2	3	3	2	3	3	2	1	1	1	1	1	1	3	3
23A0271L.3	3	3	3	3	3	3	1	1	1	1	1	1	3	3
23A0271L.4	3	3	3	3	3	3	2	1	1	1	1	1	3	3
23A0271L.5	3	3	3	3	3	3	2	1	1	1	1	1	2	2

ANNAMACHARYA INSTITUTE OF TECHNOLOGY AND SCIENCES RAJAMPET
(An Autonomous Institution)

Department of Electrical and Electronics Engineering

Title of the Course: Gender Sensitization
Category: MC
Course Code: 23AHS79T

Year : IV
Semester I
Branch/es EEE

Lecture Hours	Tutorial Hours	Practice Hours	Credits
2	0	0	0

Objectives

1. To enable students to understand the gender related issues, vulnerability of women and men
2. To familiarize them about constitutional safeguard for gender equality
3. To expose the students to debates on the politics and economics of work
4. To help students reflect critically on gender violence
5. To make them understand that gender identities and gender relations are part of culture as they shape
6. The way daily life is lived in the family as well as wider community and the workplace.

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

1. Understand the basic concepts of gender and its related terminology L1, L2,
2. notify the biological, sociological, psychological and legal aspects of gender. L1, L2
3. Use the knowledge in understanding how gender discrimination works L3
4. Analyze the gendered division of labour and its relation to politics and society and how to counter it.
5. Appraise how gender-role beliefs and sharing behaviours are associated with more well-being in all
6. culture and gender groups L5
7. Develop students' sensibility with regard to issues of gender in contemporary India L3

Unit-1 Understanding Gender

Introduction: Definition of Gender-Basic Gender Concepts and Terminology-Exploring Attitudes towards Gender-Construction of Gender-Socialization: Making Women, Making Men - Preparing for Womanhood. Growing up Male. First lessons in Caste.

Unit-2 Gender Roles and Relations

Two or Many? -Struggles with Discrimination-Gender Roles and Relations-Types of Gender Roles- Gender Roles and Relationships Matrix-Missing Women-Sex Selection and its Consequences- Declining Sex Ratio- Demographic Consequences-Gender Spectrum -

Unit-3 Gender and Labour

Division and Valuation of Labour-Housework: The Invisible Labor- —My Mother doesn't Work.|| —Share the Load.||-Work: Its Politics and Economics -Fact and Fiction- Unrecognized and Unaccounted work -Gender Development Issues-Gender, Governance and Sustainable Development-Gender and Human Rights-Gender and Mainstreaming

Unit-4 Gender-Based Violence

The Concept of Violence- Types of Gender-based Violence-Gender-based Violence from a Human Rights Perspective-Sexual Harassment - Domestic Violence - Different forms of violence against women - Causes of violence, impact of violence against women - Consequences of gender-based violence

Unit-5 Gender and Culture

Gender and Film-Gender and Electronic Media-Gender and Advertisement-Gender and Popular Literature- Gender Development Issues-Gender Issues-Gender Sensitive Language- Just Relationships

Prescribed Books

1. A.Suneetha, Uma Bhugubanda, et al. Towards a World of Equals: A Bilingual Textbook on Gender||, Telugu Akademi, Telangana, 2015.
2. Butler, Judith. Gender Trouble: Feminism and the Subversion of Identity. UK Paperback Edn. March 1990

Reference Books

1. Wtatt, Robin and Massood, Nazia, Broken Mirrors: The dowry Problems in India,London : Sage Publications, 2011
2. Datt, R. and Kornberg, J.(eds), Women in Developing Countries, Assessing Strategies for Empowerment, London: Lynne Rienner Publishers, 2002

3. Brush, Lisa D., Gender and Governance, New Delhi, Rawat Publication, 2007
4. Singh, Direeti, Women and Politics World Wide, New Delhi, Axis Publications, 2010
5. Raj Pal Singh, Anupama Sihag, Gender Sensitization: Issues and Challenges (English, Hardcover), Raj Publications, 2019
6. A.Revathy& Murali, Nandini, A Life in Trans Activism(Lakshmi Narayan Tripathi). The University of Chicago Press, 2016

Online Resources:

1.Understanding Gender chrome-extension:

//kdpelmjpfafjppnhbloffcjpeomlnpah/https://www.arvindguptatoys.com/arvindgupta/kamla-gender1.pdf
https://onlinecourses.swayam2.ac.in/nou24_hs53/preview

2.Gender Roles and Relations

<https://www.plannedparenthood.org/learn/gender-identity/sex-gender-identity/what-are-gender-roles-and-stereotypes>

<https://www.verywellmind.com/understanding-gender-roles-and-their-effect-on-our-relationships-7499408>

https://onlinecourses.swayam2.ac.in/cec23_hs29/preview

3.Gender and Labour

<https://www.economicsobservatory.com/what-explains-the-gender-division-of-labour-and-how-can-it-be-redressed>

https://onlinecourses.nptel.ac.in/noc23_mg67/preview

4.GENDER-BASED VIOLENCE

https://eige.europa.eu/gender-based-violence/what-is-gender-based-violence?language_content_entity=en

<https://www.worldbank.org/en/topic/socialsustainability/brief/violence-against-women-and-girls>

https://onlinecourses.swayam2.ac.in/nou25_ge38/preview

5.GENDER AND CULTURE

<https://gender.study/psychology-of-gender/culture-impact-gender-roles-identities/>

<https://sociology.iresearchnet.com/sociology-of-culture/gender-and-culture/>

<https://archive.nptel.ac.in/courses/109/106/109106136/>

Abdulali Sohaila. —I Fought For My Life...and Won. Available online

(at: <http://www.thealternative.in/lifestyle/i-fought-for-my-lifeand-won-sohaila-abdulal/>)

ANNAMACHARYA INSTITUTE OF TECHNOLOGY AND SCIENCES RAJAMPET (An Autonomous Institution)

Department of Electrical and Electronics Engineering

Title of the Course:	Electrical Safety Practices and Standards
Category:	OE
Course Code:	23A025ET
Year :	III
Semester	I
Branch/es	CSE/ECE/ME/Civil

Lecture Hours
3

Tutorial Hours
0

Practice Hours
0

Credits
3

Course Objectives:

1. Explain the physiological effects of electric shock and identify various hazards of electricity including arc and blast based on safety requirements.

2. Classify conductors, insulators, and voltage types, and evaluate the use of appropriate electrical safety equipment and fire extinguishers.
3. Interpret grounding and bonding requirements, and determine safe approach distances and arc hazard categories based on earthing practices.
4. Demonstrate appropriate safety practices in handling electrical appliances and installations across various environments through real-life case studies.
5. Analyze national and international electrical safety standards (e.g., NFPA 70E, OSHA, NEC, NESC) and apply statutory compliance as per the Electricity Act and regulations.

Course Outcomes:

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

1. Analyze national and international electrical safety standards and apply statutory compliance as per the Electricity Act and regulations.
2. Classify various electrical safety components including conductors, insulators, voltage levels, and select suitable protection methods for overvoltage and static electricity.
3. Explain grounding and bonding principles, and calculate safe approach distances and arc hazard levels using earthing system standards.
4. Demonstrate appropriate electrical safety practices in domestic, industrial, and public environments, and evaluate real-world case studies for safety effectiveness.
5. Compare various electrical safety standards and interpret statutory compliance requirements from governing authorities.

Unit 1 Introduction To Electrical Safety

9

Fundamentals of Electrical safety - Electric Shock- physiological effects of electric current - Safety requirements - Hazards of electricity - Arc - Blast - Causes for electrical failure.

Unit 2 Safety Components

9

Introduction to conductors and insulators - voltage classification - safety against over voltages - safety against static electricity - Electrical safety equipment - Fire extinguishers for electrical safety.

Unit 3 Grounding

9

General requirements for grounding and bonding - Definitions- System grounding - Equipment grounding - The Earth - Earthing practices - Determining safe approach distance - Determining arc hazard category.

Unit 4 Safety Practices

9

General first aid - Safety in handling hand held electrical appliances tools - Electrical safety in train stations-swimming pools, external lighting installations, medical locations - Case studies.

Unit 5 Standards For Electrical Safety

9

Electricity Acts - Rules & regulations - Electrical standards - NFPA 70 E-OSHA standards - IEEE standards-National Electrical Code 2005 - National Electric Safety code NESC - Statutory requirements from electrical inspectorate

Prescribed Textbooks:

1. Massimo A. G. Mitolo - Electrical Safety of Low-Voltage Systems, McGraw Hill, USA, 2009.
2. Mohamed El-Sharkawi - Electric Safety - Practice and Standards, CRC Press, USA, 2014.

Reference Books:

1. Kenneth G. Mastrullo, Ray A. Jones - The Electrical Safety Program Book||, Jones and Bartlett Publishers, London, 2nd Edition, 2011.
2. Palmer Hickman - Electrical Safety - Related Work Practices, Jones & Bartlett Publishers, London, 2009.
3. Fordham Cooper, W. - Electrical Safety Engineering||, Butterworth and Company, London, 1986.
4. John Cadick, Mary Capelli - Schellpfeffer, Dennis K. Neitzel - Electrical Safety Hand book, McGraw - Hill, New York, USA, 4th edition, 2012.

Web Resources:

<https://www.youtube.com/watch?v=s24Gn43mVs>
<https://www.youtube.com/@NOUCS-ey8iq>

CO-PO Mapping:

Course Outcomes	Engineering Knowledge	Problem Analysis	Design/Development of Solutions	Conduct Investigations of Complex Problems	Modern Tool Usage	The Engineer and Society	Environment And Sustainability	Ethics	Individual And Team Work	Communication	Project Management And Finance	Life-Long Learning	PSO1	PSO2
23A025ET.1	3	3	2	2	2	3	2	3	2	2	2	3	3	2
23A025ET.2	3	3	2	2	3	2	2	2	2	2	2	3	3	2
23A025ET.3	3	3	2	3	3	2	2	2	2	2	-	3	3	2
23A025ET.4	3	3	2	3	2	3	3	3	3	2	2	3	3	2
23A025ET.5	3	3	-	2	2	3	2	3	2	3	-	3	3	2

ANNAMACHARYA INSTITUTE OF TECHNOLOGY AND SCIENCES RAJAMPET
(An Autonomous Institution)

Department of Electrical and Electronics Engineering

Title of the Course Instrumentation
Category OE
Couse Code 23A025FT
Year III
Semester I
Branch CSE/ECE/ME/Civil

Lecture Hours
3

Tutorial Hours
0

Practice Hours
0

Credits
3

Course Objectives:

1. To Impart knowledge on the characteristics and classifications of signals, along with measurement systems and associated errors.
2. To Familiarize students with various methods of data transmission and telemetry systems for instrumentation.
3. To Provide insights into advanced signal analysis tools like spectrum analyzers and wave analyzers.
4. To Equip students with the knowledge to measure a wide range of non-electrical quantities using appropriate sensors and transducers.

- To Introduce the architecture and operation of real-time control systems including PLCs, SCADA, and DCS.

Course Outcomes:

Blooms Level

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

- | | |
|---|----|
| 1. Understand characteristics of signals and measurement system errors. | L2 |
| 2. Explain data transmission and telemetry techniques. | L2 |
| 3. Understand signal analyzers for waveform and spectral analysis. | L3 |
| 4. Analyze non-electrical quantities using appropriate sensors. | L4 |
| 5. Apply PLC, SCADA, and DCS in real-time control systems. | L3 |

Unit 1 Characteristics of Signals and Their Representation 10

. Measuring Systems, Performance Characteristics, - Static characteristics, Dynamic Characteristics; Errors in Measurement- Gross Errors, Systematic Errors, Statistical Analysis of Random Errors.

Signals and their representation: Standard Test, periodic, aperiodic, modulated signal, sampled data.

Unit 2 Data Transmission and Telemetry 10

Methods of Data Transmission – General Telemetry System – Land line Telemetry System – Voltage, Current and position. Land line with feedback system. Frequency Modulation System (FM), Pulse Modulation (PM), Pulse Amplitude Modulation (PAM), Pulse Code Modulation (PCM) Telemetry. Comparison of FM, PM, PAM and PCM.

Unit 3 Signal Analyzers 10

. Wave Analysers- Frequency selective analyzers, Heterodyne, Application of Wave analyzers- Harmonic Analyzers, Total Harmonic distortion, spectrum analyzers, Basic spectrum analyzers, spectral displays, vector impedance meter, Q meter. Peak reading and RMS voltmeters.

Unit 4 Measurement of Non-Electrical Quantities 10

Measurement of strain, Displacement, Velocity, Angular Velocity (DC Tachometer generator, Photoelectric tachometer), acceleration (LVDT), Force (Strain-gauge, load cells and LVDT), Torque (Magneto-Strictive), Temperature (Thermocouples and Thermistor), Pressure (Resistive, Inductive, LVDT and capacitive), Flow (electromagnetic flow meter, hot wire anemometer), Liquid level (ultrasonic level gauging, resistive and inductive methods).

Unit 5 Real Time Systems, SCADA & DCS 8

REAL TIME SYSTEMS: PLC's: Programmable logic controllers- Organisation- Hardware details- I/O- Power supply- CPU- Standards.

SACADA: Introduction, SCADA Architecture, Different Communication Protocols, Common System Components, Supervision and Control.

DCS: Introduction, DCS Architecture, Local Control (LCU) architecture, Configuration of DCS, displays, redundancy concept.

Prescribed Text Books:

- A.K. Sawhney, *A course in Electrical and Electronic Measurements and Instrumentation*. Dhanpat Rai & Co, 2015, 7th Edition
- R.G. Jamkar, *Industrial Automation using PLC, SCADA & DCS*, Global education Ltd. Publication., 2018, 2nd edition.

Reference Books:

- D O Doebelin, *Measurements Systems, Applications and Design*. McGraw Hill 4th Edition.
- A.S Morris, *Principles of Measurement and Instrumentation*. Pearson /Prentice Hall of India, 2001, 3rd edition.
- H.S.Kalsi, *Electronic Instrumentation*. Tata McGraw-Hill Edition, 3/e, 2017.
- A.D Helfrick and W.D.Cooper, *Modern Electronic Instrumentation and Measurement techniques*. Pearson/Prentice Hall of Indi, 3rd edition.

5. T. R. Padmanabhan, *Industrial Instrumentation – Principles and Design*. Springer, 1st edition, 2000.

Web Resources:

1. https://onlinecourses.nptel.ac.in/noc22_ee112/preview
2. <https://info.premieraautomation.com/blog/automation-solutions-remote-monitoring-with-telemetry>.
3. https://archive.nptel.ac.in/content/syllabus_pdf/108105153.pdf.
4. <https://www.panelmatic.com/articles/dcs-vs-plc-vs-scada/>

CO-PO Mapping:

Course Outcomes	Engineering Knowledge	Problem Analysis	Design/Development of Solutions	Conduct Investigations of Complex Problems	Modern Tool Usage	The Engineer and Society	Environment And Sustainability	Ethics	Individual And Team Work	Communication	Project Management And Finance	Life-Long Learning	PSO1	PSO2
23A025FT.1	3	2	-	-	-	-	-	-	1	-	-	3	-	3
23A025FT.2	3	2	-	-	2	-	-	-	1	-	-	3	-	3
23A025FT.3	3	3	2	2	3	-	-	-	1	-	-	3	2	3
23A025FT.4	3	3	2	2	3	-	-	-	1	-	-	3	2	3
23A025FT.5	3	2	3	2	3	2	2	2	2	2	3	3	3	3

ANNAMACHARYA INSTITUTE OF TECHNOLOGY AND SCIENCES RAJAMPET (An Autonomous Institution)

Department of Electrical and Electronics Engineering

Title of the Course: Renewable Energy Sources
Category: OE
Course Code: 23A026IT
Year: III
Semester : II
Branch/es: CSE/ECE/ME/Civil

Lecture Hours

3

Tutorial Hours

0

Practice Hours

0

Credits

3

Course Objectives:

1. Analyze the working of flat plate and concentrating collectors.
2. Describe the electrical characteristics of solar PV cells/modules and their design considerations.
3. Illustrate the components and types of Wind Energy Conversion Systems (WECS).
4. Examine Emerging Renewable Technologies and their applications.

Course Outcomes:

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

1. Understand principle operation of various renewable energy sources
2. Identify site selection of various renewable energy sources.
3. Analyze various factors affecting on solar energy measurements, wind energy conversion
4. Design of Solar PV modules and considerations of horizontal and vertical axis Wind energy

Blooms Level

L1
L2
L3
L5

systems.

5. Apply the concepts of Geo Thermal Energy, Ocean Energy, Bio mass and Fuel Cells for generation of power.

L4

Unit 1 Solar Energy:

8

Solar radiation - beam and diffuse radiation, solar constant, measurement of solar radiation, local solar time, derived solar angles, sunrise, sunset and day length. Flat plate collectors (Liquid, air), Concentrating collectors - Compound Parabolic Concentrator, Parabolic Dish Collector, Central Receiver System. Solar water heater, solar industrial heating system.

Unit 2 PV Energy Systems:

10

Advantages and Disadvantages of solar PV system, Electrical characteristics of solar PV cells and modules, Solar cell design considerations, Solar cell, module and array construction, Solar PV cell in series and parallel, Simple numerical problems, Solar power distributed system – off-line, grid connected and hybrid PV systems.

Unit 3 Wind Energy:

8

Factors affecting the distribution of Wind Energy on the Surface of Earth, Nature of winds, Basic block diagram of wind energy conversion systems (WECS), Wind mill components, various types WECS and their constructional features, Site selection considerations, Estimation of wind energy at a place, advantages and disadvantages of wind energy.

Unit 4 Geothermal Energy:

8

Advantages, disadvantages and application of Geothermal Energy, Origin and distribution of Geothermal sources, Geothermal resources - Hydrothermal, Hot dry rock, Magma, Estimation of heat content in the Hot dry rock resource.

Unit 5 Miscellaneous Energy Technologies:

10

Ocean Energy: Ocean Tidal Energy conversion schemes, advantages and limitations.

Wave Energy: Principle of working, energy and power from waves, advantages and limitations.

Bio mass Energy: Biomass conversion technologies, Biogas generation plants, Types, merits and demerits

Fuel cell: Principle of working of various types of fuel cells and their working, fuel cell power plant.

Hydrogen Energy: Principle of working of Hydrogen energy and benefits of Hydrogen energy.

Prescribed Text books:

1. G. D. Rai, —Non-Conventional Energy Sources||, 4th Edition, Khanna Publishers, 2004.
2. B H Khan , — Non-Conventional Energy Resources||, 2nd Edition, Tata Mc Graw Hill Education Pvt Ltd, 2011.

Reference Books:

1. G. N. Tiwari and M.K.Ghosal, —Renewable Energy Resource: Basic Principles and Applications||, Narosa Publishing House, 2004.
2. Stephen Peake, —Renewable Energy Power for a Sustainable Future||, Oxford International Edition, 2018.

Web Resources:

1. <https://nptel.ac.in/courses/103103206>
2. <https://nptel.ac.in/courses/108108078>

CO-PO Mapping:

Course Outcomes	Engineering Knowledge	Problem Analysis	Design/Development of Solutions	Conduct Investigations of Complex Problems	Modern Tool Usage	The Engineer and Society	Environment And Sustainability	Ethics	Individual And Team Work	Communication	Project Management And Finance	Life-Long Learning	PSO1	PSO2
23A026IT.1	3	1	-	-	1	1	-	-	-	-	2	1	3	3

23A026IT.2	3	2	1	1	1	2	-	-	-	1	1	2	3	3
23A026IT.3	2	3	1	2	2	1	-	-	-	-	1	2	3	2
23A026IT.4	2	2	3	1	3	-	-	-	1	2	-	3	3	2
23A026IT.5	1	2	2	1	1	1	2	-	2	-	-	1	3	1

ANNAMACHARYA INSTITUTE OF TECHNOLOGY AND SCIENCES RAJAMPET
(An Autonomous Institution)

Department of Electrical and Electronics Engineering

Title of the Course: Wind and Solar Energy
Category: OEC
Couse Code: 23A026JT
Year: III
Semester: II
Branch/es: CSE/ECE/ME/Civil

Lecture Hours
3

Tutorial Hours
0

Practice Hours
0

Credits
3

Course Objectives:

1. To provide a survey of the wind energy and solar energy generation technologies
2. To explain the harnessing of these resources
3. To describe the control of generated power based on power electronics.

Course Outcomes:

Blooms level

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

- | | |
|---|----|
| 1. Understand basic physics of wind and solar power generation. | L2 |
| 2. Analyze power electronic interfaces for wind and solar generation. | L4 |
| 3. Understand energy scenario and the consequent growth of the power. Generation from renewable energy sources. | L2 |
| 4. Analyze grid integration of solar and wind energy systems. | L4 |

Unit 1 Physics of Wind Power:

10

History of wind power, Indian and Global statistics, Wind physics, Betz limit, Tip speed ratio, stall and pitch control, Wind speed statistics probability distributions, Wind speed and power-cumulative distribution functions, numerical problems

- Unit 2 Wind generator topologies:** 10
Review of modern wind turbine technologies, Fixed and Variable speed wind turbines, Induction Generators, Doubly-Fed Induction Generators and their characteristics, Permanent- Magnet Synchronous Generators, Power electronics converters. Generator-Converter configurations, Converter Control.
- Unit 3 The Solar Resource and Solar thermal power generation:** 10
The Solar Resource: Introduction, solar radiation spectra, solar geometry, Earth Sun angles, observer Sun angles, solar day length, Estimation of solar energy availability. Numerical problems on solar geometry. Solar thermal power generation: Technologies, Parabolic trough, central receivers, parabolic dish, Fresnel, solar pond, elementary analysis
- Unit 4 Solar photovoltaic:** 10
Technologies-Amorphous, monocrystalline, polycrystalline; V-I characteristics of a PV cell, PV module, array, Power Electronic Converters for Solar Systems, Maximum Power Point Tracking (MPPT) algorithms, Converter Control
- Unit 5 Network Integration Issues:** 10
Overview of grid code technical requirements. Fault ride-through for wind farms - real and reactive power regulation, voltage and frequency operating limits, solar PV and wind farm behavior during grid disturbances. Power quality Challenges in Renewable Integration. Hybrid and isolated operations of solar PV and wind systems

Prescribed Textbooks:

1. G.D. Rai. Non-Conventional Energy Sources. Khanna Publishers, 6th edition, Khanna Publishers, Delhi, 2018.
2. B. H. Khan., Non-Conventional Energy Resources, 3rd edition ,McGraw-Hill Education India,2017

Reference Books:

1. Twidell & Wier, Renewable Energy Resources, CRC Press, Taylor & Francis. 2008
2. T. Ackermann, Wind Power in Power Systems, John Wiley and Sons Ltd., 2005
3. S. P. Sukhatme, Solar Energy: Principles of Thermal Collection and Storage, McGraw Hill, 1984

Web Resources:

1. <https://www.youtube.com/watch?v=wlVUiF1gdEE>
2. https://www.youtube.com/watch?v=roxuawcqzCA&list=PL9fGaCid4G_a2aS-Hjm_uVNsyhiQdYMYq

CO-PO Mapping:

Course Outcomes	Engineering Knowledge	Problem Analysis	Design/Development of Solutions	Conduct Investigations of Complex Problems	Modern Tool Usage	The Engineer and Society	Environment And Sustainability	Ethics	Individual And Team Work	Communication	Project Management And Finance	Life-Long Learning	PSO1	PSO2
23A026JT.1	3	3	2	3	3	-	3	1	-	3	-	3	2	-
23A026JT.2	3	-	1	-	3	2	3	-	-	3	-	3	2	-
23A026JT.3	3	3	3	3	3	2	3	2	1	3	1	3	2	1
23A026JT.4	3	-	3	-	3	-	3	-	-	3	-	3	2	-

ANNAMACHARYA INSTITUTE OF TECHNOLOGY AND SCIENCES RAJAMPET
(An Autonomous Institution)

Department of Electrical & Electronics Engineering

Title of the Course: Smart Grid Technologies
Category: OE
Couse Code: 23A027IT
Year: IV
Semester: I
Branch/es: CSE/ECE/ME/Civil

Lecture Hours	Tutorial Hours	Practice Hours	Credits
4	0	0	3

Course Objectives:

1. To Impart knowledge in smart grid concepts and smart grid architecture
2. To provide knowledge on Wide Area Monitoring System and smart meters
3. To understand different communication systems.
4. To know Smart Grid Applications and Cyber Security

Course Outcomes:

Blooms Level

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

- | | |
|--|----|
| 1. Understanding the Concept and Evolution of Smart Grid | L2 |
| 2. Analyzing Wide Area Monitoring System and Synchro phasor Technology | L4 |
| 3. Applying Smart Metering and Advanced Metering Infrastructure (AMI) Concepts | L3 |
| 4. Evaluating Information and Communication Technology (ICT) Systems in Smart Grids. | L5 |
| 5. Designing Smart Grid Applications and Cyber security Measures. | L6 |

Unit 1 Introduction to Smart Grid

10

Evolution of Electric Grid – Need for Smart Grid – Difference between conventional & smart grid – Overview of enabling technologies – International experience in Smart Grid deployment efforts – Smart Grid Road map for India – Smart Grid Architecture.

Unit 2 Wide Area Monitoring System

10

Fundamentals of Synchro phasor Technology – concept and benefits of Wide Area Monitoring System – Structure and functions of Phasor Measuring Unit (PMU) and Phasor Data Concentrator (PDC) – Road Map for Synchro phasor applications (NAPSI) – Operational experience and Blackout analysis using PMU - Case study on PMU.

Unit 3 Smart Meters:

10

Features and functions of Smart Meters – Functional specification – category of Smart Meters – Automatic Meter

Reading (AMR) and Advanced Metering Infrastructure (AMI) drivers and benefits – AMI protocol – Demand Side Integration: Peak load, Outage and Power Quality management.

Unit 4 Information and Communication Technology

10

Overview of Smart Grid Communication system – Modulation and Demodulation Techniques: Radio Communication – Mobile Communication – Power Line Communication – Optical Fiber Communication – Communication Protocol for Smart Grid.

Unit 5 Smart Grid Applications and Cyber Security: Applications:

10

Overview and concept of Renewable Integration – Introduction to distributed generation - Role of Protective Relaying in Smart Grid – House Area Network – Advanced Energy Storage Technology: Flow battery – Fuel cell – SMES – Super capacitors – Plug – in Hybrid electric Vehicles - Cyber Security: Security issues in DG, Distribution Automation, AMI, Electric Vehicle Management Systems – Approach to assessment of smart grid cyber security risks – Methodologies. Cyber Security requirements – Smart Grid Information Mode

Prescribed Textbooks:

1. James Momoh, "SMART GRID: Fundamentals of Design and Analysis", John Wiley and Sons, New York, 2012.
2. Janaka Ekanayake, Nick Jenkins, Kithsiri Liyanage, Jianzhong Wu, Akihiko Yokoyama, "Smart Grid: Technology and Applications", John Wiley & Sons, New Jersey, 2012.

Reference Books:

1. Stuart Borlase, "Smart Grids: Infrastructure, Technology and Solutions", 1st Edition, CRC Press Publication, England, 2013.
2. Phadke A G, Thorp J S, "Synchronized Phasor Measurements and Their Applications", 1st Edition, Springer, Newyork, 2012.
3. Fereidoon. P.Sioshansi, "Smart Grid – Integrating Renewable, Distributed and Efficient Energy", 1st Edition, Academic Press, USA, 2011..
4. Power Grid Corporation of India Limited, "Smart Grid Primer", 1st Edition, Power Grid Corporation of India Limited, Bangalore, India, 2013.

Web Resources:

1. <https://www.nsgm.gov.in/en/smart-grid>
2. <https://www.iea.org/energy-system/electricity/smart-grids>
3. https://onlinecourses.nptel.ac.in/noc23_ee60/preview

CO-PO Mapping:

Course Outcomes	Engineering Knowledge	Problem Analysis	Design/Development of Solutions	Conduct Investigations of Complex Problems	Modern Tool Usage	The Engineer and Society	Environment And Sustainability	Ethics	Individual And Team Work	Communication	Project Management And Finance	Life-Long Learning	PSO1	PSO2
23A027IT.1	3	3	2	2	-	-	-	1	-	3	3	3	2	3
23A027IT.2	2	3	3	3	2	1	2	1	1	2	3	3	2	3
23A027IT.3	3	3	3	3	-	2	-	-	-	2	3	3	3	2
23A027IT.4	2	3	3	2	2	1	2	1	1	2	2	3	2	2

23A027IT.5	2	2	3	3	-	-	-	-	-	3	2	3	2	2
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ANNAMACHARYA INSTITUTE OF TECHNOLOGY AND SCIENCES RAJAMPET
(An Autonomous Institution)

Department of Electrical and Electronics Engineering

Title of the Course: Electric Vehicles
Category: OE
Couse Code: 23A027JT
Year: IV
Semester: I
Branch/es: CSE/ECE/ME/Civil

Lecture Hours	Tutorial Hours	Practice Hours	Credits
3	0	0	3

Course Objectives:

This course covers the fundamentals of electric vehicle (EV) systems, including their evolution, configurations, and environmental impact. It explores EV propulsion dynamics, motor technologies, and vehicle performance. Students will learn about fuel cells, hybrid systems, and battery charging techniques, including wireless charging. The course also delves into advanced energy storage technologies and management for smart grids and EV applications.

Course Outcomes:

**Blooms
Taxonomy**

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

- | | |
|--|----|
| 1. To understand and differentiate between Conventional Vehicle and Electric Vehicles, electro mobility and environmental issues of EVs. | L2 |
| 2. Understand Various dynamics of Electric Vehicles. | L2 |
| 3. To remember and understand various configurations in parameters of EV system and dynamic aspects of EV. | L2 |
| 4. To analyze fuel cell technologies in EV and HEV systems. | L4 |
| 5. To analyze the battery charging and controls required of EVs | L4 |

Unit 1 Introduction to EV Systems and Energy Sources 12

Past, Present and Future of EV - EV Concept- EV Technology- State-of-the Art of EVs- EV configuration- EV system- Fixed and Variable gearing- Single and multiple motor drive- In-wheel drives- EV parameters: Weight, size, force and energy, performance parameters. Electro mobility and the environment- History of Electric power trains- Carbon emissions from fuels- Green houses and pollutants- Comparison of conventional, battery, hybrid and fuel cell electric systems.

Unit 2 EV Propulsion and Dynamics 10

Choice of electric propulsion system- Block diagram- Concept of EV Motors- Single and multi- motor configurations- Fixed and variable geared transmission- In-wheel motor configuration- Classification - Electric motors used in current vehicle applications - Recent EV Motors- Vehicle load factors- Vehicle acceleration.

Unit 3 Fuel Cells 8

Introduction of fuel cells- Basic operation- Model - Voltage, power and efficiency- Power plant system – Characteristics- Sizing - Example of fuel cell electric vehicle - Introduction to HEV- Brake specific fuel consumption - Comparison of Series-Parallel hybrid systems- Examples.

Unit 4 Battery Charging and Control 10

Battery charging: Basic requirements- Charger architecture- Charger functions- Wireless charging- Power factor correction. Control: Introduction- Modeling of electro mechanical system- Feedback controller design approach- PI

controller's designing- Torque-loop, Speed control loop compensation- Acceleration of battery electric vehicle.

Unit 5 Energy Storage Technologies

10

Role of Energy Storage Systems- Thermal- Mechanical-Chemical- Electrochemical- Electrical - Efficiency of energy storage systems- Super capacitors-Superconducting Magnetic Energy Storage (SMES)- SOC- SoH -fuel cells - G2V- V2G- Energy storage in Micro-grid and Smart grid- Energy Management with storage systems- Battery SCADA.

Prescribed Textbooks:

1. C.C Chan, K.T Chau: Modern Electric Vehicle Technology, Oxford University Press Inc., New York 2001,1st Edition.
2. Ali Emadi, —Advanced Electric Drive Vehicles, CRC Press, 2014,1st Edition.

Reference Books:

1. Electric and Hybrid Vehicles Design Fundamentals, Iqbal Husain, CRC Press 2021, 3rd Edition.
2. Francisco Díaz-González, Andreas Sumper, Oriol Gomis-Bellmunt,|| Energy Storage in Power Systems|| Wiley Publication, ISBN: 978-1-118-97130-7, Mar 2016,1st Edition.
3. A.G.Ter- Gazarian, —Energy Storage for Power Systems||, the Institution of Engineering and Technology (IET) Publication, UK, (ISBN – 978-1-84919-219-4), Second Edition, 2011.
4. Mehrdad Ehsani, Yimi Gao, Sebastian E. Gay, Ali Emadi, —Modern Electric, Hybrid Electric and Fuel Cell Vehicles: Fundamentals, Theory and Design||, CRC Press, 2004,1st Edition
5. James Larminie, John Lowry, —Electric Vehicle Technology Explained||, Wiley, 2003,2nd Edition.

Web Resources:

1. <https://archive.nptel.ac.in/courses/108/103/108103009/>
2. <https://www.mygreatlearning.com/academy/learn-for-free/courses/introduction-to-electric-vehicles>
3. <https://en.diyguru.org/electric-vehicle/>
4. <https://intellipaat.com/electric-vehicle-design-certification-course-eict-iitg/>

CO-PO Mapping:

Course Outcomes	Engineering Knowledge	Problem Analysis	Design/Development of Solutions	Conduct Investigations of Complex Problems	Modern Tool Usage	The Engineer and Society	Environment And Sustainability	Ethics	Individual And Team Work	Communication	Project Management And Finance	Life-Long Learning	PSO1	PSO2
23A027JT.1	3	2	1	1	2	2	3	1	1	1	1	1	2	2
23A027JT.2	3	3	2	2	3	1	2	1	1	1	1	1	3	2
23A027JT.3	3	3	2	2	3	1	2	1	1	1	1	1	3	2
23A027JT.4	2	3	3	3	2	1	2	1	1	1	1	1	3	2
23A027JT.5	2	3	3	3	3	1	2	1	1	2	1	1	3	3

Department of Electrical and Electronics Engineering

– Handling of Non-Process Waste, Waste Reduction During Construction, Materials With Recycled Content, Local Materials, Material Reuse, Certified Wood, Rapidly Renewable Building Materials and Furniture. Indoor Environment Quality and Occupational Health– Air Conditioning, Indoor Air Quality, Sick Building Syndrome, tobacco Smoke.

Prescribed Textbooks:

1. Handbook on Green Practices published by Indian Society of Heating Refrigerating and Air conditioning Engineers, 2009.
2. Green Building Hand Book by tom woolley and Sam kimings, 2009.

Reference Books:

1. Complete Guide to Green Buildings by Trish riley.
2. Standard for the design for High Performance Green Buildings by Kent Peterson, 2009
3. Energy Conservation Building Code –ECBC-2020, published by BEE

Online Learning Resources:

1. <https://archive.nptel.ac.in/courses/105/102/105102195/>

CO-PO Mapping:

Course Outcomes	Engineering Knowledge	Problem Analysis	Design/Development of Solutions	Conduct Investigations of Complex Problems	Modern Tool Usage	The Engineer and Society	Environment And Sustainability	Ethics	Individual And Team Work	Communication	Project Management And Finance	Life-Long Learning	PSO1	PSO2
23A015DT.1	3	-	-	-	-	2	3	-	-	-	-	-	3	3
23A015DT.2	-	3	-	-	2	-	3	-	-	-	-	2	3	3
23A015DT.3	-	-	3	3	3	-	3	-	-	-	-	-	3	3
23A015DT.4	-	-	3	3	3	-	3	-	-	-	-	-	3	3
23A015DT.5	-	-	-	-	-	3	3	3	2	-	-	-	-	3

ANNAMACHARYA INSTITUTE OF TECHNOLOGY AND SCIENCES RAJAMPET
(An Autonomous Institution)

Department of Electrical and Electronics Engineering

Title of the Construction Technology and Management
Category: OEC-I
Couse Code: 23A015ET
Year : III
Semester I
Branch/es: EEE

Lecture Hours
3

Tutorial Hours
0

Practice Hours
0

Credits
3

Course Objectives:

1. To understand project management fundamentals, organizational structures, and leadership principles in construction.
2. To analyze manpower planning, equipment management, and cost estimation in civil engineering projects.
3. To apply planning, scheduling, and project management techniques such as CPM and PERT.
4. To evaluate various contract types, contract formation, and legal aspects in construction management.
5. To assess safety management practices, accident prevention strategies, and quality management systems in construction.

Course Outcomes:

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

1. Understand project management fundamentals, organizational structures, and leadership principles in construction.
2. Analyze manpower planning, equipment management, and cost estimation in civil engineering projects.
3. Apply planning, scheduling, and project management techniques such as CPM and PERT.
4. Evaluate various contract types, contract formation, and legal aspects in construction management.
5. Assess safety management practices, accident prevention strategies, and quality management systems in construction.

Unit 1 Introduction: 8

Types of Projects, Management Objectives and Functions; Organizational Chart of a Construction Company; Manager's Duties and Responsibilities; Public Relations; Leadership and Team - Work; Ethics, Morale, Delegation and Accountability.

Unit 2 Man and Machine 8

Man-Power Planning, Training, **Recruitment, Motivation**, Welfare Measures and Safety Laws; Machinery for Civil Engineering., Earth Movers and Hauling Costs, Factors Affecting Purchase, Rent, and Lease of Equipment, and Cost Benefit Estimation.

Unit 3 Planning, Scheduling and Project Management 8

Planning Stages, Construction Schedules and Project Specification, Monitoring and Evaluation; Bar-Chart, CPM, PERT, Network- formulation and Time Computation.

Unit 4 Contracts 10

Types of Contracts, formation of Contract – Contract Conditions – Contract for Labour, Material, Design, Construction – Drafting of Contract Documents Based On IBRD/ MORTH Standard Bidding Documents – Construction Contracts – Contract Problems– Arbitration and Legal Requirements Computer Applications in Construction Management: Software for Project Planning, Scheduling and Control.

Unit 5 Safety Management

10

– Implementation and Application of QMS in Safety Programs, ISO9000 Series, Accident Theories, Cost of Accidents, Problem Areas in Construction Safety, Fall Protection, Incentives, Zero Accident Concepts, Planning for Safety, Occupational Health and Ergonomics.

Prescribed Textbooks:

1. Construction Project Management, S K.Sears, G A.Sears, R H. Clough, John Wiley and Sons, 6th Edition, 2016.
2. Construction Project Scheduling and Control by Saleh Mubarak, 4th Edition, 2019

Reference Books:

1. Brien, J.O. and Plotnick, F.L., CPM in Construction Management, Mc Graw Hill, 2010.
2. Punmia, B.C., and Khandelwal, K.K., Project Planning and control with PERT and CPM, Laxmi Publications, 2002.
3. Construction Methods and Management: Pearson New International Edition 8th Edition Stephens Nunnally.
4. Rhoden, M and Cato B, Construction Management and Organisational Behaviour, Wiley-Blackwell, 2016.

Online Learning Resources:

1. <https://archive.nptel.ac.in/courses/105/104/105104161/>
2. <https://archive.nptel.ac.in/courses/105/103/105103093/>

CO-PO Mapping:

Course Outcomes	Engineering Knowledge	Problem Analysis	Design/Development of Solutions	Conduct Investigations of Complex Problems	Modern Tool Usage	The Engineer and Society	Environment And Sustainability	Ethics	Individual And Team Work	Communication	Project Management And Finance	Life-Long Learning	PSO1	PSO2
23A015ET.1	3	-	-	-	-	2	-	2	2	-	-	-	3	3
23A015ET.2	-	3	-	-	2	-	-	-	-	-	-	2	3	3
23A015ET.3	-	-	3	3	3	-	-	-	-	2	-	-	3	3
23A015ET.4	-	-	3	3	3	-	-	2	-	-	-	-	3	3
23A015ET.5	-	-	-	-	-	3	3	3	2	-	-	-	-	3

ANNAMACHARYA INSTITUTE OF TECHNOLOGY AND SCIENCES RAJAMPET
(An Autonomous Institution)
Department of Electrical and Electronics Engineering

Title of the Course: Sustainable Energy Technologies
Category: Open Elective – I
Course Code: 23A035FT
Branch/es: CE, EEE, ECE, CSE, AIDS, AIML, CSE-DS, CSE-AI
Year & Semester: III B.Tech. I Semester

Lecture Hours	Tutorial Hours	Practice Hours	Credits
3	0	0	3

Course Objectives:

- To demonstrate the importance the impact of solar radiation, solar PV modules.
- To understand the principles of storage in PV systems.
- To discuss solar energy storage systems and their applications.
- To get knowledge in wind energy and bio-mass.
- To gain insights in geothermal energy, ocean energy and fuel cells.

Course Outcomes:

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

1. Illustrate the importance of solar radiation and solar PV modules.
2. Discuss the storage methods in PV systems.
3. Explain the solar energy storage for different applications.
4. Understand the principles of wind energy, and bio-mass energy.
5. Attain knowledge in geothermal energy, ocean energy and fuel cells.

Unit 1

09

SOLAR RADIATION: Role and potential of new and renewable sources, the solar energy option, Environmental impact of solar power, structure of the sun, the solar constant, sun-earth relationships, coordinate systems and coordinates of the sun, extraterrestrial and terrestrial solar radiation, solar radiation on tilted surface, instruments for measuring solar radiation and sun shine, solar radiation data, numerical problems.

SOLAR PV MODULES AND PV SYSTEMS: PV Module Circuit Design, Module Structure, Packing Density, Interconnections, Mismatch and Temperature Effects, Electrical and Mechanical Insulation, Lifetime of PV Modules, Degradation and Failure, PV Module Parameters, Efficiency of PV Module, Solar PV Systems-Design of Off Grid Solar Power Plant. Installation and Maintenance.

Unit 2

09

STORAGE IN PV SYSTEMS: Battery Operation, Types of Batteries, Battery Parameters, Application and Selection of Batteries for Solar PV System, Battery Maintenance and Measurements, Battery Installation for PV System.

Unit 3

09

SOLAR ENERGY COLLECTION: Flat plate and concentrating collectors, classification of concentrating collectors, orientation.

SOLAR ENERGY STORAGE AND APPLICATIONS: Different methods, sensible, latent heat and stratified storage, solar ponds, solar applications- solar heating/cooling technique, solar distillation and drying, solar cookers, central power tower concept and solar chimney

Unit 4

09

WIND ENERGY: Sources and potentials, horizontal and vertical axis windmills, performance characteristics, betz criteria, types of winds, wind data measurement.

BIO-MASS: Principles of bio-conversion, anaerobic/aerobic digestion, types of bio-gas digesters, gas yield, utilization for cooking, bio fuels, I.C. engine operation and economic aspects.

Unit 5

09

GEOTHERMAL ENERGY: Origin, Applications, Types of Geothermal Resources, Relative Merits.

OCEAN ENERGY: Ocean Thermal Energy; Open Cycle & Closed Cycle OTEC Plants, Environmental Impacts, Challenges.

FUEL CELLS: Introduction, Applications, Classification, Different Types of Fuel Cells Such as Phosphoric Acid Fuel Cell, Alkaline Fuel Cell, PEM Fuel Cell, MC Fuel Cell.

Prescribed Textbooks:

3. Solar Energy – Principles of Thermal Collection and Storage/Sukhatme S.P. and J.K.Nayak/TMH.
4. Non-Conventional Energy Resources- Khan B.H/ Tata McGraw Hill, New Delhi, 2006.

Reference Books:

6. Principles of Solar Engineering - D.Yogi Goswami, Frank Kreith& John F Kreider / Taylor & Francis.
7. Non-Conventional Energy - Ashok V Desai /New Age International (P) Ltd.
8. Renewable Energy Technologies -Ramesh & Kumar /Narosa.
9. Non-conventional Energy Source- G.D Roy/Standard Publishers.

Online Learning Resources:

- <https://nptel.ac.in/courses/112106318>
- <https://youtube.com/playlist?list=PLyqSpQzTE6M-ZgdjYukayF6QevPv7WE-r&si=-mwla2X-SuSiNy13>
- https://youtube.com/playlist?list=PLyqSpQzTE6M-ZgdjYukayF6QevPv7WE-r&si=Apfjx6oDfz1Rb_N3
- https://youtu.be/zx04KI8y4dE?si=VmOvp_OgqisILTAF

CO-PO Mapping:

Course Outcomes	Engineering Knowledge	Problem Analysis	Design/Development of	Conduct investigations	Modern tool usage	The engineer and society	Environment and	Ethics	Individual and team work	Communication	Project management	Life-long learning	PSO1	PSO2
23A035FT.1	3	2	2	2	2	1	3	1	1	1	1	2	1	1
23A035FT.2	3	2	2	2	2	1	2	1	1	1	1	2	1	1
23A035FT.3	3	2	2	2	2	2	3	1	1	1	1	2	1	1
23A035FT.4	3	2	2	2	2	1	3	1	1	1	1	2	1	1
23A035FT.5	3	2	2	2	2	1	3	1	1	1	1	2	1	1

ANNAMACHARYA INSTITUTE OF TECHNOLOGY AND SCIENCES RAJAMPET
(An Autonomous Institution)

Department of Electrical and Electronics Engineering

Title of the Electronic Circuits
Category: OEC-I
Couse Code: 23A045DT
Year : III
Semester I
Branch/es: EEE

Lecture Hours	Tutorial Hours	Practice Hours	Credits
3	0	0	3

Course Objectives:

1. To understand semiconductor diodes, their characteristics and applications.
2. To explore the operation, configurations, and biasing of BJTs.
3. To study the operation, analysis, and coupling techniques of BJT amplifiers.
4. To learn the operation, applications and uses of feedback amplifiers and oscillators.
5. To analyze the characteristics, configurations, and applications of operational amplifiers.

Course Outcomes:

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

1. Understand semiconductor diodes, their characteristics and applications.
2. Explore the operation, configurations, and biasing of BJTs.
3. Gain knowledge about the operation, analysis, and coupling techniques of BJT amplifiers.
4. Learn the operation, applications and uses of feedback amplifiers and oscillators.
5. Analyze the characteristics, configurations, and applications of operational amplifiers.

UNIT-I

Semiconductor Diode and Applications: Introduction, PN junction diode – structure, operation and VI characteristics, Half-wave, Full-wave and Bridge Rectifiers with and without Filters, Positive and Negative Clipping and Clamping circuits (Qualitative treatment only).

Special Diodes: Zener and Avalanche Breakdowns, VI Characteristics of Zener diode, Zener diode as voltage regulator, Construction, operation and VI characteristics of Tunnel Diode, LED, Varactor Diode, Photo Diode .

UNIT-II

Bipolar Junction Transistor (BJT): Principle of Operation, Common Emitter, Common Base and Common Collector Configurations, Transistor as a switch and Amplifier, Transistor Biasing and Stabilization - Operating point, DC & AC load lines, Biasing - Fixed Bias, Self Bias, Bias Stability, Bias Compensation using Diodes.

UNIT-III

Single stage amplifiers: Classification of Amplifiers - Distortion in amplifiers, Analysis of CE, CC and CB configurations with simplified hybrid model.

Multistage amplifiers: Different Coupling Schemes used in Amplifiers - RC coupled amplifiers, Transformer Coupled Amplifier, Direct Coupled Amplifier; Multistage RC coupled BJT amplifier (Qualitative treatment only).

UNIT-IV

Feedback amplifiers: Concepts of feedback, Classification of feedback amplifiers, Effect of feedback on amplifier characteristics, Voltage Series, Voltage Shunt, Current Series and Current Shunt Feedback Configurations (Qualitative treatment only).

Oscillators: Classification of oscillators, Condition for oscillations, RC Phase shift Oscillators, Generalized analysis of LC Oscillators-Hartley and Colpitts Oscillators, Wien Bridge Oscillator.

UNIT-V

Op-amp: Classification of IC'S, basic information of Op-amp, ideal and practical Op-amp, 741 op- amp and its features, modes of operation-inverting, non-inverting, differential.

Applications of op-amp : Summing, scaling and averaging amplifiers, Integrator, Differentiator, phase shift oscillator and comparator.

TEXT BOOKS:

1. Electronics Devices and Circuits, J.Millman and Christos. C. Halkias, 3rd edition, Tata McGraw Hill, 2006.
2. Electronics Devices and Circuits Theory, David A. Bell, 5th Edition, Oxford University press. 2008.

REFERENCE BOOKS:

1. Electronics Devices and Circuits Theory, R.L.Boylestad, LouisNashelsky and K.Lal Kishore, 12th edition, 2006, Pearson, 2006.
2. Electronic Devices and Circuits, N.Salivahanan, and N.Suresh Kumar, 3rd Edition, TMH, 2012
3. Microelectronic Circuits, S.Sedra and K.C.Smith, 5th Edition, Oxford University Press.

ANNAMACHARYA INSTITUTE OF TECHNOLOGY AND SCIENCES RAJAMPET
(An Autonomous Institution)

Department of Electrical and Electronics Engineering

Title of the Communication Systems
Category: OEC-I
Couse Code: 23A045ET
Year : III
Semester I
Branch/es: EEE

Lecture Hours

3

Tutorial Hours

0

Practice Hours

0

Credits

3

Course Objectives:

1. To understand the fundamentals of communication systems and amplitude modulation techniques.
2. To learn about the angle modulation techniques and bandwidth considerations in communication systems.
3. To gain knowledge on pulse analog modulation and multiple access techniques used in digital communication systems.
4. To examine pulse modulation and digital modulation techniques used in modern communication systems.
5. To study wireless communication systems, cellular networks, and GSM technology

Course Outcomes:

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

1. Comprehend the fundamentals of communication systems and amplitude modulation techniques.
2. Learn the angle modulation techniques and bandwidth considerations in communication systems.
3. Gain knowledge on pulse analog modulation and multiple access techniques used in digital communication systems.
4. Get familiar with pulse modulation and digital modulation techniques used in modern communication systems.

Unit 1 Analog communication-I

10

Elements of communication systems, need for Modulation, Modulation Methods, Baseband and carrier communication Amplitude Modulation (AM), Generation of AM signals, Rectifier detector, Envelope detector, sideband and carrier power of AM,

Unit 2 Analog communication-II

9

Double side band suppressed carrier (DSB- SC) modulation & its demodulation, Switching modulators, Ring modulator, Balanced modulator, Single sideband (SSB) transmission, VSB Modulation.

Unit 3 Angle Modulation & Demodulation

10

Concept of instantaneous frequency Generalized concept of angle modulation, Bandwidth of angle modulated waves- Narrow band frequency modulation (NBFM); and Wide band FM (WBFM), Phase modulation, Pre-emphasis & De-emphasis.

Unit 4 Digital communications-I (Qualitative Approach only):

9

Pulse analog modulation techniques, Generation and detection of Pulse amplitude modulation, Pulse width modulation, Pulse position modulation

Multiple Access Techniques: Introduction to multiple access techniques, FDMA, TDMA, CDMA, SDMA: Advantages and applications.

10

Prescribed Textbooks:

- ### Reference Books:

- CO-PO Mapping:**

[illegible]

ANNAMACHARYA INSTITUTE OF TECHNOLOGY AND SCIENCES RAJAMPET
(An Autonomous Institution)

Department of Electrical and Electronics Engineering

Title of the Java Programming
Category: OEC-I
Couse Code: 23A055ET
Year : III
Semester I
Branch/es: EEE

Lecture Hours

3

Tutorial Hours

0

Practice Hours

0

Credits

3

Course Objectives:

1. Identify Java language components and how they work together in applications
2. Learn the fundamentals of object-oriented programming in Java, including defining classes, invoking methods, using class libraries.
3. Learn how to extend Java classes with inheritance and dynamic binding and how to use exception
4. Understand how to design applications with threads in Java
5. Understand how to use Java apis for program development

Course Outcomes:

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

1. Analyze problems, design solutions using OOP principles, and implement them efficiently in Java. (L4)
2. Design and implement classes to model real-world entities, with a focus on attributes, behaviours, and relationships between objects (L4)
3. Demonstrate an understanding of inheritance hierarchies and polymorphic behaviour, including method overriding and dynamic method dispatch. (L3)
4. Apply Competence in handling exceptions and errors to write robust and fault-tolerant code. (L3)
5. Perform file input/output operations, including reading from and writing to files using Java I/O classes, graphical user interface (GUI) programming using JavaFX. (L3)
6. Choose appropriate data structure of Java to solve a problem(L6)

Unit 1 Object Oriented Programming:

Basic concepts, Principles, Program Structure in Java: Introduction, Writing Simple Java Programs, Elements or Tokens in Java Programs, Java Statements, Command Line Arguments, User Input to Programs, Escape Sequences Comments, Programming Style. Data Types, Variables, and Operators :Introduction, Data Types in Java, Declaration of Variables, Data Types, Type Casting, Scope of Variable Identifier, Literal Constants, Symbolic Constants, Formatted Output with printf() Method, Static Variables and Methods, Attribute Final, Introduction to Operators, Precedence and Associativity of Operators, Assignment Operator (=), Basic Arithmetic Operators, Increment (++) and Decrement (- -) Operators, Ternary Operator, Relational Operators, Boolean Logical Operators, Bitwise Logical Operators. Control Statements: Introduction, if Expression, Nested if Expressions, if-else Expressions, Ternary Operator? :, Switch Statement, Iteration Statements, while Expression, do-while Loop, for Loop, Nested for Loop, For-Each for Loop, Break Statement, Continue Statement.

Unit 2 Classes and Objects:

Introduction, Class Declaration and Modifiers, Class Members, Declaration of Class Objects, Assigning One Object to Another, Access Control for Class Members, Accessing Private Members of Class, Constructor Methods for Class, Overloaded Constructor Methods, Nested Classes, Final Class and Methods, Passing Arguments by Value and by Reference, Keyword this.

Methods: Introduction, Defining Methods, Overloaded Methods, Overloaded Constructor Methods, Class

Objects as Parameters in Methods, Access Control, Recursive Methods, Nesting of Methods, Overriding Methods, Attributes Final and Static.

Unit 3 Arrays:

Introduction, Declaration and Initialization of Arrays, Storage of Array in Computer Memory, Accessing Elements of Arrays, Operations on Array Elements, Assigning Array to Another Array, Dynamic Change of Array Size, Sorting of Arrays, Search for Values in Arrays, Class Arrays, Two dimensional Arrays, Arrays of Varying Lengths, Three-dimensional Arrays, Arrays as Vectors. Inheritance: Introduction, Process of Inheritance, Types of Inheritances, Universal Super Class Object Class, Inhibiting Inheritance of Class Using Final, Access Control and Inheritance, Multilevel Inheritance, Application of Keyword Super, Constructor Method and Inheritance, Method Overriding, Dynamic Method Dispatch, Abstract Classes, Interfaces and Inheritance.

Interfaces: Introduction, Declaration of Interface, Implementation of Interface, Multiple Interfaces, Nested Interfaces, Inheritance of Interfaces, Default Methods in Interfaces, Static Methods in Interface, Functional Interfaces, Annotations.

Unit 4 Packages and Java Library :

Introduction, Defining Package, Importing Packages and Classes into Programs, Path and Class Path, Access Control, Packages in Java SE, Java. lang Package and its Classes, Class Object, Enumeration, class Math, Wrapper Classes, Auto-boxing and Auto un boxing, Java util Classes and Interfaces, Formatter Class, Random Class, Time Package, Class Instant (java. Instant), Formatting for Date/Time in Java, Temporal Adjusters Class, Temporal Adjusters Class.

Exception Handling: Introduction, Hierarchy of Standard Exception Classes, Keywords throws and throw, try, catch, and finally Blocks, Multiple Catch Clauses, Class Throw able, Unchecked Exceptions, Checked Exceptions. Java I/O and File: Java I/O API, standard I/O streams, types, Byte streams, Character streams, Scanner class, Files in Java(Text Book 2)

Unit 5 String Handling in Java:

Introduction, Interface Char Sequence, Class String, Methods for Extracting Characters from Strings, Comparison, Modifying, Searching; Class String Buffer. Multithreaded Programming: Introduction, Need for Multiple Threads Multithreaded Programming for Multi-core Processor, Thread Class, Main Thread Creation of New Threads, Thread States, Thread Priority-Synchronization, Deadlock and Race Situations, Inter thread Communication - Suspending, Resuming, and Stopping of Threads.

Java Database Connectivity: Introduction, JDBC Architecture, Installing My SQL and My SQL Connector/J, JDBC Environment Setup, Establishing JDBC Database Connections, Result Set Interface Java FX GUI: Java FX Scene Builder, Java FX App Window Structure, displaying text and image, event handling, laying out nodes in scene graph, mouse events (Text Book 3)

Textbooks:

1. JAVA one step ahead, Anitha Seth, B.L. Juneja, Oxford.
2. Joy with JAVA, Fundamentals of Object-Oriented Programming, Debasis Samanta, Monalisa Sarma, Cambridge, 2023.
3. JAVA 9 for Programmers, Paul Deitel, Harvey Deitel, 4th Edition, Pearson.

Reference Books:

1. The complete Reference Java, 11th edition, Herbert Schildt, TMH
2. Introduction to Java programming, 7th Edition, Y Daniel Liang, Pearson

Online Learning Resources:

1. <https://nptel.ac.in/courses/106/105/106105191/>
2. https://infyspringboard.onwingspan.com/web/en/app/toc/lex_auth_01288046454761881_6347_shared/overview

ANNAMACHARYA INSTITUTE OF TECHNOLOGY AND SCIENCES RAJAMPET
(An Autonomous Institution)

Department of Electrical and Electronics Engineering

Title of the Course: Fundamentals of Artificial Intelligence
Category: OEC-I
Course Code: 23A055FT
Year : III
Semester I
Branch/es: EEE

Lecture Hours

4

Tutorial Hours

0

Practice Hours

0

Credits

3

Course Objectives: This course will be able to

1. To learn the distinction between optimal reasoning Vs. human like reasoning.
2. To understand the concepts of state space representation, exhaustive search, heuristic search together with the time and space complexities.
3. To learn different knowledge representation techniques.
4. To understand the applications of AI, namely game playing, theorem proving, and machine learning.

Course Outcomes:

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

1. Learn the distinction between optimal reasoning Vs human like reasoning and formulate an efficient problem space for a problem expressed in natural language. Also select a search algorithm for a problem and estimate its time and space complexities
2. Apply AI techniques to solve problems of game playing, theorem proving, and machine Learning.
3. Learn different knowledge representation techniques.
4. Understand the concepts of state space representation, exhaustive search, heuristic search together with the time and space complexities.
5. Comprehend the applications of Probabilistic Reasoning and Bayesian Networks.

Unit 1

Introduction to AI - Intelligent Agents, Problem-Solving Agents, Searching for Solutions - Breadth-first search, Depth-first search, Hill-climbing search, Simulated annealing search, Local Search in Continuous Spaces.

Unit 2

Games - Optimal Decisions in Games, Alpha–Beta Pruning, Defining Constraint Satisfaction Problems, Constraint Propagation, Backtracking Search for CSPs, Knowledge-Based Agents, Logic- Propositional Logic, Propositional Theorem Proving: Inference and proofs, Proof by resolution, Horn clauses and definite clauses.

Unit 3

First-Order Logic - Syntax and Semantics of First-Order Logic, Using First Order Logic, Knowledge Engineering in First-Order Logic. Inference in First-Order Logic: Propositional vs. First- Order Inference, Unification, Forward Chaining, Backward Chaining, Resolution. Knowledge Representation: Ontological Engineering, Categories and Objects, Events.

Unit 4

Planning - Definition of Classical Planning, Algorithms for Planning with State Space Search, Planning Graphs, other Classical Planning Approaches, Analysis of Planning approaches.
Hierarchical Planning.

Unit 5

Probabilistic Reasoning: Acting under Uncertainty, Basic Probability Notation Bayes' Rule and Its Use, Probabilistic Reasoning, Representing Knowledge in an Uncertain Domain, The Semantics of Bayesian Networks, Efficient Representation of Conditional Distributions, Approximate Inference in Bayesian Networks, Relational and First- Order Probability.

TEXT BOOK:

1. Artificial Intelligence: A Modern Approach, Third Edition, Stuart Russell and Peter Norvig, Pearson Education.

REFERENCE BOOKS:

1. Artificial Intelligence, 3rd Edn., E. Rich and K. Knight (TMH)
2. Artificial Intelligence, 3rd Edn., Patrick Henry Winston, Pearson Education.
3. Artificial Intelligence, Shivani Goel, Pearson Education.
4. Artificial Intelligence and Expert systems – Patterson, Pearson Education.

ANNAMACHARYA INSTITUTE OF TECHNOLOGY AND SCIENCES RAJAMPET
(An Autonomous Institution)

Department of Electrical and Electronics Engineering

Title of the Course: QUANTUM TECHNOLOGIES AND APPLICATIONS
Category: OEC-I
Course Code: 23A055GT
Year : III
Semester I
Branch/es: EEE

Lecture Hours

3

Tutorial Hours

0

Practice Hours

0

Credits

3

Course Objectives:

1. To introduce the fundamentals of quantum mechanics relevant to quantum technologies.
2. To explain key quantum phenomena and their role in enabling novel technologies.
3. To explore applications in quantum computing, communication, and sensing.
4. To encourage understanding of emerging quantum-based technologies and innovations.

1. Course Outcomes

2. Understand key quantum mechanical concepts and phenomena.
3. Comprehend the structure and function of quantum algorithms and circuits.
4. Explore applications in quantum communication and cryptography.
5. Appreciate the role of quantum technologies in modern engineering systems.

UNIT I: Fundamentals of Quantum Mechanics (7 Hours)

- Classical vs Quantum Paradigm
- Postulates of Quantum Mechanics
- Wavefunction and Schrödinger Equation (Time-independent)
- Quantum states, Superposition, Qubits
- Measurement, Operators, and Observables
- Entanglement and Non-locality

UNIT II: Quantum Computing

- Qubits and Bloch Sphere
- Quantum Logic Gates: Pauli, Hadamard, CNOT, and Universal Gates
- Quantum Circuits
- Basic Algorithms: Deutsch-Jozsa, Grover's, Shor's (conceptual)
- Error Correction and Decoherence

UNIT III: Quantum Communication and Cryptography (7 Hours)

- Teleportation & No-Cloning
- BB84 Protocol
- Quantum Networks & Repeaters
- Classical vs Quantum Cryptography
- Challenges in Implementation

UNIT IV: Quantum Sensors and Metrology

- Quantum Sensing: Principles and Technologies
- Quantum-enhanced Measurements
- Atomic Clocks, Gravimeters
- Magnetometers, NV Centers
- Industrial Applications

UNIT V: Quantum Materials and Emerging Technologies

- Quantum Materials: Superconductors, Topological Insulators
- Quantum Devices: Qubits, Josephson Junctions
- National Quantum Missions (India, EU, USA, China)
- Quantum Careers and Industry Initiatives

Textbooks and References

Primary Textbooks:

1. "Quantum Computation and Quantum Information" by Michael A. Nielsen and Isaac L. Chuang (Cambridge University Press)
2. "Quantum Mechanics: The Theoretical Minimum" by Leonard Susskind and Art Friedman (Basic Books)

Supplementary Reading:

1. "Quantum Computing for Everyone" by Chris Bernhardt (MIT Press)
2. "Quantum Physics: A Beginner's Guide" by Alastair I.M. Rae
3. "An Introduction to Quantum Computing" by Phillip Kaye, Raymond Laflamme, and Michele Mosca
4. IBM Quantum Experience and Qiskit Documentation (<https://qiskit.org/>)

ANNAMACHARYA INSTITUTE OF TECHNOLOGY AND SCIENCES RAJAMPET
(An Autonomous Institution)

Department of Electrical and Electronics Engineering

Title of the Course	Mathematics for Machine Learning and AI
Category	OEC-I
Couse Code	23AHS51T
Year	III
Semester	I
Branch	EEE

Lecture Hours	Tutorial Hours	Practice Hours	Credits
3	0	0	3

Course Objectives:

1. To provide a strong mathematical foundation for understanding and developing AI/ML algorithms.
2. To enhance the ability to apply linear algebra, probability, and calculus in AI/ML models.
3. To equip students with optimization techniques and graph-based methods used in AI applications.
4. To develop critical problem-solving skills for analyzing mathematical formulations in AI/ML.

Course Outcomes:

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

6. Apply linear algebra concepts to ML techniques like PCA and regression.
7. Analyze probabilistic models and statistical methods for AI applications.
8. Implement optimization techniques for machine learning algorithms.
9. Utilize vector calculus and transformations in AI-based models.
10. Develop graph-based AI models using mathematical representations.

Unit 1 Linear Algebra for Machine Learning 8

Review of Vector spaces, basis, linear independence, Vector and matrix norms, Matrix factorization techniques, Eigenvalues, eigenvectors, diagonalization, Singular Value Decomposition (SVD) and Principal Component Analysis (PCA).

Unit 2 Probability and Statistics for AI 8

Probability distributions: Gaussian, Binomial, Poisson. Bayes' Theorem, Maximum Likelihood Estimation (MLE), and Maximum a Posteriori (MAP). Entropy and Kullback-Leibler (KL) Divergence in AI, Cross entropy loss, Markov chains.

Unit 3 Optimization Techniques for ML 8

Multivariable calculus: Gradients, Hessians, Jacobians. Constrained optimization: Lagrange multipliers and KKT (Karush-Kuhn-Tucker) conditions. Gradient Descent and its variants (Momentum, Adam) Newton's method, BFGS (Broyden-Fletcher-Goldfarb-Shanno) method.

Unit 4 Vector Calculus & Transformations 8

Vector calculus: Gradient, divergence, curl. Fourier Transform & Laplace Transform in ML applications.

Unit 5 Graph Theory for AI 8

Graph representations: Adjacency matrices, Laplacian matrices. Bayesian Networks & Probabilistic Graphical Models. Introduction to Graph Neural Networks (GNNs).

ANNAMACHARYA INSTITUTE OF TECHNOLOGY AND SCIENCES: RAJAMPET
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Department of Electrical and Electronics Engineering

Title of the Course	Materials Characterization Techniques
Category	OEC-I
Couse Code	23AHS52T
Year	III
Semester	I
Branch/es	EEE

Lecture Hours	Tutorial Hours	Practical	Credits
3	0	0	3

Course Objectives:

1. To provide exposure to different characterization techniques.
2. To explain the basic principles and analysis of different spectroscopic techniques.
3. To elucidate the working of Scanning electron microscope - Principle, limitations and applications.
4. To illustrate the working of the Transmission electron microscope (TEM) - SAED patterns and its applications.
5. To educate the uses of advanced electric and magnetic instruments for characterization.

Course Outcomes:

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

1. Analyze the crystal structure and crystallite size by various methods
2. Analyze the morphology of the sample by using a Scanning Electron Microscope
3. Analyze the morphology and crystal structure of the sample by using Transmission Electron Microscope
4. Explain the principle and experimental arrangement of various spectroscopic techniques
5. Identify the construction and working principle of various Electrical & Magnetic Characterization technique

Unit 1 Structure analysis by Powder X-Ray Diffraction

9

Introduction, Bragg's law of diffraction, Intensity of Diffracted beams, Factors affecting Diffraction, Intensities, Structure of polycrystalline Aggregates, Determination of crystal structure, Crystallite size by Scherer and Williamson-Hall (W-H) Methods, Small angle X- ray scattering (SAXS) (in brief).

Unit 2 Microscopy technique -1 –Scanning Electron Microscopy (SEM)

9

Introduction, Principle, Construction and working principle of Scanning Electron Microscopy, Specimen preparation, Different types of modes used (Secondary Electron and Backscatter Electron), Advantages, limitations and applications of SEM.

Unit 3 Microscopy Technique -2 - Transmission Electron Microscopy (TEM)

9

Construction and Working principle, Resolving power and Magnification, Bright and dark fields, Diffraction and image formation, Specimen preparation, Selected Area Diffraction, Applications of Transmission Electron Microscopy, Difference between SEM and TEM, Advantage and Limitations of Transmission Electron Microscopy

Unit 4 Spectroscopy techniques

9

Principle, Experimental arrangement, Analysis and advantages of the spectroscopic techniques – (i) UV-Visible spectroscopy (ii) Raman Spectroscopy, (iii) Fourier Transform infrared (FTIR) spectroscopy, (iv) X-

ray photoelectron spectroscopy (XPS).

Unit 5 Electrical & Magnetic Characterization techniques

9

Electrical Properties analysis techniques (DC conductivity, AC conductivity) Activation Energy, Effect of Magnetic field on the electrical properties (Hall Effect). Magnetization measurement by induction method, Vibrating sample Magnetometer (VSM) and SQUID.

Prescribed Textbooks:

1. Material Characterization: Introduction to Microscopic and Spectroscopic Methods – Yang Leng – John Wiley & Sons (Asia) Pvt. Ltd. 2013.
2. Microstructural Characterization of Materials - David Brandon, Wayne D Kalpan, John Wiley & Sons Ltd., 2008

Reference Books:

1. Fundamentals of Molecular Spectroscopy – IV Ed. – Colin Neville Banwell and Elaine M. McCash, Tata McGraw-Hill, 2008.
2. Elements of X-ray diffraction – Bernard Dennis Cullity & Stuart R Stocks, Prentice Hall , 2001 – Science.
3. Practical Guide to Materials Characterization: Techniques and Applications - Khalid Sultan – Wiley – 2021.
4. Materials Characterization Techniques -Sam Zhang, Lin Li, Ashok Kumar -CRC Press - 2008

NPTEL courses link:

1. <https://nptel.ac.in/courses/115/103/115103030/>
2. https://nptel.ac.in/content/syllabus_pdf/113106034.pdf
3. <https://nptel.ac.in/noc/courses/noc19/SEM1/noc19-mm08/>

CO-PO Mapping:

[illegible]

ANNAMACHARYA INSTITUTE OF TECHNOLOGY AND SCIENCES RAJAMPET
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Department of Electrical and Electronics Engineering

Title of the Course: Chemistry of Energy Systems
Category: OEC-I
Course Code: 23AHS53T
Year: III
Semester: I
Branch/es: EEE

Lecture Hours	Tutorial Hours	Practice Hours	Credits
3	0	0	3

Course Objectives:

1. To make the student understand basic electrochemical principles such as standard electrode potentials, emf and applications of electrochemical principles in the design of batteries.
2. To understand the basic concepts of processing and limitations of Fuel cells & their applications.
3. To impart knowledge to the students about fundamental concepts of photo chemical cells, reactions and applications
4. To know the necessity of harnessing alternate energy resources such as solar energy and its basic concepts.
5. To impart knowledge to the students about fundamental concepts of hydrogen storage in different materials and liquification method.

Course Outcomes:

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

1. Understand electrochemical concepts and battery technologies with their practical applications.
2. Apply the principles of fuel cell technology to explain their design, working, classification, efficiency, and applications, including PEM and SOFC types.
3. Apply the concepts of photochemical cells to understand their working, specificity, advantages in photo electrocatalytic conversions, and practical applications.
4. Analyze the principles of solar energy conversion to differentiate between photovoltaic and concentrated solar power technologies and evaluate the performance and applications of solar cells.
5. Analyze hydrogen storage and delivery methods by comparing their mechanisms, advantages, and limitations.

Unit 1 Electrochemical Systems 9

Introduction to electrodes, concepts, electrochemical reactions, Galvanic cell, Nernst equation, standard electrode potential, application of EMF, electrical double layer, polarization, Batteries – Introduction, primary battery-Zn/air, secondary battery, Lithium-ion batteries and their applications.

Unit 2 Fuel Cells 9

Fuel cell- Introduction, Basic design of fuel cell, working principle, Classification of fuel cells, Polymer electrolyte membrane (PEM) fuel cells-Methanol oxygen fuel cell, fuel cell, Solid-oxide fuel cells (SOFC), Fuel cell efficiency and applications.

Unit 3 Photo and Photo electrochemical Conversions 9

Photochemical cells-Introduction and application, photochemical reactions- Electricity generation using Dye-Sensitized Solar Cells (DSSCs), specificity of photo electrochemical cell (PEC)- Water Splitting (Hydrogen Generation), advantage of photoelectron catalytic conversions and their applications.

Unit 4 Solar Energy

9

Introduction and prospects, photovoltaic (PV) technology, concentrated solar power (CSP), Solar cells-Types, Construction, working principle of PN junction, and electricity generation through light-induced charge separation and applications.

Unit 5 Hydrogen Storage

9

Introduction-Hydrogen fuel, Hydrogen storage and delivery: State-of-the art, Established technologies, Chemical and Physical methods of hydrogen storage, Compressed gas storage, Liquid hydrogen storage, Other storage methods, Hydrogen storage in metal hydrides, metal organic frameworks (MOF), Metal oxide porous structures, hydrogel, and Organic hydrogen carriers.

Prescribed Textbooks:

1. Ira N. Levine Physical Chemistry, 6th edition, McGraw-Hill Education, 2011
2. Bahl, A., Bahl, B. S., & Tuli, G. D. Essentials of physical chemistry. New Delhi: S. Chand. 2010.

Reference Books:

1. Fuel Cell Hand Book, 7th Edition, by US Department of Energy (EG&G technical services and corporation)
2. Arvind, & Shyam. (2018). Handbook of Solar Energy: Theory, Analysis and Applications. Springer.
3. Solar energy fundamental, technology and systems by Klaus Jagar et.al. (2014) Delft University of Technology, Delft.

CO-PO Mapping:

Course Outcomes	Engineering Knowledge	Problem Analysis	Design/Development of Solutions	Conduct Investigations of Complex Problems	Modern Tool Usage	The Engineer and Society	Environment And Sustainability	Ethics	Individual And Team Work	Communication	Project Management And Finance	Life-Long Learning	PSO1	PSO2
23AHS53T.1	3	2	2	1	-	-	2	-	-	-	-	1	-	-
23AHS53T.2	3	2	2	1	-	-	2	-	-	-	-	1	-	-
23AHS53T.3	3	2	2	1	-	-	2	-	-	-	-	1	-	-
23AHS53T.4	3	2	2	1	-	-	2	-	-	-	-	1	-	-
23AHS53T.5	3	2	2	1	-	-	2	-	-	-	-	1	-	-

ANNAMACHARYA INSTITUTE OF TECHNOLOGY AND SCIENCES RAJAMPET
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Department of Electrical and Electronics Engineering

Title of the English for Competitive Examinations
Category: OEC-I
Couse Code: 23AHS54T
Year III
Semester: I
Branch/es: EEE

Lecture Hours	Tutorial Hours	Practice Hours	Credits
3	1	0	3

Course Objectives:

1. To raise awareness of the importance of English for competitive exams
2. To understand the grammatical aspects and identify the errors
3. To enhance verbal ability and identify the errors
4. To enrich vocabulary to face competitive exams and for effective expression
5. To equip learners with the skills and confidence needed to succeed in competitive exams.

Course Outcomes:

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

1. Identify the basics of English grammar and its importance
2. Explain the use of grammatical structures in sentences
3. Demonstrate the ability to use various concepts in grammar and vocabulary and their applications in everyday use and in competitive exams L3
4. Analyze an unknown passage and reach conclusions about it.
5. Use correct verb forms and improve speed reading and comprehension to excel in competitive exams

Unit 1 Grammar-1 9

Nouns-classification-errors-Pronouns-types-errors-Adjectives-types-errors-Articles-definite-indefinite degree of comparison-Adverbs-types- errors-Conjunctions-usage

Unit 2 Grammar-2 9

Verbs-tenses- structure-usages- negatives- positives- time adverbs-Sequence of tenses--If Clause- Voice-active voice and passive voice- Reported Speech-Agreement- subject and verb-Modals-Spotting Errors-Practices.

Unit 3 Verbal Ability 9

Sentence completion-Verbal analogies-Word Groups-Instructions-Critical reasoning-Verbal deduction-Select appropriate pair-Reading Comprehension-Paragraph-Jumbles. Selecting the proper statement by reading a given paragraph.

Unit 4 Reading Comprehension and Vocabulary 9

Competitive Vocabulary: Word Building – Memory Techniques-Synonyms, Antonyms, Affixes-Prefix & Suffix-One-word substitutes-Compound Words-Phrasal Verbs-Idioms and Phrases-Homophones- Linking Words-Modifiers-Intensifiers- Mastering Competitive Vocabulary- Cracking the unknowning passage-speed reading techniques- Skimming & Scanning-types of answering–Elimination methods

Unit 5 Writing for Competitive Examinations

9

Punctuation- Spelling rules- Word Order-Sub Skills of Writing- Paragraph- meaning-salient features- types - Note-making, Note-taking, summarizing-precise writing- Paraphrasing-Expansion of proverbs. Essay writing-types.

Prescribed Textbooks:

1. Wren & Martin, English for Competitive Examinations, S.Chand & Co, 2021
2. Objective English for Competitive Examination, Tata McGraw Hill, New Delhi, 2014.Polymer science-

Reference Books:

1. Hari Mohan Prasad, Objective English for Competitive Examination, Tata McGraw Hill, New Delhi, 2014.
2. Philip Sunil Solomon, English for Success in Competitive Exams, Oxford 2016
3. Shalini Verma, Word Power Made Handy, S Chand Publications
4. Neira, Anjana Dev & Co. Creative Writing: A Beginner's Manual. Pearson Education India, 2008.
5. Abhishek Jain, Vocabulary Learning Techniques Vol.I&II,RR Global Publishers 2013.
6. Michel Swan, Practical English Usage, Oxford,2006

References

1. <https://www.grammar.cl/english/parts-of-speech.htm>
2. <https://academicguides.waldenu.edu/writingcenter/grammar/partsofspeech>
3. <https://learnenglish.britishcouncil.org/grammar/english-grammar-reference/active-passive-voice>
4. <https://languagetool.org/insights/post/verb-tenses/>
5. <https://www.britishcouncil.in/blog/best-free-english-learning-resources-british-council>
6. <https://www.careerride.com/post/social-essays-for-competitive-exams-586.aspx>

CO-PO Mapping:

Course Outcomes	Engineering Knowledge	Problem Analysis	Design/Development of Solutions	Conduct Investigations of Complex Problems	Modern Tool Usage	The Engineer and Society	Environment And Sustainability	Ethics	Individual And Team Work	Communication	Project Management And Finance	Life-Long Learning	PSO1	PSO2
23AHS54T-1	-	-	-	-	-	-	-	-	-	3	-	3	-	-
23AHS54T-2	-	-	-	-	-	-	-	-	-	3	-	3	-	-
23AHS54T-3	-	-	-	-	-	-	-	-	-	3	-	3	-	-
23AHS54T-4	-	-	-	-	-	-	-	-	-	3	-	3	-	-
23AHS54T-5	-	-	-	-	-	-	-	-	-	3	-	3	-	-

ANNAMACHARYA INSTITUTE OF TECHNOLOGY AND SCIENCES RAJAMPET
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Department of Electrical and Electronics Engineering

Title of the	Entrepreneurship and New Venture Creation
Category:	OEC-1
Couse Code:	23AHS56T
year	III
Semester:	I
Branch/es	EEE

Lecture Hours	Tutorial Hours	Practice Hours	Credits
3	0	0	3

COURSE OBJECTIVES: The objectives of this course are

1. To foster an entrepreneurial mind-set for venture creation and entrepreneurial leadership.
2. To encourage creativity and innovation
3. To enable them to learn pitching and presentation skills
4. To make the students understand MVP development and validation techniques to determine Product-Market fit and Initiate Solution design, Prototype for Proof of Concept.
5. To enhance the ability of analyzing Customer and Market segmentation, estimate Market size, develop and validate Customer Persona

COURSE OUTCOMES: At the end of the course, the student will be able to

1. Understand the concept of Entrepreneur and Entrepreneurship in India and Analyze recent trends in Entrepreneurship role in economic development. L3
2. Analyze problem and validating with potential customer L4
3. Analyze jobs-to-be-done and evaluate customer needs to create a strong value proposition L4
4. Apply business plan, sales plan and financial plan and analyze financial planning, marketing channels of distribution. L3
5. Analyze venture idea and its key components and evaluate and build investors ready pitch. L4

UNIT-I: Entrepreneurship Fundamentals and context:

Meaning and concept, attributes and mindset of entrepreneurial and intrapreneurial leadership, role models in each and their role in economic development. An understanding of how to build entrepreneurial mindset, skill sets, attributes and networks while on campus.

Core Teaching Tool: Simulation, Game, Industry Case Studies (Personalized for students – 16 industries to choose from), Venture Activity.

Unit II: Problem & Customer Identification

Understanding and analysing the macro-Problem and Industry perspective - technological, socioeconomic and urbanization trends and their implication on new opportunities - Identifying passion - identifying and defining problem using Design thinking principles - Analysing problem and validating with the potential customer - Understanding customer segmentation, creating and validating customer personas.

Core Teaching Tool: Several types of activities including Class, game, Gen AI, ‘Get out of the Building’ and Venture Activity.

Unit III: Solution design, Prototyping & Opportunity Assessment and Sizing.

Understanding Customer Jobs-to-be-done and crafting innovative solution design to map to customer’s needs and create a strong value proposition - Understanding prototyping and Minimum Viable product (MVP) - Developing a feasibility prototype with differentiating value, features and benefits - Assess relative market position via competition analysis - Sizing the market and assess scope and potential scale of the opportunity.

Core Teaching Tool: Venture Activity, no-code Innovation tools, Class activity

UNIT-IV: Business & Financial Model, Go-to-Market Plan

Introduction to Business model and types, Lean approach, 9 block lean canvas model, riskiest assumptions to Business models. Importance of Build - Measure – Lean approach. Business planning: components of Business plan- Sales plan, People plan and financial plan. Financial Planning: Types of costs, preparing a financial plan for profitability using financial template, understanding basics of Unit economics and analysing financial performance. Introduction to Marketing and Sales, Selecting the Right Channel, creating digital presence, building customer acquisition strategy.

Choosing a form of business organization specific to your venture, identifying sources of funds: Debt& Equity, Map the Start-up Life-cycle to Funding Options.

Core Teaching Tool: Founder Case Studies – Sama and Securely Share; Class activity and discussions; Venture Activities.

UNIT-V: Scale Outlook and Venture Pitch readiness

Understand and identify potential and aspiration for scale vis-a-vis your venture idea. Persuasive Storytelling and its key components. Build an Investor ready pitch deck.

Core Teaching Tool: Expert talks; Cases; Class activity and discussions; Venture Activities.

TEXT BOOKS

1. Robert D. Hisrich, Michael P. Peters, Dean A. Shepherd, Sabyasachi Sinha .
2. Entrepreneurship, McGrawHill, 11th Edition.(2020)
3. Ries, E. The Lean Startup: How Today's Entrepreneurs Use Continuous Innovation to Create Radically Successful Businesses. Crown Business,(2011).
4. Osterwalder, A., & Pigneur, Y. Business Model Generation: A Handbook for Visionaries, Game Changers, and Challengers. John Wiley & Sons. (2010).

REFERENCES

1. Simon Sinek,Start with Why, Penguin Books limited. (2011)
2. Brown Tim,Change by Design Revised & Updated: How Design Thinking
3. Transforms Organizations and Inspires Innovation, Harper Business.(2019)
4. Namita Thapar (2022) The Dolphin and the Shark: Stories on Entrepreneurship, Penguin Books Limited
5. Saras D. Sarasvathy, (2008) Effectuation: Elements of Entrepreneurial Expertise, Elgar Publishing Ltd.

ANNAMACHARYA INSTITUTE OF TECHNOLOGY AND SCIENCES RAJAMPET
(An Autonomous Institution)

Department of Electrical and Electronics Engineering

Title of the Disaster Management
Category: OEC-II
Couse Code: 23A016GT
year: III
Semester: II
Branch/es EEE

Lecture Hours
3

Tutorial Hours
0

Practice Hours
0

Credits
3

Course Objectives:

The objectives of this course are to make the student :

1. To understand the fundamental concepts of natural disasters, their occurrence, and disaster risk reduction strategies.
2. To analyze the impact of cyclones on structures and explore retrofitting techniques for adaptive reconstruction.
3. To apply wind engineering principles and computational techniques in designing wind-resistant structures.
4. To evaluate earthquake effects on buildings and develop strategies for seismic retrofitting.
5. To assess seismic safety planning, design considerations, and innovative construction materials for disaster-resistant structures.

Course Outcomes:

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

1. Understand the fundamental concepts of natural disasters, their occurrence, and disaster risk reduction strategies.
2. Analyze the impact of cyclones on structures and explore retrofitting techniques for adaptive reconstruction.
3. Apply wind engineering principles and computational techniques in designing wind-resistant structures.
4. Evaluate earthquake effects on buildings and develop strategies for seismic retrofitting.
5. Assess seismic safety planning, design considerations, and innovative construction materials for disaster-resistant structures.

Unit 1 Introduction to Natural Disasters

8

Brief Introduction to Different Types of Natural Disasters, Occurrence of Disasters in Different Climatic and Geographical Regions, Hazard Maps (Earthquake and Cyclone) (World and India), Regulations for Disaster Risk Reduction, Post-Disaster Recovery and Rehabilitation (Socio-economic Consequences).

Unit 2 Cyclones

8

Cyclones and Their Impact– Climate Change and Its Impact on Tropical Cyclones, Nature of Cyclonic Wind, Velocities and Pressure, Cyclone Effects, Storm Surges, Floods, and Landslides. Behavior of Structures in Past Cyclones and Windstorms, Case Studies. Cyclonic Retrofitting, Strengthening of Structures, and Adaptive Sustainable Reconstruction. Life-Line Structures Such as Temporary Cyclone Shelters.

Unit 3 Wind Effects

10

Wind Engineering and structural response -basic, Aerodynamics of Bluff Bodies, Vortex Shedding, and Associated Unsteadiness Along and Across Wind forces. Demo on Wind Tunnel Testing and Its Salient Features. Introduction to Computational Fluid Dynamics (CFD). General Planning and Design Considerations Under Windstorms and Cyclones. Wind Effects On Buildings, towers, Glass Panels, Etc., and Wind-Resistant Features in Design. Codal Provisions, Design Wind Speed, Pressure Coefficients. Coastal Zoning Regulations for Construction and Reconstruction in Coastal Areas. Innovative Construction Materials and Techniques, Traditional Construction Techniques in Coastal Areas.

Unit 4 Seismic Risk Assessment

10

Seismology and Earthquake Effects– Causes of Earthquakes, Plate Tectonics, Faults, Seismic Waves; Magnitude, Intensity, Epicenter, Energy Release, and Ground Motions. Earthquake Effects– On Ground, Soil Rupture, Liquefaction, Landslides. Performance of Ground and Buildings in Past Earthquakes– Behavior of Various Types of Buildings and Structures, Collapse Patterns; Behavior of Non-Structural Elements Such as Services, Fixtures, and Mountings – Case Studies. Seismic Retrofitting– Weakness in Existing Buildings, Aging, Concepts in Repair, Restoration, and Seismic Strengthening

Unit 5 Seismic Safety

10

Planning and Design Considerations for Seismic Safety– General Planning and Design Considerations; Building forms, Horizontal and Vertical Eccentricities, Mass and Stiffness Distribution, Soft Storey Effects, Etc.; Seismic Effects Related to Building Configuration. Plan and Vertical Irregularities, Redundancy, and Setbacks. Construction Details– Various Types of Foundations, Soil Stabilization, Retaining Walls, Plinth Fill, Flooring, Walls, Openings, Roofs, Terraces, Parapets, Boundary Walls, Underground and Overhead Tanks, Staircases, and Isolation of Structures. Innovative Construction Materials and Techniques. Local Practices– Traditional Regional Responses. Computational Investigation Techniques.

Prescribed Textbooks:

1. David Alexander, Natural Disasters, 1st Edition, CRC Press, 2017.
2. Edward A. Keller and Duane E. DeVecchio, Natural Hazards: Earth's Processes as Hazards, Disasters, and Catastrophes, 5th Edition, Routledge, 2019.

Reference Books:

1. Ben Wisner, J.C. Gaillard, and Ilan Kelman (Editors), Handbook of Hazards and Disaster Risk Reduction and Management, 2nd Edition, Routledge, 2012.
2. Damon P. Coppola, Introduction to International Disaster Management, 4th Edition, Butterworth-Heinemann, 2020.
3. Bimal Kanti Paul, Environmental Hazards and Disasters: Contexts, Perspectives and Management, 2nd Edition, Wiley-Blackwell, 2020.

Online Learning Resources:

1. <https://nptel.ac.in/courses/124107010>
2. https://onlinecourses.swayam2.ac.in/cec19_hs20/preview

CO-PO Mapping:

Course Outcomes	Engineering Knowledge	Problem Analysis	Design/Development of Solutions	Conduct Investigations of Complex Problems	Modern Tool Usage	The Engineer and Society	Environment And Sustainability	Ethics	Individual And Team Work	Communication	Project Management And Finance	Life-Long Learning	PSO1	PSO2
23A016GT.1	3	-	-	-	-	2	-	2	2	-	-	-	3	3
23A016GT.2	-	3	-	-	2	-	-	-	-	-	-	2	3	-
23A016GT.3	3	-	-	3	-	-	3	-	-	2	-	-	-	3
23A016GT.4	-	-	3	-	3	-	-	2	-	-	-	-	3	-
23A016GT.5	-	-	-	3	-	3	3	3	2	-	-	-	-	3

ANNAMACHARYA INSTITUTE OF TECHNOLOGY AND SCIENCES RAJAMPET
(An Autonomous Institution)

Department of Electrical and Electronics Engineering

Title of the Course: Sustainability In Engineering Practices
Category: OEC-II
Couse Code: 23A016HT
year: III
Semester: II
Branch/es EEE

Lecture Hours	Tutorial Hours	Practice Hours	Credits
3	0	0	3

Course Objectives:

1. To understand the fundamentals of sustainability, the carbon cycle, and the environmental impact of construction materials.
2. To analyse sustainable construction materials, their durability, and life cycle assessment.
3. To apply energy calculations in construction materials and assess their embodied energy.
4. To evaluate green building standards, energy codes, and performance ratings.
5. To assess the environmental effects of energy use, climate change, and global warming.

Course Outcomes:

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

1. Understand the fundamentals of sustainability, the carbon cycle, and the environmental impact of construction materials.
2. Analyze sustainable construction materials, their durability, and life cycle assessment.
3. Apply energy calculations in construction materials and assess their embodied energy.
4. Evaluate green building standards, energy codes, and performance ratings.
5. Assess the environmental effects of energy use, climate change, and global warming.

Unit 1 Introduction 8

Introduction and Definition of Sustainability - Carbon Cycle - Role of Construction Material: Concrete and Steel, Etc. - CO₂ Contribution From Cement and Other Construction Materials.

Unit 2 Materials for Sustainable Construction 8

Construction Materials and Indoor Air Quality - No/Low Cement Concrete - Recycled and Manufactured Aggregate - Role of QC and Durability - Life Cycle and Sustainability.

Unit 3 Energy Estimate 10

Components of Embodied Energy - Calculation of Embodied Energy for Construction Materials - Energy Concept and Primary Energy - Embodied Energy Via-A-Vis Operational Energy in Conditioned Building - Life Cycle Energy Use

Unit 4 Green Building Regulations 10

Control of Energy Use in Building - ECBC Code, Codes in Neighbouring Tropical Countries - OTTV Concepts and Calculations – Features of LEED and TERI – GRIHA Ratings – Roel of Insulation and Thermal Properties of Construction Materials - Influence of Moisture Content and Modelling - Performance Ratings of Green Buildings - Zero Energy Building.

Unit 5 Environmental Impact

10

Non-Renewable Sources of Energy and Environmental Impact– Energy Norm, Coal, Oil, Natural Gas - Nuclear Energy - Global Temperature, Green House Effects, Global Warming - Acid Rain: Causes, Effects and Control Methods - Regional Impacts of Temperature Change.

Prescribed Textbooks:

1. Charles J Kibert, Sustainable Construction: Green Building Design & Delivery, 4th Edition , Wiley Publishers 2016.
2. Steve Goodhew, Sustainable Construction Process, Wiley Blackwell,UK, 2016.

Reference Books:

1. Craig A. Langston & Grace K.C. Ding, Sustainable Practices in the Built Environment, Butterworth Heinemann Publishers, 2011.
2. William P Spence, Construction Materials, Methods & Techniques (3e), Yesdee Publication Pvt. Ltd, 2012.

Online Learning Resources:

1. <https://archive.nptel.ac.in/courses/105/105/105105157/>

CO-PO Mapping:

Course Outcomes	Engineering Knowledge	Problem Analysis	Design/Development of Solutions	Conduct Investigations of Complex Problems	Modern Tool Usage	The Engineer and Society	Environment And Sustainability	Ethics	Individual And Team Work	Communication	Project Management And Finance	Life-Long Learning	PSO1	PSO2
23A016HT.1	3	-	-	-	-	2	3	2	-	-	-	-	3	3
23A016HT.2	-	3	-	-	2	-	3	-	-	-	-	2	3	3
23A016HT.3	-	-	3	3	3	-	2	-	-	2	-	-	3	3
23A016HT.4	-	-	3	3	3	-	3	2	-	-	-	-	3	3
23A016HT.5	-	-	-	-	-	3	3	3	-	-	-	-	-	3

ANNAMACHARYA INSTITUTE OF TECHNOLOGY AND SCIENCES RAJAMPET
(An Autonomous Institution)

Department of Electrical and Electronics Engineering

Title of the Automation and Robotics
Category: OEC-II
Couse Code: 23A036KT
year: III
Semester: II
Branch/es EEE

Lecture Hours	Tutorial Hours	Practice Hours	Credits
3	0	0	3

Course Objectives:

1. To acquire basic knowledge on automation and hardware components of automation.
2. To learn about the automated flow lines, line balancing methods and automated assembly systems.
3. To learn about the robotics and fundamentals of robots with their needs in present trend and the sensors, actuators.
4. To understand robot kinematics, dynamics and to acquire knowledge on importance of trajectory planning in robots.
5. To learn about the robot programming methods and applications of industrial robots.

Course Outcomes:

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

6. Summarize the concepts of an automation and hardware components of automation
7. Analyze the line balancing methods and automated assembly systems, automated flow lines.
8. Summarize the fundamentals of Robots, sensors and actuators.
9. Analyze the Robot kinematics, dynamics and trajectory planning
10. Summarize the concept of robot programming methods and robot applications

Unit 1 Introduction to Automation 12

Introduction to Automation, Need, Types, Basic elements of an automated system, Manufacturing Industries, Types of production, Functions in manufacturing, Organization and information processing in manufacturing, Automation strategies and levels of automation, Hardware components for automation and process control, mechanical feeders, hoppers, orienters, high speed automatic insertion devices.

Unit 2 Automated Flow Lines and Assembly line balancing 12

Automated flow lines, Part transfer methods and mechanisms, types of Flow lines, flow line with/without buffer storage, Quantitative analysis of flow lines. Assembly line balancing: Assembly process and systems assembly line, line balancing methods, ways of improving line balance, flexible assembly lines.

Unit 3 Introduction to Industrial Robotics, actuators and Feedback components 12

Introduction to Industrial Robotics: Introduction to Industrial Robotics, Classification of Robot Configurations, functional line diagram, degrees of freedom. Components common types of arms, joints grippers, factors to be considered in the design of grippers.

Robot actuators and Feedback components: Actuators, Pneumatic, Hydraulic actuators, Electric & Stepper motors, comparison. Position sensors - potentiometers, resolvers, encoders - velocity sensors, Tactile sensors, Proximity sensors.

Unit 4 Manipulator Kinematics, Manipulator Dynamics and Trajectory Planning 12

Manipulator Kinematics: Homogenous transformations as applicable to rotation and transition - D-H notation, Forward inverse kinematics.

Trajectory Planning: Trajectory Planning and avoidance of obstacles path planning, skew motion, joint integrated motion - straight line motion.

10 Hrs

Robot Application in Manufacturing: Material Transfer - Material handling, loading and unloading - Process - spot and continuous arc welding & spray painting - Assembly and In

5. Automation, Production systems and CIM, M.P.Groover, Pearson Edu 2004. ISBN-10: 9789332572492, ISBN-13: 978-9332572492
6. Introduction to Robotics: Analysis, systems, Applications, Niku Saeed B., PHI New Delhi. ISBN-10: 0130613096

10. Robotics. Fu KS, McGraw Hill. 2014. ISBN: 9780071822282
11. Introduction to Robotics, Saha, S.K., Second Edition McGraw Hill New Edition 2014. ISBN: 9789332902800.
12. Industrial Robotics, M.P. Groover, TMH 2003. ISBN-10: 007024989X
13. Introduction to Robotics. John J. Craig, Pearson Edu 2017. ISBN: 0133489795

- <https://youtu.be/oxMdDsud5vg>
- <https://www.youtube.com/watch?v=xrwz9IxpMJg&t=1311>

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ANNAMACHARYA INSTITUTE OF TECHNOLOGY AND SCIENCES RAJAMPET
(An Autonomous Institution)

Department of Electrical and Electronics Engineering

Title of the Transducers and Sensors
Category: OEC-II
Couse Code: 23A046HT
year: III
Semester: II
Branch/es EEE

Lecture Hours

3

Tutorial Hours

0

Practice Hours

0

Credits

3

Course Objectives:

1. To understand characteristics of Instrumentation System and the operating principle of motion transducers.
2. To explore working principles, and applications of different temperature transducers and Piezo-electric sensors.
3. To provide knowledge on flow transducers and their applications.
4. To study the working principles of pressure transducers.
5. To introduce working principles and applications of force and sound transducers.

Course Outcomes:

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

1. Comprehend the characteristics of Instrumentation System and the operating principle of motion transducers. L2
2. Explore working principles, and applications of different temperature transducers and Piezo-electric sensors.L2
3. Gain knowledge on flow transducers and their applications. L2
4. Learn the working principles of pressure transducers.L2
5. Comprehend the working principle and applications of force and sound transducers. L2

Unit 1

10

Introduction: General Configuration and Functional Description of measuring instruments, Static and Dynamic Characteristics of Instrumentation System, Errors in Instrumentation System, Active and Passive Transducers and their Classification.

Motion Transducers: Resistive strain gauge, LVDT, RVDT, Capacitive transducers, Piezo- electric transducers, seismic displacement pick-ups, vibrometers and accelerometers.

Unit 2

10

Temperature Transducers: Standards and calibration, fluid expansion and metal expansion type transducers - bimetallic strip, Thermometer, Thermistor, RTD, Thermocouple and their characteristics. Hall effect transducers, Digital transducers, Proximity devices, Bio-sensors, Smart sensors, Piezo-electric sensors

Unit 3

10

Flow Transducers: Bernoulli's principle and continuity, Orifice plate, Nozzle plate, Venture tube, Rotameter, Anemometers, Electromagnetic flow meter, Impeller meter and Turbid flow meter.

Unit 4**10**

Pressure Transducers: Standards and calibration, different types of manometers, elastic transducers, diaphragm bellows, bourdon tube, capacitive and resistive pressure transducers, high and low pressure measurement.

Unit 5**9**

Force and Sound Transducers: Proving ring, hydraulic and pneumatic load cell, dynamometer and gyroscopes. Sound level meter, sound characteristics, Microphone.

Prescribed Textbooks:

1. A.K.Sawhney, —A course in Electrical and Electronics Measurements and Instrumentation||, Dhanpat Rai& Co. 3rd edition Delhi, 2010.
2. Rangan C.S, Sarma G.R and Mani V S V, —Instrumentation Devices and Systems||, TATA Mc Graw Hill publications, 2007.

Reference Books:

1. Doebelin.E.O,— Measurement Systems Application and Design, McGraw Hill International, New York, 2004.
2. Nakra B.C and Chaudhary K.K , - Instrumentation Measurement and Analysis, Second Edition, Tata McGraw-Hill Publication Ltd.2006.

CO-PO Mapping:

Course Outcomes	Engineering Knowledge	Problem Analysis	Design/Development of Solutions	Conduct Investigations of Complex Problems	Modern Tool Usage	The Engineer and Society	Environment And Sustainability	Ethics	Individual And Team Work	Communication	Project Management And Finance	Life-Long Learning	PSO1	PSO2
23A046HT.1	3	-	3	3	-	-	-	-	1	-	-	-	2	-
23A046HT.2	3	-	3	3	-	-	-	-	2	-	-	-	2	-
23A046HT.3	3	2	3	3	-	-	-	-	2	-	-	-	2	-
23A046HT.4	3	-	3	3	-	-	-	-	2	-	-	-	2	-
23A046HT.5	3	2	3	3	-	-	-	-	1	-	-	-	2	-

ANNAMACHARYA INSTITUTE OF TECHNOLOGY AND SCIENCES RAJAMPET
(An Autonomous Institution)

Department of Electrical and Electronics Engineering

Title of the Operating Systems
Category: OEC-II
Couse Code: 23A056IT
year: III
Semester: II
Branch/es EEE

Lecture Hours	Tutorial Hours	Practice Hours	Credits
3	0	0	3

Course Objectives: This course will be able to

1. Understand the fundamental principles of operating systems and their role in managing hardware and software resources.
2. Explore process management techniques, including scheduling algorithms, multithreading, and inter process communication mechanisms.
3. Analyze memory management strategies such as paging, segmentation, and virtual memory to optimize system performance.
4. Evaluate deadlock conditions and file system structures, including resource allocation, disk scheduling, and RAID technologies.
5. Implement security and protection mechanisms to safeguard computer systems from threats and unauthorized access.

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

1. Explain core operating system functions such as process, memory, file, and device management.
2. Analyze scheduling algorithms and IPC mechanisms to enhance process efficiency.
3. Apply memory management techniques to improve system performance.
4. Assess deadlock conditions and propose solutions for resource management.
5. Able to design and implement file systems, focusing on file access methods, directory structure, free space management, and also explore various protection mechanisms,

Unit 1 Operating Systems Overview, System Structures

8

Operating Systems Overview: Introduction, Operating system functions, Operating systems operations, Computing environments, Open-Source Operating Systems System Structures: Operating System Services, User and Operating-System Interface, systems calls, Types of System Calls, system programs, Operating system Design and Implementation, Operating system structure, Operating system debugging, System Boot.

Unit 2 Process Concept, Multithreaded Programming, Process

Scheduling, Inter-process Communication

10

Process Concept: Process scheduling, Operations on processes, Inter-process communication, Communication in client server systems. Multithreaded Programming: Multithreading models, Thread libraries, Threading issues, Examples. Process Scheduling: Basic concepts, Scheduling criteria, Scheduling algorithms, Multiple processor scheduling, Thread scheduling, Examples. Inter-process Communication: Race conditions, Critical Regions, Mutual exclusion with busy waiting, Sleep and wakeup, Semaphores, Mutexes, Monitors, Message passing, Barriers, Classical IPC Problems - Dining philosophers problem, Readers and writers problem.

Unit 3 Memory-Management Strategies, Virtual Memory Management**10**

Memory-Management Strategies: Introduction, Swapping, Contiguous memory allocation, Paging, Segmentation, Examples. Virtual Memory Management: Introduction, Demand paging, Copy on-write, Page replacement, Frame allocation, Thrashing, Memory-mapped files, Kernel memory allocation, Examples

Unit 4 Deadlocks, File Systems**10**

Deadlocks: Resources, Conditions for resource deadlocks, Ostrich algorithm, Deadlock detection And recovery, Deadlock avoidance, Deadlock prevention. File Systems: Files, Directories, File system implementation, management and optimization. Secondary-Storage Structure: Overview of disk structure, and attachment, Disk scheduling, RAID structure, Stable storage implementation

Unit 5 System Protection, System Security**10**

System Protection: Goals of protection, Principles and domain of protection, Access matrix, Access control, Revocation of access rights. System Security: Introduction, Program threats, System and network threats, Cryptography as a security, User authentication, implementing security defenses, firewalling to protect systems and networks, Computer security classification. Case Studies: Linux, Microsoft Windows.

Textbooks:

- 1.Silberschatz A, Galvin P B, and Gagne G, Operating System Concepts, 9th edition, Wiley, 2016.
- 2.Tanenbaum A S, Modern Operating Systems, 3rd edition, Pearson Education, 2008.

Reference Books:

- 1.Tanenbaum A S, Woodhull A S, Operating Systems Design and Implementation, 3rd edition, PHI,2006
2. Dhamdhere D M, Operating Systems A Concept Based Approach, 3rd edition, Tata McGraw Hill, 012.
3. Stallings W, Operating Systems -Internals and Design Principles, 6th edition, Pearson Education, 2009
4. Nutt G, Operating Systems, 3rd edition, Pearson Education, 2004

Online Learning Resources:

1. <https://nptel.ac.in/courses/106/106/106106144/>
2. <http://peterindia.net/OperatingSystems.html>

ANNAMACHARYA INSTITUTE OF TECHNOLOGY AND SCIENCES RAJAMPET
(An Autonomous Institution)

Department of Electrical and Electronics Engineering

Title of the Course: Introduction to Machine Learning
Category: OEC-II
Course Code: 23A056JT
year: III
Semester: II
Branch/es EEE

Lecture Hours	Tutorial Hours	Practice Hours	Credits
3	0	0	3

Course Objectives: This course will be able to

1. Understand the fundamental concepts of machine learning, its types, applications, and data preprocessing techniques.
3. Learn to select, train, evaluate, and improve machine learning models while applying feature engineering techniques.
5. Explore Bayesian methods for concept learning and understand various classification algorithms.
6. Understand regression techniques for predictive modeling and methods to enhance model accuracy.
7. Learn unsupervised learning techniques such as clustering and association rule mining for pattern discovery.

Course Outcomes:

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

1. Explain the significance of machine learning types, applications, and data quality in model building
2. Apply feature engineering methods to improve model performance and interpretability. Implement classification models such as k-NN, Decision Trees, and Random Forest for predictive tasks
3. Implement classification algorithms such as k-NN, Decision Trees, and Random Forests.
4. Analyze regression algorithms and improve model accuracy using optimization techniques.
5. Design clustering models using partitioning and density-based techniques for pattern recognition.

Unit 1 Introduction to Machine Learning and Linear Models

9

Definition and Scope of Machine Learning, Applications and Types of Learning: Supervised, Unsupervised, Reinforcement, Linear Regression: Least Squares, Cost Function, Gradient Descent, Polynomial Regression and Overfitting, Evaluation Metrics: RMSE, MAE, R^2 Score, Bias-Variance Trade off.

UNIT II: Classification Algorithms

9

Classification Overview and Decision Boundaries, Logistic Regression: Sigmoid Function and Cost, K-Nearest Neighbors (KNN), Naïve Bayes Classifier, Decision Trees and Random Forests, Model Evaluation: Confusion Matrix, Precision, Recall, F1-Score.

UNIT III: Support Vector Machines and Ensemble Methods

9

Support Vector Machines: Concepts, Kernels, Hyperplane and Margin Concepts, Kernel Tricks: RBF and Polynomial, Ensemble Learning: Bagging, Boosting, and Voting, Gradient Boosting, AdaBoost, and XGBoost, Model Tuning and Hyperparameter Optimization.

UNIT IV: Unsupervised Learning Techniques

9

Clustering Overview: Applications, K-Means Clustering Algorithm, Hierarchical Clustering, DBSCAN and Density Based Methods, Principal Component Analysis (PCA) for Dimensionality Reduction, Silhouette Score, Davies-Bouldin Index for Cluster Validation

UNIT V: Advanced Topics and Applications

Reinforcement Learning Basics and Markov Decision Processes, Introduction to Neural Networks and Deep Learning, Cross-Validation Techniques: k-Fold, Leave-One-Out, Feature Engineering and Feature Selection, Deployment of ML Models (Flask, Streamlit, etc.), Case Studies: Medical Diagnosis, Spam Detection, Credit Scoring.

Textbooks:

1. Machine Learning, SaikatDutt, Subramanian Chandramouli, Amit Kumar Das, Pearson, 2019.

Reference Books:

1. EthernAlpaydin, —Introduction to Machine Learning||, MIT Press, 2004.
2. Tephenn Marsland, —Machine Learning -An Algorithmic Perspective||, Second Edition,
3. Chapman and Hall/CRC Machine Learning and Pattern Recognition Series,2014.
4. Andreas C. Müller and Sarah Guido —Introduction to Machine Learning with
5. Python: A Guide for Data Scientists||, Oreilly.

Online Learning Resources:

1. Andrew Ng, —Machine Learning B.Techning||
2. <https://www.deeplearning.ai/machine-learning- B.Techning/>
3. Shai Shalev-Shwartz , Shai Ben-David, —Understanding Machine Learning: From Theory to Algorithms , Cambridge University Press
4. <https://www.cse.huji.ac.il/~shais/UnderstandingMachineLearning/index.html>

ANNAMACHARYA INSTITUTE OF TECHNOLOGY AND SCIENCES RAJAMPET
(An Autonomous Institution)

Department of Electrical and Electronics Engineering

Title of the Course: Optimization Techniques for Engineers
Category: OEC-II
Course Code: 23AHS61T
Year : III
Semester II
Branch/es: EEE

Lecture Hours	Tutorial Hours	Practice Hours	Credits
3	0	0	3

Course Objectives:

1. To formulate and solve optimization problems using various techniques.
2. To apply optimization algorithms to real-world problems.
3. To analyze and interpret the results of optimization models.
4. To use optimization software tools to solve problems.

Course Outcomes:

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

1. Understand the meaning, purpose, tools of Operations Research and linear programming in solving practical problems in industry.
2. Interpret the transportation models' solutions and infer solutions to the real-world problems.
3. Develop mathematical skills to analyze and solve nonlinear programming models arising from a wide range of applications.
4. Apply the concept of non-linear programming for solving the problems involving on-linear constraints and objectives
5. Apply the concept of unconstrained geometric programming for solving the problems involving non-linear constraints and objectives.

Unit 1 Linear programming I 8

Introduction, Applications of Linear Programming, Standard form of a Linear Programming Problem, Graphical Method for Linear Programming Problems, Basic Definitions in Linear Programming. Simplex Method, Simplex Algorithm and Two phase Simplex Method, Big-M method.

Unit 2 Linear programming II: Duality in Linear Programming 8

Symmetric Primal-Dual Relations, General Primal-Dual Relations, Duality Theorem, Dual Simplex Method, Transportation Problem and assignment problem, Complementary slackness Theorem

Unit 3 Non-linear programming: Unconstrained optimization techniques 8

Introduction: Methods of Unconstrained minimization,

Direct Search Methods: Random Search Methods: Descent Method and Fletcher Powell Method, Grid Search Method

Unit 4 Non-linear programming: Constrained optimization techniques 8

Introduction, Characteristics of a constrained problem, Random Search Methods, complex method, Sequential linear programming, Basic approach in methods of Feasible directions, Zoutendijk's method of feasible directions: direction finding problem, determination of step length, Termination criteria.

8

Constrained minimization Problems: Solution of a constrained geometric programming problem, primal-dual programming in case of less-than inequalities, geometric programming with mixed inequality constraints.

1. Singiresu S Rao., Engineering Optimization: Theory and Practices, New Age Int. (P) Ltd. Publishers, New Delhi.
2. J. C. Panth, Introduction to Optimization Techniques, (7-e) Jain Brothers, New Delhi.

1. Harvey M. Wagner, Principles of Operation Research, Printice-Hall of India Pvt. Ltd. New Delhi.
2. Peressimi A.L., Sullivan F.E., Vhl, J. J. Mathematics of Non-linear Programming, Springer – Verlag.

1. https://onlinecourses.nptel.ac.in/noc24_ee122/preview
2. <https://archive.nptel.ac.in/courses/111/105/111105039/>
3. https://onlinecourses.nptel.ac.in/noc21_ce60/preview

Course Outcomes	Engineering Knowledge	Problem Analysis	Design/Development of Solutions	Conduct Investigations of Complex Problems	Modern Tool Usage	The Engineer and Society	Environment And Sustainability	Ethics	Individual And Team Work	Communication	Project Management And Finance	Life-Long Learning	PSO1	PSO2
23AHS61T.1	3	3	2	2	-	-	-	-	-	-	-	1	-	-
23AHS61T.2	3	2	2	2	-	-	-	-	-	-	-	1	-	-
23AHS61T.3	3	2	2	1	-	-	-	-	-	-	-	1	-	-
23AHS61T.4	2	2	2	1	-	-	-	-	-	-	-	1	-	-
23AHS61T.5	3	3	2	1	-	-	-	-	-	-	-	1	-	-

ANNAMACHARYA INSTITUTE OF TECHNOLOGY AND SCIENCES RAJAMPET
(An Autonomous Institution)

Department of Electrical and Electronics Engineering

Title of the Course	Physics of Electronic Materials and Devices
Category	OEC-II
Couse Code	23AHS62T
Year	III
Semester	II
Branch	EEE

Lecture Hours	Tutorial Hours	Practice Hours	Credits
2	0	0	3

Course Objectives:

1. To make the students to understand the concept of crystal growth, defects in crystals and thin films.
2. To provide insight into various semiconducting materials and their properties.
3. To develop a strong foundation in semiconductor physics and device engineering.
4. To elucidate excitonic and luminescent processes in solid-state materials.
5. To understand the principles, technologies, and applications of modern display systems.

Course Outcomes:

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

1. Understand crystal growth and thin film preparation
2. Summarize the basic concepts of semiconductors
3. Illustrate the working of various semiconductor devices
4. Analyze various luminescent phenomena and the devices based on these concepts
5. Explain the working of different display devices

Unit 1 Fundamentals of Materials Science 9

Introduction, Phase rule, Phase Diagram, Elementary idea of Nucleation and Growth, Methods of crystal growth. The basic idea of point, line, and planar defects. Concept of thin films, preparation of thin films, Deposition of thin film using sputtering methods (RF and glow discharge).

Unit 2 Semiconductors 9

Introduction, charge carriers in semiconductors, effective mass, Diffusion and drift, Diffusion and recombination, Diffusion length. The Fermi level & Fermi-Dirac distribution, Electron and Hole in quantum well, change of electron-hole concentration- Qualitative analysis, Temperature dependency of carrier concentration, Conductivity and mobility, Effects of temperature and doping on mobility, High field effects.

Unit 3 Physics of Semiconductor Devices 9

Introduction, Band structure, PN junctions and their typical characteristics under equilibrium and under bias, Heterojunctions, Transistors, MOSFETs.

Unit 4 Excitons and Luminescence 9

Luminescence: Different types of luminescence, basic definitions, Light emission in solids, Inter- band luminescence, Direct and indirect gap materials. Photoluminescence: General Principles of photoluminescence, Excitation and relaxation, OLED, Quantum-dot. Electro-luminescence: General Principles of electroluminescence, light emitting diode, diode laser.

Unit 5 Display devices 9

LCD, three-dimensional display: Holographic display, light-field displays: Head-mounted display, MOEMS (Micro-Opto-Electro-Mechanical Systems) and MEMS displays.

Prescribed Textbooks:

1. Principles of Electronic Materials and Devices-S.O. Kasap, McGraw-Hill Education (India) Pvt. Ltd., 4th edition, 2021.
2. Semiconductor physics & devices: basic principles, 4th Edition, McGraw-Hill, 2012.

Reference Books:

1. Solid State Electronic Devices -B.G. Streetman and S. Banerjee, PHI Learning,6th edition
2. Electronic Materials Science- Eugene A. Irene, Wiley, 2005
3. Electronic Components and Materials, Grover and Jamwal, Dhanpat Rai and Co., New Delhi., 2012.

NPTEL course links:

1. <https://nptel.ac.in/courses/113/106/113106062/>
2. https://onlinecourses.nptel.ac.in/noc20_ph24/preview

CO-PO Mapping:

[illegible]

ANNAMACHARYA INSTITUTE OF TECHNOLOGY AND SCIENCES RAJAMPET
(An Autonomous Institution)

Department of Electrical and Electronics Engineering

Title of the Course Chemistry of Polymers and Applications
Category: OEC-II
Couse Code: 23AHS63T
year: III
Semester: II
Branch/es EEE

Lecture Hours	Tutorial Hours	Practice Hours	Credits
3	0	0	3

Course Objectives:

1. To understand the basic principles of polymers
2. To understand natural polymers and their applications.
3. To impart knowledge to the students about synthetic polymers, their preparation and importance.
4. To enumerate the applications of hydrogel polymers
5. To enumerate applications of conducting and degradable polymers in engineering.

Course Outcomes:

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

1. explain polymerization mechanism and measurement of molecular weight of polymer
2. describe the physical, chemical properties and applications of natural polymers and modified cellulotics.
3. explain types of polymerizations, types of polymers and applications.
4. understand polymer networks, hydrogels, and their applications.
5. explain classification and mechanism of conducting and degradable polymers.

Unit 1 Polymers-Basics and Characterization 9

Basic concepts: monomers, repeating units, degree of polymerization, linear, branched and network polymers, classification of polymers, Polymerization: addition, condensation, copolymerization and coordination polymerization. Average molecular weight concepts: number, weight and viscosity average molecular weights, polydispersity and molecular weight distribution. Measurement of molecular weight: End group, viscosity, light scattering, osmotic and ultracentrifugation methods, analysis and testing of polymers.

Unit 2 Natural Polymers & Modified Cellulosics 9

Natural Polymers: Chemical & Physical structure, properties, source, important chemical modifications, applications of polymers such as cellulose, lignin, starch, rosin, shellac, latexes, vegetable oils and gums, proteins.

Modified cellulotics: Cellulose esters and ethers such as Ethyl cellulose, CMC, HPMC, cellulose acetals, Liquid crystalline polymers; specialty plastics- PES, PAES, PEEK, PEA.

Unit 3 Synthetic Polymers 9

Addition and condensation polymerization processes– Bulk, Solution, Suspension and Emulsion polymerization. Preparation and significance, classification of polymers based on physical properties. Thermoplastics, Thermosetting plastics, Fibers and elastomers, General Applications. Preparation of Polymers based on different types of monomers, Olefin polymers (PE, PVC), Butadiene polymers (BUNA-S, BUNA-N), nylons, Urea-formaldehyde, phenol – formaldehyde, Melamine Epoxy and Ion exchange resins.

Unit 4 Hydrogels of Polymer Networks

9

Definitions of Hydrogel, polymer networks, Types of polymer networks, Methods involved in hydrogel preparation, Classification, Properties of hydrogels, Applications of hydrogels in drug delivery.

Unit 5 Conducting and Degradable Polymers

9

Conducting polymers: Introduction, Classification, Mechanism of conduction in Poly Acetylene, Poly Aniline, Poly Thiophene, Doping, Applications.

Degradable polymers: Introduction, Classifications, Examples, Mechanism of degradation, poly lactic acid, PHB (Polyhydroxybutyrate) Nylon-6, Polyesters, applications.

Prescribed Textbooks:

1. Fred W. Billmeyer, Jr. is: Billmeyer F. W. A Textbook of Polymer Science, Textbook of Polymer Science (3rd ed.). Wiley-Interscience, 1984.
2. Introduction to polymer chemistry, G.S. Mishra, Wiley Eastern Ltd., New Delhi. Newage publishers
3. Polymer science- V.R Gowrikar, N V Viswanathan, Jayaadev Sreedhar-New age International Publishers. 1986

Reference Books:

1. Organic polymer Chemistry, K.J.Saunders, Chapman and Hall
2. Advanced Organic Chemistry, B.Miller, Prentice Hall
3. Polymer Science and Technology by Premamoy Ghosh, 3rd edition, McGraw-Hill, 2010

CO-PO Mapping:

Course Outcomes	Engineering Knowledge	Problem Analysis	Design/Development of Solutions	Conduct Investigations of Complex Problems	Modern Tool Usage	The Engineer and Society	Environment And Sustainability	Ethics	Individual And Team Work	Communication	Project Management And Finance	Life-Long Learning	PSO1	PSO2
23AHS63T.1	3	3	2	2	-	-	2	-	-	-	-	1	-	-
23AHS63T.2	2	2	1	1	-	-	2	-	-	-	-	1	-	-
23AHS63T.3	2	2	1	1	-	-	2	-	-	-	-	1	-	-
23AHS63T.4	2	2	1	1	-	-	2	-	-	-	-	1	-	-
23AHS63T.5	2	2	1	1	-	-	2	-	-	-	-	1	-	-

ANNAMACHARYA INSTITUTE OF TECHNOLOGY AND SCIENCES RAJAMPET
(An Autonomous Institution)

Department of Electrical and Electronics Engineering

Title of the Course: Academic Writing and Public Speaking
Category: OEC-II
Course code 23AHS64T
Year : III
Semester II
Branch/es: EEE

Lecture Hours
3

Tutorial Hours
0

Practice Hours
0

Credits
3

Course Objectives:

1. To encourage all-round development of the students by focusing on writing skills
2. To make the students aware of non-verbal skills
3. To enhance analytical skills in academic writing for deeper knowledge enhancement
4. To cultivate proficiency in delivering clear and engaging public speeches

Course Outcomes:

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

1. Understand various elements of Academic Writing
2. Identify sources and avoid plagiarism
3. Demonstrate the knowledge in writing a Research paper
4. Analyze different types of essays
5. Assess the strengths of other speakers and build confidence in delivering impactful presentations to an audience.

Unit 1 Introduction to Academic Writing

9

Introduction to Academic Writing – Essential Features of Academic Writing – Courtesy – Clarity – Conciseness – Correctness – Coherence – Completeness – Types – Descriptive, Analytical, Persuasive, Critical writing.

Unit 2 Academic Journal Article

9

Art of condensation- summarizing and paraphrasing - Abstract Writing, writing Project Proposal, writing application for internship, Technical/Research/Journal Paper Writing – Conference Paper writing - Editing, Proof Reading - Plagiarism.

Unit 3 Essay & Writing Reviews

9

Compare and Contrast – Argumentative Essay – Exploratory Essay – Features and Analysis of Sample Essays – Writing Book Report, Summarizing, Book/film Review- Sop

Unit 4 Public Speaking

9

Introduction, Nature, characteristics, significance of Public Speaking – Presentation – 4 Ps of Presentation– Stage Dynamics – Answering Strategies –Analysis of Impactful Speeches- Speeches for Academic events

Unit 5 Public Speaking and Non-Verbal Delivery

9

Body Language – Facial Expressions-Kinesics – Proxemics – Haptics – Chronemics -Paralanguage – Signs

Prescribed Textbooks:

1. Critical Thinking, Academic Writing and Presentation Skills: MG University Edition Paperback – 1 January 2010 Pearson Education; First edition (1 January 2010)
2. Pease, Allan & Barbara. The Definitive Book of Body Language, RHUS Publishers, 2016

Reference Books:

1. Alice Savage, Masoud Shafiei Effective Academic Writing, 2Ed., 2014 Oxford University Press.
2. Shalini Verma, Body Language, S Chand Publications 2011.
3. Sanjay Kumar and Pushpalata, Communication Skills 2E 2015, Oxford.
4. Sharon Gerson, Steven Gerson, Technical Communication Process and Product, Pearson, New Delhi, 2014
5. Elbow, Peter. Writing with Power. OUP USA, 1998

Online Learning Resources

- 1 <https://youtu.be/NNhTIT81nH8>
- 2 <https://www.youtube.com/watch?v=478ccrWKY-A>
- 3 <https://www.youtube.com/watch?v=nzGo5ZC1gMw>
- 4 <https://www.youtube.com/watch?v=Qve0ZBmJMh4>
- 5 <https://courses.lumenlearning.com/publicspeakingprinciples/chapter/chapter-12-nonverbal-aspects-of-delivery/>
- 6 https://onlinecourses.nptel.ac.in/noc21_hs76/preview
- 7 <https://archive.nptel.ac.in/courses/109/107/109107172/#>
- 8 <https://archive.nptel.ac.in/courses/109/104/10910410>

CO-PO Mapping:

Course Outcomes	Engineering Knowledge	Problem Analysis	Design/Development of Solutions	Conduct Investigations of Complex Problems	Modern Tool Usage	The Engineer and Society	Environment And Sustainability	Ethics	Individual And Team Work	Communication	Project Management And Finance	Life-Long Learning	PSO1	PSO2
23AHS64T.1	-	-	-	-	-	-	-	-	-	3	-	3	-	-
23AHS64T.2	-	-	-	-	-	-	-	-	-	3	-	3	-	-
23AHS64T.3	-	-	-	-	-	-	-	-	-	3	-	3	-	-
23AHS64T.4	-	-	-	-	-	-	-	-	-	3	-	3	-	-
23AHS64T.5	-	-	-	-	-	-	-	-	-	3	-	3	-	-

ANNAMACHARYA INSTITUTE OF TECHNOLOGY AND SCIENCES RAJAMPET
(An Autonomous Institution)
Department of Electrical and Electronics Engineering

Title of the Course	Mathematical Foundation of Quantum technologies
Category	OEC-II
Couse Code	23AHS65T
Year	III
Semester	II
Branch	EEE

Lecture Hours	Tutorial Hours	Practice Hours	Credits
3	0	0	3

Course Objectives:

1. To provide students with essential linear algebra foundations including vector spaces, inner products, and operators for quantum mechanical applications.
2. To develop understanding of the transition from finite-dimensional systems to infinite-dimensional function spaces and Hilbert space concepts.
3. To establish quantum mechanical formalism including measurement theory, uncertainty relations, and time evolution principles.
4. To enable students to apply quantum mechanical principles to solve problems in simple quantum systems and understand statistical interpretation.
5. To introduce advanced concepts in composite systems, measurement processes, and modern perspectives in quantum mechanics.

Course Outcomes:

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

1. Understand vector spaces, inner products, and linear operators with applications to quantum systems. L2
2. Apply linear algebra concepts to function spaces and analyze the transition from finite to infinite dimensional systems. L1, L4
3. Analyze quantum mechanical formalism including measurement theory, uncertainty relations, and time evolution. L4
4. Apply quantum mechanical principles to solve problems in simple quantum systems and evaluate statistical interpretations. L3, L5
5. Evaluate advanced concepts in composite systems and synthesize understanding of measurement processes and modern quantum theory. L5

UNIT I: Linear Algebra Foundation for Quantum Mechanics (10 hours)

Vector spaces definition and examples ($\mathbb{R}^2$, $\mathbb{R}^3$, function spaces), Inner products (dot product, orthogonality, normalization), Linear operators matrices, eigenvalues, eigenvectors), Finite-dimensional examples (2×2 matrices, spin 1/2 systems), Dirac notation introduction ($|\psi\rangle$, $\langle\phi|$, $\langle\phi|\psi\rangle$), Change of basis (transformations, unitary matrices).

UNIT II: From Finite to Infinite Dimensions (08 hours)

Function spaces (L^2 space, square-integrable functions), Inner products for functions ($\int \psi^* \phi dx$), Orthogonal function sets (Fourier series, basis functions), Introduction to Hilbert space concept (complete inner product spaces), Position and momentum representations (wave functions), Operators on functions (d/dx , multiplication by x).

UNIT III: Quantum Mechanical Formalism (08 hours)

Mathematical formulation (states as vectors, observables as operators), Measurement theory (Born rule, expectation values, probabilities), Uncertainty relations (mathematical derivation from commutators), Time evolution (Schrödinger equation, unitary evolution).

UNIT IV: Applications and Statistical Interpretation (06 hours)

Simple applications (infinite square well, harmonic oscillator), Statistical interpretation (ensembles, pure vs mixed states), Measurement process (von Neumann measurement scheme).

UNIT V: Advanced Topics (08 hours)

Composite systems (tensor products basic introduction), Reversibility and irreversibility (unitary evolution vs measurement), Thermodynamic connections (equilibrium states, entropy), Modern perspectives (decoherence, measurement problem conceptual).

Textbooks:

1. David J. Griffiths, Darrell F. Schroeter, —Introduction to Quantum Mechanics||, 3rd Edition, Cambridge University Press (2018).
2. R. Shankar, Principles of Quantum Mechanics, 2nd Edition, Kluwer Academy/Plenum Publishers (1994).

Reference Books:

1. George. F. Simmons, —Introduction to Topology and Modern Analysis||, MedTech Science Press.
2. Gilbert Strang, Linear Algebra and Its Applications, 4th Edition, Cengage Learning (2006).
3. John von Neumann and Robert T Beyer, Mathematical Foundations of Quantum Mechanics, Princeton Univ. Press (1996).

Web Resources

1. <https://eclass.uoa.gr/modules/document/file.php/CHEM248/Griffiths%20Introduction%20to%20Quantum%20Mechanics%203rd%20ed%202018.pdf>
2. <https://eclass.uoa.gr/modules/document/file.php/CHEM248/Griffiths%20Introduction%20to%20Quantum%20Mechanics%203rd%20ed%202018.pdf>
3. <https://fisica.net/mecanica-quantica/Shankar%20-%20Principles%20of%20quantum%20mechanics.pdf>.

CO-PO Mapping:

Course Outcomes	Engineering Knowledge	Problem Analysis	Design/Development of Solutions	Conduct Investigations of Complex Problems	Modern Tool Usage	The Engineer and Society	Environment And Sustainability	Ethics	Individual And Team Work	Communication	Project Management And Finance	Life-Long Learning	PSO1	PSO2
23AHS65T.1	3	3	2	2	1	-	-	-	-	-	-	-	-	2
23AHS65T.2	3	3	2	3	2	-	-	-	-	-	-	-	-	2
23AHS65T.3	3	3	3	3	2	-	-	-	-	-	-	-	-	2
23AHS65T.4	3	3	3	3	2	-	-	-	-	-	-	-	-	2
23AHS65T.5	3	3	3	3	2	1	-	-	-	-	-	-	-	3

ANNAMACHARYA INSTITUTE OF TECHNOLOGY AND SCIENCES RAJAMPET
(An Autonomous Institution)

Department of Electrical and Electronics Engineering

Title of the Course	Building Materials and Services
Category	OEC-III
Couse Code	23A017GT
Year	IV
Semester	I
Branch	EEE

Lecture Hours	Tutorial Hours	Practice Hours	Credits
3	0	0	3

Course Objectives:

1. To understand the properties, classifications, and applications of building materials like stones, bricks, tiles, wood, aluminum, glass, paints, and plastics.
2. To analyze the composition, manufacturing process, and properties of cement and admixtures.
3. To apply knowledge of building components such as lintels, arches, walls, stairs, floors, roofs, foundations, and joinery.
4. To evaluate masonry, mortars, finishing techniques, and formwork systems.
5. To assess various building services including plumbing, ventilation, air conditioning, acoustics, and fire protection.

Course Outcomes:

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

1. Understand the properties, classifications, and applications of building materials like stones, bricks, tiles, wood, aluminum, glass, paints, and plastics.
2. Analyze the composition, manufacturing process, and properties of cement and admixtures.
3. Apply knowledge of building components such as lintels, arches, walls, stairs, floors, roofs, foundations, and joinery.
4. Evaluate masonry, mortars, finishing techniques, and formwork systems.
5. Assess various building services including plumbing, ventilation, air conditioning, acoustics, and fire protection.

Unit 1	Building Materials	8
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Building Stones – Classifications and Quarrying – Properties –Structural Requirements – Dressing. Bricks – Composition of Brick Earth – Manufacture and Structural Requirements, Fly Ash, Ceramics. Timber, Aluminum, Glass, Paints and Plastics: Wood - Structure – Types and Properties – Seasoning – Defects; Alternate Materials for Timber – GI / Fibre – Reinforced Glass Bricks, Steel & Aluminum, Plastics.

Unit 2	Cementitious materials	8
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Types of Cement - Ingredients of Cement – Manufacture – Chemical Composition – Hydration - Field & Lab Tests – Fineness – Consistency – Initial &Final Setting – Soundness. Admixtures – Mineral & Chemical Admixtures – Uses

Unit 3	Building Components	8
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Lintels, Arches, Walls, Vaults – Stair Cases – Types of Floors, Types of Roofs – Flat, Curved, Trussed; Foundations – Types; Damp Proof Course; Joinery – Doors -Windows – Materials – Types.

Unit 4 Masonry and Finishing

10

Lime and Cement Mortars Brick Masonry – Types – Bonds; Stone Masonry – Types; Composite Masonry – Brick-Stone Composite; Concrete, Reinforced Brick. Finishers: Plastering, Pointing, Painting, Claddings – Types – Tiles – ACP form Work: Types: Requirements – Standards – Scaffolding – Design; Shoring, Underpinning.

Unit 5 Building Services

10

Plumbing Services: Water Distribution, Sanitary – Lines & Fittings; Ventilations: Functional Requirements Systems of Ventilations. Air-Conditioning, Building Orientation - Essentials and Types; Acoustics – Characteristic – Absorption – Acoustic Design; Fire Protection – Fire Hazards – Classification of Fire-Resistant Materials and Constructions.

Prescribed Textbooks:

1. Building Materials and Construction – Arora & Bindra, Dhanpat Roy Publications.
2. Building Materials and Construction by G C Sahu, Joygopal Jena McGraw hill Pvt Ltd 2015.

Reference Books:

1. Building Construction by B. C. Punmia, Ashok Kumar Jain and Arun Kumar Jain – Laxmi Publications (P) Ltd., New Delhi.
2. P. C. Varghese, Building Materials, Prentice Hall of India, 2015.
3. N. Subramanian ,||Building Materials Testing and Sustainability||, Oxford Higher Education, 2019.
4. R. Chudley, Construction Technology, Longman Publishing Group, 1973.
5. S. K. Duggal, Building Materials, Oxford & IBH Publishing Co. Ltd., New Delhi, 2019

Online Learning Resources:

1. <https://archive.nptel.ac.in/courses/105/102/105102088/>

CO-PO Mapping:

Course Outcomes	Engineering Knowledge	Problem Analysis	Design/Development of Solutions	Conduct Investigations of Complex Problems	Modern Tool Usage	The Engineer and Society	Environment And Sustainability	Ethics	Individual And Team Work	Communication	Project Management And Finance	Life-Long Learning	PSO1	PSO2
23A017GT.1	3	-	-	-	2	-	-	-	-	-	-	-	3	3
23A017GT.2	3	3	-	-	2	-	-	-	-	-	-	2	3	3
23A017GT.3	3	-	3	2	3	-	-	-	-	-	-	-	3	3
23A017GT.4	-	-	3	3	3	-	2	-	-	-	-	-	3	3
23A017GT.5	-	-	-	-	-	3	3	2	-	-	-	-	-	3

ANNAMACHARYA INSTITUTE OF TECHNOLOGY AND SCIENCES RAJAMPET
(An Autonomous Institution)

Department of Electrical and Electronics Engineering

Title of the Course: Environmental Impact Assessment
Category: OEC-III
Course Code: 23A017HT
Year : IV
Semester I
Branch/es: EEE

Lecture Hours	Tutorial Hours	Practice Hours	Credits
3	0	0	3

Course Objectives:

1. Understand the principles, methodologies, and significance of Environmental Impact Assessment (EIA).
2. Analyze the impact of developmental activities on land use, soil, and water resources.
3. Evaluate the impact of development on vegetation, wildlife, and assess environmental risks.
4. Develop environmental audit procedures and assess compliance with environmental regulations.
5. Understand and apply environmental acts, notifications, and legal frameworks in EIA studies.

Course Outcomes:

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

1. Apply various methodologies for conducting Environmental Impact Assessments.
2. Analyze the impact of land-use changes on soil, water, and air quality.
3. Evaluate the environmental impact on vegetation, wildlife, and conduct risk assessments.
4. Develop environmental audit reports and assess compliance with environmental policies.
5. Interpret and apply environmental acts and regulations related to EIA.

Unit 1 Concepts and methodologies of EIA 8

Initial Environmental Examination, Elements of EIA, - Factors Affecting E-I-A Impact Evaluation and Analysis, Preparation of Environmental Base Map, Classification of Environmental Parameters- Criteria for The Selection of EIA Methodology, E I A Methods, Ad-Hoc Methods, Matrix Methods, Network Method Environmental Media Quality Index Method, Overlay Methods and Cost/Benefit Analysis.

Unit 2 Impact of Developmental Activities and Land Use 8

Introduction and Methodology for The Assessment of Soil and Ground Water, Delineation of Study Area, Identification of Actives. Procurement of Relevant Soil Quality, Impact Prediction, Assessment of Impact Significance, Identification and Incorporation of Mitigation Measures. E I A in Surface Water, Air and Biological Environment: Methodology for The Assessment of Impacts on Surface Water Environment, Air Pollution Sources, Generalized Approach for Assessment of Air Pollution Impact.

Unit 3 Assessment of Impact on Vegetation, Wildlife and Risk Assessment 8

Introduction - Assessment of Impact of Development Activities on Vegetation and Wildlife, Environmental Impact of Deforestation – Causes and Effects of Deforestation - Risk Assessment and Treatment of Uncertainty-Key Stages in Performing an Environmental Risk Assessment- Advantages of Environmental Risk Assessment.

Unit 4 Environmental Audit

10

Introduction - Environmental Audit & Environmental Legislation Objectives of Environmental Audit, Types of Environmental Audit, Audit Protocol, Stages of Environmental Audit, Onsite Activities, Evaluation of Audit Data and Preparation of Audit Report

Unit 5 Environmental Acts and Notifications

10

The Environmental Protection Act, The Water Preservation Act, The Air (Prevention & Control of Pollution Act), Wild Life Act - Provisions in The EIA Notification, Procedure for Environmental Clearance, Procedure for Conducting Environmental Impact Assessment Report- Evaluation of EIA Report. Environmental Legislation Objectives, Evaluation of Audit Data and Preparation of Audit Report. Post Audit Activities, Concept of ISO and ISO 14000.

Prescribed Textbooks:

1. Environmental Impact Assessment Methodologies, by Y. Anjaneyulu, B. S. Publication, Hyderabad 2nd edition 2011
2. Environmental Impact Assessment, by Canter Larry W., McGraw-Hill education Edi (1996)

Reference Books:

1. Environmental Engineering, by Peavy, H. S, Rowe, D. R, Tchobanoglous, G. Mc-Graw Hill International Editions, New York 1985.
2. Environmental Science and Engineering, by Suresh K. Dhaneja, S.K., Katania & Sons Publication, New Delhi
3. Environmental Science and Engineering, by J. Glynn and Gary W. Hein Ke, Prentice Hall Publishers.
4. Environmental Pollution and Control, by H. S. Bhatia, Galgotia Publication (P) Ltd, Delhi

Online Learning Resources:

1. <https://archive.nptel.ac.in/courses/124/107/124107160/>

CO-PO Mapping:

Course Outcomes	Engineering Knowledge	Problem Analysis	Design/Development of Solutions	Conduct Investigations of Complex Problems	Modern Tool Usage	The Engineer and Society	Environment And Sustainability	Ethics	Individual And Team Work	Communication	Project Management And Finance	Life-Long Learning	PSO1	PSO2
23A017HT.1	3	2	2	2	2	3	-	-	-	-	-	1	2	2
23A017HT.2	3	3	3	2	2	3	-	-	-	-	-	1	3	2
23A017HT.3	3	3	3	2	2	3	3	-	-	-	-	1	3	3
23A017HT.4	3	3	3	3	2	3	3	-	-	-	-	1	3	3
23A017HT.5	2	2	2	2	2	3	3	3	-	-	-	1	2	2

ANNAMACHARYA INSTITUTE OF TECHNOLOGY AND SCIENCES RAJAMPET
(An Autonomous Institution)

Department of Electrical and Electronics Engineering

Title of the Course: 3D Printing Technologies
Category: OEC-III
Couse Code: 23A037KT
Year : IV
Semester I
Branch/es: EEE

Lecture Hours	Tutorial Hours	Practice Hours	Credits
3	0	0	3

Course Objectives:

1. Understand the fundamental concepts of prototyping and distinguish between traditional and rapid prototyping methods.
2. Demonstrate the working principles, materials, and applications of solid-, liquid-, and powder-based RP systems.
3. Define the processes and classifications of rapid tooling and reverse engineering techniques.
4. Identify common errors in 3D printing and evaluate pre-processing, processing, and post-processing issues.
5. Familiarize RP-related software and its role in applications such as design, manufacturing, and medical fields.

Course Outcomes:

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

1. Define and explain the evolution and need for rapid prototyping in modern product development.
2. Compare and contrast various 3D printing technologies based on working principles, materials, and limitations.
3. Apply knowledge of rapid tooling and reverse engineering techniques for industrial and design applications.
4. Diagnose and interpret different types of errors encountered in 3D printing processes and recommend solutions.
5. Use RP-specific software tools to manipulate STL files and prepare models for printing in real-world scenarios.

Unit 1 Introduction to 3D Printing

09

Introduction to Prototyping, Traditional Prototyping Vs. Rapid Prototyping (RP), Need for time compression in product development, Usage of RP parts, Generic RP process, Distinction between RP and CNC, other related technologies, Classification of RP.

Unit 2 Solid and Liquid Based RP Systems

09

Working Principle, Materials, Advantages, Limitations and Applications of Fusion Deposition Modelling (FDM), Laminated Object Manufacturing (LOM), Stereo lithography (SLA), Direct Light Projection System (DLP) and Solid Ground Curing (SGC).

Unit 3 Powder Based & Other RP Systems**09**

Powder Based RP Systems: Working Principle, Materials, Advantages, Limitations and Applications of Selective Laser Sintering (SLS), Direct Metal Laser Sintering (DMLS), Laser Engineered Net Shaping (LENS) and Electron Beam Melting (EBM). Other RP Systems: Working Principle, Materials, Advantages, Limitations and Applications of Three Dimensional Printing (3DP), Ballistic Particle Manufacturing (BPM) and Shape Deposition Manufacturing (SDM).

Unit 4 Rapid Tooling & Reverse Engineering**09**

Rapid Tooling: Conventional Tooling Vs. Rapid Tooling, Classification of Rapid Tooling, Direct and Indirect Tooling Methods, Soft and Hard Tooling methods. Reverse Engineering (RE): Meaning, Use, RE – The Generic Process, Phases of RE Scanning, Contact Scanners and Noncontact Scanners, Point Processing, Application Geometric Model, Development

Unit 5 Errors in 3D Printing and Applications:**09**

Pre-processing, processing and post-processing errors, Part building errors in SLA, SLS, etc. Software: Need for software, MIMICS, Magics, SurgiGuide, 3-matic, 3D-Doctor, Simplant, Velocity2, VoXim, Solid View, 3DView, etc., software, Preparation of CAD models, Problems with STL files, STL file manipulation, RP data formats: SLC, CLI, RPI, LEAF, IGES, HP/GL, CT, STEP. Applications: Design, Engineering Analysis and planning applications, Rapid Tooling, Reverse Engineering, Medical Applications of RP.

Prescribed Textbooks:

1. Chee Kai Chua and Kah Fai Leong, —3D Printing and Additive Manufacturing Principles and Applications|| 5/e, World Scientific Publications, 2017.
2. Ian Gibson, David W Rosen, Brent Stucker, —Additive Manufacturing Technologies: 3D Printing, Rapid Prototyping, and Direct Digital Manufacturing||, Springer, 2/e, 2010.

Reference Books:

1. Frank W.Liou, —Rapid Prototyping & Engineering Applications||, CRC Press, Taylor & Francis Group, 2011.
2. Rafiq Noorani, —Rapid Prototyping: Principles and Applications in Manufacturing||, John Wiley&Sons, 2006.

Online Learning Resources:

1. NPTEL Course on Rapid Manufacturing.
2. <https://nptel.ac.in/courses/112/104/112104265/>
3. <https://www.hubs.com/knowledge-base/introduction-fdm-3d-printing/>
4. <https://slideplayer.com/slide/6927137/>
5. <https://www.mdpi.com/2073-4360/12/6/1334>
6. <https://www.centropiaggio.unipi.it/sites/default/files/course/material/2013-11-29%20-%20FDM.pdf>
7. <https://lecturenotes.in/subject/197>
8. https://www.cet.edu.in/noticefiles/258_Lecture%20Notes%20on%20RP-ilovepdfcompressed.pdf
9. https://www.vssut.ac.in/lecture_notes/lecture1517967201.pdf
10. <https://www.youtube.com/watch?v=NkC8TNts4B4>.

CO-PO Mapping:

Course Outcomes	Engineering Knowledge	Problem Analysis	Design/Development of Solutions	Conduct Investigations of Complex Problems	Modern Tool Usage	The Engineer and Society	Environment And Sustainability	Ethics	Individual And Team Work	Communication	Project Management And Finance	Life-Long Learning	PSO1	PSO2
23A037KT.1	3	2	3	3	2	2	1	2	-	2	3	3	3	3
23A037KT.2	3	2	3	3	3	2	1	2	-	2	2	3	3	3
23A037KT.3	3	2	3	3	3	2	1	2	-	2	2	3	3	3
23A037KT.4	3	2	3	3	3	2	1	2	-	2	2	3	3	3
23A037KT.5	3	2	3	3	3	2	1	2	-	2	2	3	3	3

Department of Electrical and Electronics Engineering

Lecture Hours	Tutorial Hours	Practice Hours	Credits
3	0	0	3

- 1 To learn the fundamental architectural concepts of Microprocessors.
- 2 To gain knowledge about assembly language programming concepts.
- 3 To get familiar with the 8086 interfacing.
- 4 To understand the fundamentals of the 8051Microcontroller.
- 5 To learn interfacing with the 8051 Microcontroller.

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

- 1 Learn the fundamental architectural concepts of microprocessors. (L2)
- 2 Write the assembly language programs. (L6).
- 3 Interface various sensors, display devices and other ICs with 8086 and also comprehend the concepts of MSP 430 (L3).
- 4 Comprehend the fundamentals of the 8051 Microcontroller. (L2).
- 5 Interface input and output devices with 8051 Microcontroller. (L6).

Unit 1	8086 Architecture	10
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Main features, pin diagram/description, 8086 microprocessor family, internal architecture, bus interfacing unit, execution unit, interrupts and interrupt response, 8086 system timing, minimum mode and maximum mode configuration.

Unit 2	8086 Programming	13
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Program development steps, instructions, addressing modes, assembler directives, writing simple programs with an assembler, assembly language program development tools.

Unit 3	8086 Interfacing	14
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Semiconductor memories (RAM, ROM) - Intel 8255 Programmable Peripheral Interface, interfacing switches and LEDs, Seven segment displays, Stepper motor - A/D and D/A converter - Intel 8251 USART architecture and interfacing - Need of DMA.

Features and architecture of MSP 430 (Mixed Signal Processor).

Unit 4	Microcontroller	10
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Architecture of 8051 – Special Function Registers (SFRs) - I/O Pins Ports and Circuits - Instruction set - Addressing modes - Assembly language programming.

Unit 5	Interfacing Microcontroller	12
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Programming 8051 Timers - Serial Port Programming - Interrupts – LCD & Keyboard Interfacing - ADC, DAC & Sensor Interfacing - External Memory Interface- Stepper Motor and Waveform generation - Comparison of Microprocessor, Microcontroller, PIC and ARM processors.

Prescribed Textbooks:

- 1 M Bhurchandi, A K Ray, Advanced Microprocessors and Peripherals, 3rd edition, McGraw Hill Education, 2017
2. Kenneth J. Ayala, The 8051Microcontroller, 3rdedition, Cengage Learning,2004.

Reference Books:

- 1 Ramesh S Gaonkar, Microprocessor Architecture Programming and Applications with the 8085, 6th edition, Penram International Publishing, 2013.
2. RajKamal, Microcontrollers: Architecture, Programming, Interfacing and System Design, 2nd edition, Pearson, 2012.
3. Microprocessors and Interfacing–Programming and Hardware by Douglas V Hall SSSP Rao, Tata McGraw Hill Education Private Limited, 3rd Edition,1994.

Online Learning Resources:

1. <https://nptel.ac.in/courses/108/105/108105102/>
2. <https://www.classcentral.com/course/swayam-microprocessors-and-microcontrollers-9894>

CO-PO Mapping:

Course Outcomes	Engineering Knowledge	Problem Analysis	Design/Development of Solutions	Conduct Investigations of Complex Problems	Modern Tool Usage	The Engineer and Society	Environment And Sustainability	Ethics	Individual And Team Work	Communication	Project Management And Finance	Life-Long Learning	PSO1	PSO2
23A047GT. 1	2	1	1	1	-	-	-	1	-	-	-	1	-	-
23A047GT. 2	3	3	3	3	3	-	-	1	2	2	-	3	3	-
23A047GT. 3	3	2	1	1	-	-	-	1	-	-	-	1	-	-
23A047GT. 4	2	1	1	1	-	-	-	1	-	-	-	1	-	-
23A047GT. 5	3	3	3	3	3	-	-	1	2	2	-	3	3	-

ANNAMACHARYAINSTITUTE OF TECHNOLOGY AND SCIENCES RAJAMPET
(An Autonomous Institution)

Department of Electrical and Electronics Engineering

Title of the Course: Data Base Management Systems
Category: OEC-III
Couse Code: 23A057IT
Year : IV
Semester I
Branch/es: EEE

Lecture Hours	Tutorial Hours	Practice Hours	Credits
3	0	0	3

Course Objectives: This course will be able to

1. To introduce the fundamental concepts of database systems and data modeling.
2. To provide knowledge on relational databases and SQL for data retrieval and manipulation.
3. To understand database design principles using normalization and ER modeling.
4. To study transaction management, concurrency control, and database recovery.
5. To explore emerging database technologies and architectures including NoSQL.

Course Outcomes:

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

1. Understand the basic concepts of database systems and their architecture.
2. Apply ER modeling and relational algebra for database design.
3. Analyze and implement normalization techniques for schema refinement.
4. Evaluate transaction management techniques, concurrency control, and recovery.
5. Explore non-relational databases and recent trends in database systems.

Unit 1 Introduction to Databases

10

Database System Applications and Purpose, View of Data: Data Abstraction and Data Independence, database Users and Administrators, DBMS Architecture and Data Models, ER Model: Entities, Attributes, relationships, ER Diagrams, Reduction of ER Model to Tables

Unit 2 Relational Model and Algebra

10

Structure of Relational Databases, Relational Model Concepts and Integrity Constraints, Relational Algebra: Selection, Projection, Set Operations, Joins, Tuple Relational Calculus, Introduction to SQL: DDL, DML, DCL, Advanced SQL: Sub queries, Joins, Views, Indexes

Unit 3

10

Schema Design and Logical Database Design, Functional Dependencies, Normal Forms: 1NF, 2NF, 3NF, BCNF, Decomposition and Lossless Join, Dependency Preservation, Multi-Valued and Join Dependencies.

Unit 4 Transaction Management and Concurrency Control

10

Concept of a Transaction, ACID Properties, Serializability and Schedules, Concurrency Control: Lock-Based, Timestamp-Based Protocols, Deadlock Handling, Recovery Techniques: Log-Based, Shadow Paging

Distributed Databases and Parallel Databases, Introduction to NoSQL: Types – Document, Columnar, Key-Value, Graph, CAP Theorem, MongoDB: Basics and CRUD Operations, Big Data and New SQL Overview, Case Studies on Real- World Databases

Prescribed Textbooks:

1. Abraham Silberschatz, Henry F. Korth, S. Sudarshan – Database System Concepts, 7th Edition, McGraw Hill
2. Ramez Elmasri, Shamkant B. Navathe – Fundamentals of Database Systems, 7th Edition, Pearson Education

Reference Books:

1. C.J. Date – An Introduction to Database Systems, 8th Edition, Addison-Wesley
2. Raghu Ramakrishnan, Johannes Gehrke – Database Management Systems, 3rd Edition, McGraw Hill

Online Resources & Courses:

1. NPTEL – Database Management Systems by IIT Madras
2. Coursera – Databases by Stanford University
3. Khan Academy – Intro to SQL
4. MongoDB University – Free Courses on NoSQL Databases
5. W3Schools SQL Tutorial
6. Geeks for Geeks – DBMS Concepts and Practice Problems

ANNAMACHARYA INSTITUTE OF TECHNOLOGY AND SCIENCES RAJAMPET
(An Autonomous Institution)
Department of Electrical and Electronics Engineering

Title of the Cyber Security
Category: OEC-III
Couse Code: 23A057JT
Year : IV
Semester I
Branch/es: EEE

Lecture Hours	Tutorial Hours	Practice Hours	Credits
3	0	0	3

Course Objectives:

6. To introduce the concept of cybercrime and its impact on information security, and provide an overview of cybercriminal behavior and various classifications of cybercrimes.
7. To explore the methodologies used by cybercriminals to plan and execute attacks, including techniques like social engineering, botnets, and cloud-related threats.
8. To understand the security risks associated with mobile and wireless devices, and examine countermeasures for securing mobile computing in organizational environments.

Course Outcomes:

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

1. Understand the fundamentals of cybercrime and information security, and explain the legal and global perspectives, especially with reference to Indian IT Act 2000.
2. Analyze how cybercriminals plan and execute cyber offenses using techniques like social engineering, cyber stalking, and botnets, including threats posed by cloud computing.
3. Evaluate the security challenges of mobile and wireless devices and formulate measures to secure mobile environments within an organization.
4. Identify and explain various cyber-attack tools and methods such as phishing, keyloggers, Trojans, and SQL injection used in committing cybercrimes.
5. Assess the organizational implications of cybercrimes, including IPR issues, social media risks, and formulate strategies to mitigate security and privacy challenges.

Unit 1 Introduction to Cybercrime

9

Introduction, Cybercrime, and Information Security, Who are Cybercriminals, Classifications of Cybercrimes, And Cybercrime: The legal Perspectives and Indian Perspective, Cybercrime and the Indian ITA 2000, A Global Perspective on Cybercrimes.

Unit 2 Cyber Offenses How Criminals Plan Them

9

Introduction, How Criminals plan the Attacks, Social Engineering, Cyber stalking, Cyber cafe and Cybercrimes, Botnets: The Fuel for Cybercrime, Attack Vector, Cloud Computing

Unit 3 Cybercrime: Mobile and Wireless Devices**9**

Introduction, Proliferation of Mobile and Wireless Devices, Trends in Mobility, Credit card Frauds in Mobile and Wireless Computing Era, Security Challenges Posed by Mobile Devices, Registry Settings for Mobile Devices, Authentication service Security, Attacks on Mobile/Cell Phones. **Mobile Devices:** Security Implications for Organizations, Organizational Measures for Handling Mobile, Organizational Security Policies a Measures in Mobile Computing Era, Laptops.

Unit 4 Tools and Methods Used in Cybercrime**9**

Introduction, Proxy Servers and Anonymizers, Phishing, Password Cracking, Keyloggers and Spywares, Virus and Worms, Trojan Horse and Backdoors, Steganography, DoS and DDoS attacks, SQL Injection, Buffer Overflow.

Unit 5 Cyber Security: Organizational Implications**9**

Introduction, Cost of Cybercrimes and IPR issues, Web threats for Organizations, Security and Privacy Implications, Social media marketing: Security Risks and Perils for Organizations, Social Computing and the associated challenges for Organizations.

Prescribed Textbooks:

1. Cyber Security: Understanding Cyber Crimes, Computer Forensics and Legal Perspectives, Nina Godbole and Sunil Belapure, Wiley INDIA.

Reference Books:

1. Cyber Security Essentials, James Graham, Richard Howard and Ryan Otson, CRC Press
2. Introduction to Cyber Security , Chwan –Hwa (john) Wu ,J. DavidIrwin.CRC Press T&F Group

Online Learning Resources:

1. <http://nptel.ac.in/courses/106105031/40>
2. <http://nptel.ac.in/courses/106105031/39>
3. <http://nptel.ac.in/courses/106105031/38>

ANNAMACHARYA INSTITUTE OF TECHNOLOGY AND SCIENCES RAJAMPET

(An Autonomous Institution)

Department of Electrical and Electronics Engineering

Title of the Course: Wavelet transforms and its applications

Category: OEC-III

Couse Code: 23AHS71T

Year IV

Semester: I

Branch/es EEE

Lecture Hours

3

Tutorial Hours

0

Practice Hours

0

Credits

3

Course Objectives:

1. To Apply wavelet transforms to analyze signals and images.
2. To Use wavelet analysis for denoising, compression, and feature extraction.
3. To Identify suitable applications of wavelet transforms in various fields.
4. To Implement wavelet transforms using software tools.

Course Outcomes:

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

1. Understand wavelets and wavelet basis and characterize continuous and discrete wavelet Transforms.
2. Illustrate the multi resolution analysis and scaling functions.
3. Implement discrete wavelet transforms with multirate digital filters.
4. Understand multi resolution analysis and identify various wavelets and evaluate their time-frequency resolution properties.
5. Design certain classes of wavelets to specification and justify the basis of the application of wavelet transforms to different fields.

Unit 1 Wavelets

8

Introduction to Wavelets - Wavelets and Wavelet Expansion Systems - Wavelet Expansion- Wavelet Transform- Wavelet System- More Specific Characteristics of Wavelet Systems -Haar Scaling Functions and Wavelets -effectiveness of Wavelet Analysis -The Discrete Wavelet Transform- The Discrete-Time and Continuous Wavelet Transforms.

Unit 2 A Multiresolution Formulation of Wavelet Systems

8

Signal Spaces -The Scaling Function -Multiresolution Analysis - The Wavelet Functions - The Discrete Wavelet Transform- A Parseval's Theorem - Display of the Discrete Wavelet Transform and the Wavelet Expansion.

Unit 3 Filter Banks and the Discrete Wavelet Transform

8

Analysis - From Fine Scale to Coarse Scale- Filtering and Down-Sampling or Decimating -Synthesis - From Coarse Scale to Fine Scale -Filtering and Up-Sampling or Stretching - Input Coefficients - Lattices and Lifting - -Different Points of View.

Unit 4 Time-Frequency and Complexity

8

Multiresolution versus Time-Frequency Analysis- Periodic versus Nonperiodic Discrete Wavelet Transforms -The Discrete Wavelet Transform versus the Discrete-Time Wavelet Transform- Numerical Complexity of the Discrete Wavelet Transform.

Unit 5 Bases and Matrix Examples

8

Bases, Orthogonal Bases, and Biorthogonal Bases -Matrix Examples - Fourier Series Example - Sine Expansion Example - Frames and Tight Frames - Matrix Examples -Sine Expansion as a Tight Frame Example.

1. C. Sidney Burrus, Ramesh A. Gopinath, —Introduction to Wavelets and Wavelets Transforms||, Prentice Hall, (1997).
2. James S. Walker, —A Primer on Wavelets and their Scientific Applications||, CRC Press, (1999)..

1. RaghuvveerRao, —Wavelet Transforms||, Pearson Education, Asia
2. C. S. Burrus, Ramose and A. Gopinath, Introduction to Wavelets and Wavelet Transform, Prentice Hall Inc.

1. <http://users.rowan.edu/~polikar/WAVELETS/WTtutorial.html>
2. <http://www.wavelet.org/>
3. <http://www.math.hawaii.edu/~dave/Web/Amara's%20Wavelet%20Page.htm>
4. <https://jqichina.wordpress.com/wp-content/uploads/2012/02/ten-lectures-of-waveletsefbc88e5b08fe6b3a2e58d81e8aeb2efbc891.pdf>

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ANNAMACHARYA INSTITUTE OF TECHNOLOGY AND SCIENCES RAJAMPET

(An Autonomous Institution)

Department of Electrical and Electronics Engineering

Title of the Course: Smart Materials and Devices
Category: OEC-III
Course Code: 23AHS72T
Year : IV
Semester I
Branch/es: EEE

Lecture Hours

3

Tutorial Hours

0

Practice Hours

0

Credits

3

Course Objectives:

1. To provide exposure to smart materials and their engineering applications.
2. To impart knowledge on the basics and phenomenon behind the working of smart materials
3. To explain the properties exhibited by smart materials
4. To educate various techniques used to synthesize and characterize smart materials
5. To identify the required smart material for distinct applications/devices

Course Outcomes:

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

1. Identify key discoveries that led to modern applications of shape memory materials, describe the two phases in shape memory alloys.
2. Describe how different external stimuli (light, electricity, heat, stress, and magnetism) influence smart material properties.
3. Summarize various types of synthesis of smart materials
4. Analyze various characterization techniques used for smart materials
5. Interpret the importance of smart materials in various devices

Unit 1 Introduction to Smart Materials

9

Historical account of the discovery and development of smart materials, Shape memory materials, chromoactive materials, magnetorheological materials, photoactive materials, Polymers and polymer composites (Basics).

Unit 2 Properties of Smart Materials

9

Optical, Electrical, Dielectric, Piezoelectric, Ferroelectric, Pyroelectric and Magnetic properties of smart materials.

Unit 3 Synthesis of Smart Materials

9

Chemical route: Chemical vapour deposition, Sol-gel technique, Hydrothermal method, Mechanical alloying and Thin film deposition techniques: Chemical etching, Spray pyrolysis.

Unit 4 Characterization Techniques

9

Powder X-ray diffraction, Raman spectroscopy (RS), UV-Visible spectroscopy, Scanning electron microscopy (SEM), Transmission electron microscopy (TEM), Atomic force microscopy (AFM).

Unit 5 Smart Materials based Devices

9

Devices based on smart materials: Shape memory alloys in robotic hands, piezoelectric based devices, MEMS and intelligent devices.

Prescribed Textbooks:

1. YaserDahman, Nanotechnology and Functional Materials for Engineers-, Elsevier, 2017
2. E. Zschech, C. Whelan, T. Mikolajick, Materials for Information Technology: Devices, Interconnects and Packaging Springer-Verlag London Limited 2005.

Reference Books:

1. Gauenzi,P.,Smart Structures, Wiley, 2009.
2. MahmoodAliofkhazraei, Handbook of functional nanomaterials, Vol (1&2), Nova Publishers, 2014
3. Handbook of Smart Materials, Technologies, and Devices: Applications of Industry,4.0,Chaudhery MustansarHussain, Paolo Di Sia, Springer,2022.
4. Fundamentals of Smart Materials,Mohsen Shahinpoor, Royal Society of Chemistry, 2020

NPTEL course link: : https://onlinecourses.nptel.ac.in/noc22_me17/preview

CO-PO Mapping:

[illegible]

ANNAMACHARYA INSTITUTE OF TECHNOLOGY AND SCIENCES RAJAMPET

(An Autonomous Institution)

Department of Electrical and Electronics Engineering

Title of the Course: Green Chemistry and Catalysis for Sustainable Environment
Category: OEC-III
Course Code: 23AHS73T
Year : IV
Semester I
Branch/es: EEE

Lecture Hours

3

Tutorial Hours

0

Practice Hours

0

Credits

3

Course Objectives:

1. To understand principle and concepts of green chemistry.
2. To understand the types of catalysis and industrial applications.
3. To apply green solvents in chemical synthesis.
4. To enumerate different sources of green energy.
5. To apply alternative greener methods for chemical reactions

Course Outcomes:

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

1. Apply green chemistry principles in daily life and synthesis, including sustainable development, economic reactions, and polymer recycling.
2. Explain types of catalysis and their applications, including heterogeneous, homogeneous, bio, photo, transition metal, and phase transfer catalysis.
3. Demonstrate the use and importance of green solvents, including supercritical CO₂ and water, and their recycling methods
4. Apply green chemistry for sustainable development by utilizing biomass, solar power, sonochemistry, renewable resources, and mechanochemical synthesis.
5. Discuss alternative green methods such as photoredox catalysis, SET, photochemical, microwave-assisted, and sonochemical reactions with examples and applications.

Unit 1 Principles and Concepts of Green Chemistry

9

Introduction, Green chemistry Principles, sustainable development and green chemistry, E factor, atom economy, atom economic Reactions: Rearrangement and addition reactions and atom un-economic reactions: Substitution, elimination and Wittig reactions, Reducing Toxicity. Waste - problems and Prevention: Design for degradation, Polymer recycling.

Unit 2 Catalysis and Green Chemistry

9

Introduction, Types of catalysis, Heterogeneous catalysis: Basics of Heterogeneous Catalysis, Zeolite and the Bulk Chemical Industry, Heterogeneous Catalysis in the Fine Chemical and Pharmaceutical Industries, Catalytic Converters, Homogeneous catalysis: Transition Metal Catalysts with Phosphine Ligands, Greener Lewis Acids, and Phase transfer catalysis, Bio-catalysis and Photo-catalysis with examples.

Unit 3 Green Solvents in Chemical Synthesis

9

Green Solvents: Concept, Tools and techniques for solvent selection, supercritical fluids: Super critical carbondioxide, super critical water, Polyethylene glycol (PEG), Ionic liquids, Recycling of green solvents.

Unit 4 Emerging Greener Technologies

9

Biomass as renewable resource, Energy: Energy from Biomass, Solar Power, Chemicals from Renewable Feedstock's, Chemicals from Fatty Acids, Polymers from Renewable Resources, Alternative Economies: The Syngas Economy, The Biorefinery, Design for energy efficiency, Mechanochemical synthesis.

Photochemical Reactions - Examples, Advantages and Challenges, Photoredox catalysis, single electron transfer reactions (SET), Examples of Photochemical Reactions, Microwave-assisted Reactions and Sonochemical reactions, examples and applications.

Prescribed Textbooks:

3. M. Lancaster, Green Chemistry an introductory text, Royal Society of Chemistry, 2002.
4. Paul T. Anastas and John C. Warner, Green Chemistry Theory and Practice, 4th Edition, Oxford University Press, USA

Reference Books:

4. Green Chemistry for Environmental Sustainability, First Edition, Sanjay K. Sharma and AckmezMudhoo, CRC Press, 2010.
5. Hand Book of Green chemistry, edited by Alvise Perosa and Maurizio Selva, Volume 8: Green Nanoscience, wiley-VCH, 2013.

CO-PO Mapping:

Course Outcomes	Engineering Knowledge	Problem Analysis	Design/Development of Solutions	Conduct Investigations of Complex Problems	Modern Tool Usage	The Engineer and Society	Environment And Sustainability	Ethics	Individual And Team Work	Communication	Project Management And Finance	Life-Long Learning	PSO1	PSO2
23AHS73T.1	3	3	2	2	-	-	3	-	-	-	-	1	-	-
23AHS73T.2	3	2	2	1	-	-	3	-	-	-	-	1	-	-
23AHS73T.3	3	2	2	1	-	-	3	-	-	-	-	1	-	-
23AHS73T.4	3	2	2	1	-	-	3	-	-	-	-	1	-	-
23AHS73T.5	3	2	2	1	-	-	3	-	-	-	-	1	-	-

ANNAMACHARYA INSTITUTE OF TECHNOLOGY AND SCIENCES RAJAMPET
(An Autonomous Institution)

Department of Electrical and Electronics Engineering

Title of the Course: Employability Skills
Category: OEC-III
Couse Code: 23AHS74T
Year: IV
Semester I
Branch/es EEE

Lecture Hours	Tutorial Hours	Practice Hours	Credits
3	0	0	3

Course Objectives:

1. To strengthen writing skills Intune with the needs of academic and Industry domains.
2. To strengthen communication skills through effective public speaking.
3. To lend exposure to different types of writing skills, relevant to research and academia.
4. To help them develop organizational skills through group activities.
5. To function effectively with heterogeneous teams.

Course Outcomes:

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

1. Understand the importance of goals and try to achieve them.
2. Explain the significance of self-management .
3. Apply the knowledge of writing skills in preparing eye-catching resumes
4. Analyze various forms of Presentation skills
5. Evaluate group behavior effectively and develop essential skills for employability

Unit 1 Goal Setting and Self-Management 9

Definition, importance, types of Goal Setting – SMART Goal Setting – Advantages-Motivation – Intrinsic and Extrinsic Motivation – Self-Management - Knowing about self – SWOC Analysis

Unit 2 Writing Skills 9

Definition, significance, types of writing skills – Resume writing Vs CV Writing - E-Mail writing, Cover Letters - E-Mail Etiquette -SoP (Statement of Purpose)

Unit 3 Technical Presentation Skills 9

Nature, meaning & significance of Presentation Skills – Planning, Preparation, Presentation, Stage Dynamics –Anxiety in Public speaking (Glossophobia)- PPT & Poster Presentation.

Unit 4 Group Presentation Skills 9

Body Language – Group Behavior - Team Dynamics – Leadership Skills – Personality Manifestation- Group Discussion-Debate –Corporate Etiquette

Unit 5 Interview Skills 9

Nature, characteristics, importance & types of Interviews – Job Interviews – Skills for success – Job searching skills - STAR method - FAQs- Answering Strategies – Mock Interviews

Prescribed Textbooks:

1. Sabina Pillai, Agna Fernandez. *Soft Skills & Employability Skills*,2014. Cambridge Publisher. [Alka Wadkar](#). *Life Skills for Success*, Sage Publications, 2016.

Reference Books:

1. Gangadhar Joshi. Campus to Corporate Paperback, Sage Publications. 2015
2. Sherfield Montgomery Moody, Cornerstone Developing Soft Skills, Pearson Publications. 4 Ed. 2008
3. Shikha Kapoor. Personality Development and Soft Skills - Preparing for Tomorrow .1 Edition, Wiley, 2017.
4. M. Sen Gupta, Skills for Employability, Innovative Publication, 2019. Steve Duck and David T McMahan, The Basics Communication Skills A Relational Perspective, Sage press, 2012.

Online Learning Resources

1. <https://youtu.be/gkLsn4ddmTs>
2. <https://youtu.be/2bf9K2rRWwo>
3. <https://youtu.be/FchfE3c2jzc>
4. https://youtu.be/xBaLgJZ0t6A?list=PLzf4HHIsQFwJZel_j2PUy0pwjVUgj7KIJ
5. <https://www.youtube.com/c/skillopedia/videos>
6. https://onlinecourses.nptel.ac.in/noc25_hs96/preview
7. https://onlinecourses.nptel.ac.in/noc21_hs76/preview
8. <https://archive.nptel.ac.in/courses/109/107/109107172/#>
9. <https://archive.nptel.ac.in/courses/109/104/109104107/>

CO-PO Mapping:

Course Outcomes	Engineering Knowledge	Problem Analysis	Design/Development of Solutions	Conduct Investigations of Complex Problems	Modern Tool Usage	The Engineer and Society	Environment And Sustainability	Ethics	Individual And Team Work	Communication	Project Management And Finance	Life-Long Learning	PSO1	PSO2
23AHS74T.1	-	-	-	-	-	-	-	-	-	3	-	3	-	-
23AHS74T.2	-	-	-	-	-	-	-	-	-	3	-	3	-	-
23AHS74T.3	-	-	-	-	-	-	-	-	-	3	-	3	-	-
23AHS74T.4	-	-	-	-	-	-	-	-	-	3	-	3	-	-
23AHS74T.5	-	-	-	-	-	-	-	-	-	3	-	3	-	-

ANNAMACHARYA INSTITUTE OF TECHNOLOGY AND SCIENCES RAJAMPET

(An Autonomous Institution)

Department of Electrical and Electronics Engineering

Title of the Course: VLSI Design

Category: OEC-III

Course Code: 23A047HT

Year : IV

Semester I

Branch/es: EEE

Lecture Hours

4

Tutorial Hours

0

Practice Hours

0

Credits

3

Course Objectives:

- 1 To understand the steps involved in fabrication of ICs using MOS transistor technology.
- 2 To learn about the VLSI design processes, Stick diagrams and Layouts.
- 3 To gain knowledge on the Gate Level Design concepts.
- 4 To learn the design of various subsystems with different VLSI Design styles.
- 5 To get familiar with CMOS testing technique.

Course Outcomes:

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

- 1 Explain MOS transistor behavior, CMOS technology, and inverter characteristics.
- 2 Apply VLSI design methodologies including stick diagrams, design rules, and layout creation.
- 3 Analyze and design gate-level circuits considering resistance, capacitance, and delays.
- 4 Design and integrate functional units like adders, ALUs, and multipliers in a subsystem.
- 5 Apply testability concepts and evaluate different testing strategies in VLSI design.

Unit 1

13

Introduction: Brief Introduction to IC technology MOS, PMOS, NMOS, CMOS Technologies. Basic Electrical Properties of MOS:IDS-VDS relationships, MOS transistor Threshold Voltage, figure of merit, Transconductance, Pass transistor, NMOS Inverter, Various pull ups, CMOS Inverter analysis and design.

Unit 2

13

VLSI Circuit Design Processes: VLSI Design Flow, MOS Layers, Stick Diagrams, Design Rules and Layout, Lambda(λ)-based design rules for wires, contacts and Transistors, Layout Diagrams for NMOS and CMOS Inverters and Gates, Scaling of MOS circuits.

Unit 3

14

Gate level Design: Logic gates and other complex gates, Switch logic, Alternate gate circuits. Basic Circuit Concepts: Sheet Resistance R_s and its concepts to MOS, Area Capacitances calculations, Inverter Delays, Driving large Capacitive Loads.

Unit 4

10

Subsystem Design: Shifters, Adders, ALUs, Multipliers, Parity generators, Comparators, Counters. VLSI Design styles: Full-custom, Standard Cells, Gate-arrays, FPGAs, CPLDs.

Unit 5

12

CMOS Testing: Need for testing, Design for testability - built in self-test (BIST) – testing combinational logic –testing sequential logic – practical design for test guide lines – scan design techniques.

Prescribed Textbooks:

1. Essentials of VLSI Circuits and Systems, Kamran Eshraghian, Eshraghian Douglas, A. Pucknell, 2005,
2. Modern VLSI Design –Wayne Wolf, 3 Ed., 1997, Pearson Education.

Reference Books:

1. CMOS VLSI Design-A Circuits and Systems Perspective, Neil H.E Weste, David Harris, Ayan Banerjee, 3rd Edn, Pearson, 2009.
2. Behzad Razavi, —Design of Analog CMOS Integrated Circuits, McGrawHill, 2003.
3. Jan M. Rabaey, —Digital Integrated Circuits, Anantha Chandrakasan and Borivoje Nikolic, Prentice-Hall of India Pvt. Ltd, 2nd edition, 2009.

CO-PO Mapping:

Course Outcomes	Engineering Knowledge	Problem Analysis	Design/Development of Solutions	Conduct Investigations of Complex Problems	Modern Tool Usage	The Engineer and Society	Environment And Sustainability	Ethics	Individual And Team Work	Communication	Project Management And Finance	Life-Long Learning	PSO1	PSO2
23A047HT. 1	3	2	1	-	-	-	-	-	-	1	-	1	1	2
23A047HT. 2	2	3	3	-	2	-	-	-	-	2	-	2	1	1
23A047HT. 3	3	2	2	1	1	-	-	-	-	2	-	2	1	2
23A047HT. 4	2	2	3	1	2	-	-	-	-	2	-	2	1	1
23A047HT. 5	2	2	2	-	3	-	-	-	-	1	-	2	2	1

ANNAMACHARYA INSTITUTE OF TECHNOLOGY AND SCIENCES RAJAMPET

(An Autonomous Institution)

Department of Electrical and Electronics Engineering

Title of the Course: Introduction To Quantum Mechanics

Category: OEC-III

Couse Code: 23AHS7AT

Year : IV

Semester I

Branch/es: EEE

Lecture Hours

3

Tutorial Hours

0

Practice Hours

0

Credits

3

Course Objectives:

- 1 To understand the fundamental differences between classical and quantum mechanics.
- 2 To study wave-particle duality, uncertainty principle, and their implications.
- 3 To learn and apply Schrödinger equations to basic quantum systems.
- 4 To use operator formalism and mathematical tools in quantum mechanics.
- 5 To explore angular momentum, spin and their quantum mechanical representations.

Course Outcomes:

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

1. Explain the key principles of quantum mechanics and wave-particle duality
2. Apply Schrödinger equations to solve one-dimensional quantum problems
3. Solve quantum mechanical problems using operator and matrix methods.
4. Evaluate quantum states using Dirac notation and expectation values.

UNIT- I: Principles of Quantum Mechanics

Introduction: Limitations of classical Mechanics, Difficulties with classical theories of black body radiation and origin of quantum theory of radiation. Wave-particle duality: de Broglie wavelength, Heisenberg uncertainty principle. Schrödinger time independent and time dependent wave equation, Solution of the time dependent Schrödinger equation, Concept of stationary states, Physical significance of wave function (ψ), Orthogonal, Normalized and Orthonormal functions

UNIT- II: One Dimensional Problems and Solutions

Potential step – Reflection and Transmission at the interface. Potential well: Square well potential with rigid walls, Square well potential with finite walls. Potential barrier: Penetration of a potential barrier (tunneling effect). Periodic potential and Harmonic oscillator, Energy eigen functions and eigen values.

UNIT-III: Operator Formalism

Operators, Operator Algebra, Eigen values and Eigen vectors, Postulates of quantum mechanics, Matrix representation of wave functions and linear operators.

UNIT- IV: Mathematical Tools for Quantum Mechanics

The concept of row and column matrices, Matrix algebra, Hermitian operators – definition. Dirac's bra and ket notation, Expectation values, Heisenberg (operator) representation of harmonic oscillator, Ladder operators and their significance.

UNIT- V : Angular Momentum and Spin

Angular momentum operators: Definition. Eigen functions and Eigen values of AM operators. Matrix representation of angular momentum operators, System with spin half(1/2), Spin angular momentum, Pauli's spin matrices. Clebsch- Gordon coefficients. Rigid Rotator: Eigen functions and Eigen values.

Prescribed Textbooks:

1. Quantum Mechanics. Vol 1, A. Messia Noth-Holland Pub. Co., Amsterdam, (1961).
2. A Text Book of Quantum Mechanics. P.M.Mathews and K.Venkatesam, Tata McGraw Hill, New Delhi,(1976).
3. Introduction to Quantum Mechanics. R.H.Dicke and J.P.Witke, Addison-Wisley Pub. Co.Inc., London, (1960).
4. Quantum Mechanics. S.L.Gupta, V.Kumar, H.V.Sarama and R.C.Sharma, Jai PrakashNath& Co, Meerut, (1996).

Reference Books:

1. Quantum Mechanics. L.I. Schiff, McGraw Hill Book Co., Tokyo, (1968).
- 2.Introduction to Quantum Mechanics. Richard L. Liboff, Pearson Education Ltd (Fourth Edn.) 2003.

ANNAMACHARYA INSTITUTE OF TECHNOLOGY AND SCIENCES RAJAMPET

(An Autonomous Institution)

Department of Electrical and Electronics Engineering

Title of the Course: Geo-Spatial Technologies

Category: OEC-IV

Couse Code: 23A017IT

Year : IV

Semester I

Branch/es: EEE

Lecture Hours

3

Tutorial Hours

0

Practice Hours

0

Credits

3

Course Objectives:

1. To understand raster-based spatial analysis techniques, including query, overlay, and cost-distance analysis.
2. To analyze vector-based spatial analysis techniques such as topology, overlay, and proximity analysis.
3. To apply network analysis techniques for geocoding, shortest path analysis, and location-allocation problems.
4. To evaluate surface and geostatistical analysis methods, including terrain modeling, watershed analysis, and spatial interpolation.
5. To assess GIS customization, Web GIS, and mobile mapping techniques for real- world applications.

Course Outcomes:

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

1. Understand raster-based spatial analysis techniques, including query, overlay, and cost-distance analysis.
2. Analyze vector-based spatial analysis techniques such as topology, overlay, and proximity analysis.
3. Apply network analysis techniques for geocoding, shortest path analysis, and location-allocation problems.
4. Evaluate surface and geostatistical analysis methods, including terrain modeling, watershed analysis, and spatial interpolation.
5. Assess GIS customization, Web GIS, and mobile mapping techniques for real-world applications.

Unit 1 Raster Analysis

8

Raster Data Exploration: Query Analysis - Local Operations: Map Algebra, Reclassification, Logical and Arithmetic Overlay Operations—Neighborhood - Operations: Aggregation, Filtering – Extended Neighborhood-Operations- Zonal Operations - Statistical Analysis – Cost-Distance Analysis-Least Cost Path.

Unit 2 Vector Analysis

8

Non-Topological Analysis: Attribute Database Query, Structured Query Language, Co-Ordinate Transformation, Summary Statistics, Calculation of Area, Perimeter and Distance – topological Analysis: Reclassification, Aggregation, Overlay Analysis: Point-In-Polygon, Line-In-Polygon, Polygon-On-Polygon: Clip, Erase, Identity, Union, Intersection – Proximity Analysis: Buffering

Unit 3 Network Analysis

8

Network – Introduction - Network Data Model – Elements of Network - Building A Network Database - Geocoding – Address Matching - Shortest Path in A Network – Time and Distance Based Shortest Path Analysis – Driving Directions – Closest Facility Analysis – Catchment / Service Area Analysis-Location-Allocation Analysis

Unit 4 Surface And Geostatistical Analysis

10

Surface Data – Sources of X, Y, Z Data – DEM, TIN – Terrain Analysis – Slope, Aspect, Viewshed, Watershed Analysis: Watershed Boundary, Flow Direction, Flow Accumulation, Drainage Network, Spatial Interpolation: IDW, Spline, Kriging, Variogram.

Unit 5 Customisation, Web Gis, Mobile Mapping

10

Customization of GIS: Need, Uses, Scripting Languages –Embedded Scripts – Use of Python Script - Web GIS: Web GIS Architecture, Advantages of Web GIS, Web Applications- Location Based Services: Emergency and Business Solutions - Big Data Analytics.

Prescribed Textbooks:

1. Kang – Tsung Chang, Introduction to Geographical Information System, 4th Ed., Tata McGraw Hill Edition, 2008.
2. Lo, C.P. and Yeung, Albert K.W., Concepts and Techniques of Geographic Information Systems Prentice Hall, 2002.

Reference Books:

1. Michael N. Demers, Fundamentals of Geographic Information Systems, Wiley, 2009
2. Ian Heywood, Sarah Cornelius, Steve Carver, Srinivasa raju, -An Introduction to Geographical Information Systems, Pearson Education, 2nd Edition, 2007.
3. John Peter Wilson, The Handbook of Geographic Information Science, Blackwell Pub., 2008

Online Learning Resources:

1. <https://archive.nptel.ac.in/courses/105/105/105105202/>
2. https://onlinecourses.nptel.ac.in/noc19_cs76/preview

CO-PO Mapping:

Course Outcomes	Engineering Knowledge	Problem Analysis	Design/Development of Solutions	Conduct Investigations of Complex Problems	Modern Tool Usage	The Engineer and Society	Environment And Sustainability	Ethics	Individual And Team Work	Communication	Project Management And Finance	Life-Long Learning	PSO1	PSO2
23A017IT.1	3	-	-	-	2	-	-	-	-	-	-	-	3	3
23A017IT.2	3	3	-	-	2	-	-	-	-	-	-	2	3	3
23A017IT.3	3	-	3	2	3	-	-	-	-	-	-	-	3	3
23A017IT.4	-	-	3	3	3	-	2	-	-	-	-	-	3	3
23A017IT.5	-	-	-	-	3	3	3	2	-	-	-	-	3	3

ANNAMACHARYA INSTITUTE OF TECHNOLOGY AND SCIENCES RAJAMPET

(An Autonomous Institution)

Department of Electrical and Electronics Engineering

Title of the Solid Waste Management
Category: OEC-IV
Couse Code: 23A017JT
Year : IV
Semester I
Branch/es: EEE

Lecture Hours	Tutorial Hours	Practice Hours	Credits
3	0	0	3

Course Objectives:

1. To understand the types, sources, and characteristics of solid waste, along with regulatory frameworks.
2. To analyze engineering systems for solid waste collection, storage, and transportation.
3. To apply resource and energy recovery techniques for sustainable solid waste management.
4. To evaluate landfill design, construction, and environmental impact mitigation strategies.
5. To assess hazardous waste management techniques

Course Outcomes:

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

1. Understand the types, sources, and characteristics of solid waste, along with regulatory frameworks.
2. Analyze engineering systems for solid waste collection, storage, and transportation.
3. Apply resource and energy recovery techniques for sustainable solid waste management.
4. Evaluate landfill design, construction, and environmental impact mitigation strategies.
5. Assess hazardous waste management techniques, including biomedical and e-waste

Unit 1	Solid Waste	8
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Definitions, Types of Solid Wastes, Sources of Solid Wastes, Characteristics, and Perspectives; Properties of Solid Wastes, Sampling of Solid Wastes, Elements of Solid Waste Management - Integrated Solid Waste Management, Solid Waste Management Rules 2016.

Unit 2	Solid Waste Management:	8
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Solid Waste Generation; On-Site Handling, Storage and Processing; Collection of Solid Wastes; Stationary Container System and Hauled Container Systems – Route Planning - Transfer and Transport; Processing Techniques;

Unit 3	Resource and Energy Recovery	8
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Processing Techniques; Materials Recovery Systems; Recovery of Biological Conversion Products – Composting, Pre and Post Processing, Types of Composting, Critical Parameters, Problems with Composing - Recovery of Thermal Conversion Products; Pyrolysis, Gasification, RDF - Recovery of Energy from Conversion Products; Materials and Energy Recovery Systems.

Unit 4	Landfills	10
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Evolution of Landfills – Types and Construction of Landfills – Design Considerations – Life of Landfills- Landfill Problems – Lining of Landfills – Types of Liners- Leachate Pollution and Control – Monitoring Landfills – Landfills Reclamation.

Unit 5	Hazardous Waste Management	10
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Sources and Characteristics, Effects On Environment, Risk Assessment – Disposal of Hazardous Wastes – Secured Landfills, Incineration - Monitoring – Biomedical Waste Disposal, E-Waste Management, Nuclear Wastes, Industrial Waste Management

Prescribed Textbooks:

1. Tchobanoglous G, Theisen H and Vigil SA Integrated Solid Waste Management, Engineering Principles and Management Issues, McGraw-Hill, 1993.
2. Vesilind PA, Worrell W and Reinhart D, Solid Waste Engineering' Brooks/Cole Thomson Learning Inc., 2002.

Reference Books:

1. Peavy, H.S, Rowe, D.R., and G. Tchobanoglous, _Environmental Engineering, McGraw Hill Inc., New York, 1985.
2. Qian X, Koerner R.M and Gray DH, _Geotechnical Aspects of Landfill Design and Construction Prentice Hall, 2002.

Online Learning Resources:

1. <https://archive.nptel.ac.in/courses/105/103/105103205/>
2. <https://archive.nptel.ac.in/courses/120/108/120108005/>

CO-PO Mapping:

Course Outcomes	Engineering Knowledge	Problem Analysis	Design/Development of Solutions	Conduct Investigations of Complex Problems	Modern Tool Usage	The Engineer and Society	Environment And Sustainability	Ethics	Individual And Team Work	Communication	Project Management And Finance	Life-Long Learning	PSO1	PSO2
23A017JT.1	3	-	-	-	2	-	2	-	-	-	-	-	3	3
23A017JT.2	3	3	-	-	2	-	3	-	-	-	-	2	3	3
23A017JT.3	3	-	3	2	3	-	3	-	-	-	-	-	3	3
23A017JT.4	-	-	3	3	3	-	3	2	-	-	-	-	3	3
23A017JT.5	-	-	-	-	3	3	3	3	-	-	-	-	3	3

ANNAMACHARYA INSTITUTE OF TECHNOLOGY AND SCIENCES RAJAMPET

(An Autonomous Institution)

Department of Electrical and Electronics Engineering

Title of the Total Quality Management
Category: OEC-IV
Couse Code: 23A037LT
Year : IV
Semester I
Branch/es: EEE

Lecture Hours

3

Tutorial Hours

0

Practice Hours

0

Credits

3

Course Objectives:

1. To introduce the students, the basic concepts of Total Quality Management.
2. To expose with various quality issues in Inspection.
3. To gain Knowledge on quality control and its applications to real time.
4. To know the extent of customer satisfaction by the application of various quality concepts.
5. To understand the importance of Quality standards in Production.

Course Outcomes:

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

- 1 Explain definition of quality, TQM, quality planning, quality costs and techniques of quality cost.
- 2 Explain quality council, quality statements, characteristics of a quality leader and can apply the knowledge of Deming's 14 principle of philosophy
- 3 Describe customer satisfaction and his perception of quality, TQM principles like Juran Trilogy, PDSA cycle, Kaizen principles for achieving continuous process improvement
- 4 Explain the concept of bench marking for organizational processes, the quality function deployment, Taguchi quality loss functions, TPM concepts, seven tools of quality and the concepts of six sigma in production processes
- 5 Summarize the ISO 9000, ISO 14000 quality systems concept, requirements and benefits and can apply the documentation procedures of quality systems

Unit 1 Introduction

10

Introduction: Definition of Quality, Dimensions of Quality, Definition of Total quality management, Quality Planning, Quality costs – Analysis, Techniques for Quality costs, Basic concepts of Total Quality Management.

Unit 2 Historical Review

9

Quality council, Quality statements, Strategic Planning, Deming Philosophy, Barriers of TQM Implementation, Benefits of TQM, Characteristics of successful quality leader, Contributions of Gurus of TQM, Case studies.

Unit 3 TQM Principles

10

Customer Satisfaction – Customer Perception of Quality, Customer Complaints, Service Quality, Customer Retention, Employee Involvement – Motivation, Empowerment teams, Continuous Process Improvement – Juran Trilogy, PDSA Cycle, Kaizen, Supplier Partnership – Partnering, sourcing, Supplier Selection, Supplier Rating, Relationship Development, Performance Measures – Basic Concepts, Strategy, Performance Measure Case studies.

Unit 4 TQM Tools

10

Benchmarking – Reasons to Benchmark, Benchmarking Process, Quality Function Deployment (QFD) – House of Quality, QFD Process, Benefits, Taguchi Quality Loss Function, Total Productive Maintenance (TPM) – Concept, Improvement Needs, FMEA – Stages of FMEA, The seven tools of quality, Process capability, Concept of Six Sigma, New Seven management tools, Case studies

Unit 5 Quality Systems

9 Hrs

[illegible]

ANNAMACHARYA INSTITUTE OF TECHNOLOGY AND SCIENCES RAJAMPET
(An Autonomous Institution)

Department of Electrical and Electronics Engineering

Title of the Course: Digital Electronics
Category: OEC-IV
Couse Code: 23A047BT
Year : IV
Semester I
Branch/es EEE

Lecture Hours
3

Tutorial Hours
0

Practice Hours
0

Credits
3

Course Objectives:

1. To Learn Boolean algebra, logic simplification techniques, and combinational circuit design.
2. To analyze combinational circuits like adders, subtractors, and code converters.
3. To explore combinational logic circuits and their applications in digital design.
4. To comprehend sequential logic circuits, including latches, flip-flops, counters, and shift registers.
5. To gain knowledge about programmable logic devices and digital IC's.

Course Outcomes:

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

1. To Learn Boolean algebra, logic simplification techniques, and combinational circuit design.
2. To analyze combinational circuits like adders, subtractors, and code converters.
3. To explore combinational logic circuits and their applications in digital design.
4. To understand sequential logic circuits, including latches, flip-flops, counters, and shift registers.
5. To gain knowledge about programmable logic devices and digital IC's.

Unit 1

10

Logic Simplification and Combinational Logic Design: Review of Boolean Algebra and De Morgan's Theorem, SOP & POS forms, Canonical forms, Introduction to Logic Gates, Ex-OR, Ex-NOR operations, Minimization of Switching Functions: Karnaugh map method, Logic function realization: AND-OR, OR-AND and NAND/NOR realizations.

Unit 2

15

Introduction to Combinational Design 1: Binary Adders, Subtractors and BCD adder, Code converters - Binary to Gray, Gray to Binary, BCD to excess3, BCD to Seven Segment display.

Unit 3

15

Combinational Logic Design 2: Decoders, Encoders, Priority Encoder, Multiplexers, Demultiplexers, Comparators, Implementations of Logic Functions using Decoders and Multiplexers.

Unit 4

12

Sequential Logic Design: Latches, Flip-flops, S-R, D, T, JK and Master-Slave JK FF, Edge triggered FF, set up and hold times, Ripple counters, Shift registers.

Unit 5

10

Programmable Logic Devices: ROM, Programmable Logic Devices (PLA and PAL).

Digital IC's: Decoder (74x138), Priority Encoder (74x148), multiplexer (74x151) and de- multiplexer (74x155), comparator (74x85).

Prescribed Textbooks:

1. Digital Design, M.Morris Mano & Michel D. Ciletti, 5th Edition, Pearson Education, 1999
2. Switching theory and Finite Automata Theory, ZviKohavi and NirahK.Jha, 2nd Edition, Tata McGraw Hill, 2005.

Reference Books:

1. Fundamentals of Logic Design, Charles H Roth,Jr., 5th Edition, Brooks/cole Cengage Learning, 2004.

CO-PO Mapping:

[illegible]

ANNAMACHARYA INSTITUTE OF TECHNOLOGY AND SCIENCES RAJAMPET
(An Autonomous Institution)

Department of Electrical and Electronics Engineering

Title of the Course: Introduction to Computer Networks
Category: OEC-IV
Course Code: 23A057KT
Year : IV
Semester I
Branch/es EEE

Lecture Hours

3

Tutorial Hours

0

Practice Hours

0

Credits

3

Course Objectives: This course will be able to

7. To introduce the fundamentals of the Internet, networking concepts, reference models, and transmission media.
8. To understand the data link layer design, error handling mechanisms, LAN technologies, and access networks.
9. To study the routing algorithms, internetworking concepts, and network layer functionalities.
10. To explore transport layer protocols such as UDP and TCP, and understand their mechanisms, including congestion control.
11. To introduce the principles behind network applications and protocols, and explore widely used application-layer services such as the Web, Email, DNS, peer-to-peer systems, and content distribution networks.

Course Outcomes:

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

1. Describe the architecture of the Internet, reference models, and explain different types of transmission media used in networking.
2. Apply error detection and correction techniques and analyze data link layer protocols and LAN technologies.
3. Explain routing algorithms and the structure of the network layer, including internetworking.
4. Analyze the working of transport layer protocols like TCP and UDP, including concepts of connection management and congestion control.
5. Explain the principles of network applications and describe the functionality of protocols such as HTTP, SMTP, DNS, and peer-to-peer systems, including multimedia streaming and content delivery networks.

Unit 1 Computer Networks and the Internet

09

What Is the Internet? The Network Edge, The Network Core, Delay, Loss, and Throughput in Packet Switched Networks (Textbook 2), Reference Models, Example Networks, Guided Transmission Media, Wireless Transmission (Textbook 1)

Unit 2 The Data Link Layer, Access Networks, and LANs

09

Data Link Layer Design Issues, Error Detection and Correction, Elementary Data Link Protocols, Sliding Window Protocols (Textbook 1) Introduction to the Link Layer, Error-Detection and -Correction Techniques, Multiple Access Links and Protocols, Switched Local Area Networks
Link Virtualization: A Network as a Link Layer, Data Center Networking, Retrospective: A Day in the Life of a Web Page Request (Textbook 2)

Unit 3 The Network Layer

09

Routing Algorithms, Internetworking, The Network Layer in The Internet (Textbook 1)

Unit 4 The Transport Layer

09

Layer Connectionless Transport: UDP (Textbook 2), The Internet Transport Protocols: TCP, Congestion Control (Textbook 1)

Unit 5 Principles of Network Applications

09

Principles of Network Applications, The Web and HTTP, Electronic Mail in the Internet, DNS—The Internet's Directory Service, Peer-to-Peer Applications Video Streaming and Content Distribution Networks (Textbook 2)

Prescribed Textbooks:

1. Andrew S.Tanenbaum, David j.wetherall, Computer Networks, 5th Edition, PEARSON.
2. James F. Kurose, Keith W. Ross, —Computer Networking: A Top-Down Approach||, 6th edition, Pearson, 2019.

Reference Books:

1. Forouzan, Data communications and Networking, 5th Edition, Mc Graw Hill Publication.
2. Youlu Zheng, Shakil Akthar, —Networks for Computer Scientists and Engineers||, Oxford Publishers, 2016.

Online Learning Resources:

1. <https://nptel.ac.in/courses/106105183/25>
2. <http://www.nptelvideos.in/2012/11/computer-networks.html>
3. <https://nptel.ac.in/courses/106105183/3>

ANNAMACHARYA INSTITUTE OF TECHNOLOGY AND SCIENCES RAJAMPET
(An Autonomous Institution)
Department of Electrical and Electronics Engineering

Title of the Course: Internet of Things
Category: OEC-IV
Course Code: 23A057LT
Year : IV
Semester I
Branch/es EEE

Lecture Hours

3

Tutorial Hours

0

Practice Hours

0

Credits

3

Course Objectives: This course will be able to

6. Understand the basics of Internet of Things and protocols.
7. Discuss the requirement of IoT technology
8. Introduce some of the application areas where IoT can be applied.
9. Understand the vision of IoT from a global perspective, understand its applications, determine its market perspective using gateways, devices and data management
10. Understand the basics of Internet of Things and protocols.

Course Outcomes:

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

1. Understand general concepts of Internet of Things. L2
2. Apply design concept to IoT solutions L3
3. Analyze various M2M and IoT architectures L4
4. Evaluate design issues in IoT applications L3
5. Create IoT solutions using sensors, actuators and Devices L2

Unit 1 Introduction to IoT

09

Definition and Characteristics of IoT, physical design of IoT, IoT protocols, IoT communication models, IoT Communication APIs, Communication protocols, Embedded Systems, IoT Levels and Templates

Unit 2 Prototyping IoT Objects using Microprocessor/Microcontroller

09

Working principles of sensors and actuators, setting up the board – Programming for IoT, Reading from Sensors, Communication: communication through Bluetooth, Wi-Fi.

Unit 3 IoT Architecture and Protocols

09

Architecture Reference Model- Introduction, Reference Model and architecture, IoT reference Model, Protocols- 6LowPAN, RPL, CoAP, MQTT, IoT frameworks- Thing Speak.

Unit 4 Device Discovery and Cloud Services for IoT

09

Device discovery capabilities- Registering a device, Deregister a device, Introduction to Cloud Storage models and communication APIs Web-Server, Web server for IoT.

Unit 5 UAV IoT

09

Introduction to Unmanned Aerial Vehicles/Drones, Drone Types, Applications: Defense, Civil, Environmental Monitoring; UAV elements and sensors- Arms, motors, Electronic Speed Controller (ESC), GPS, IMU, Ultra sonic sensors; UAV Software –Arudpilot, Mission Planner, Internet of Drones (IoD)- Case study FlytBase.

Prescribed Textbooks:

1. Vijay Madiseti and Arshdeep Bahga, — Internet of Things (A Hands-on-Approach)||, 1st Edition, VPT, 2014
2. Handbook of unmanned aerial vehicles, K Valavanis; George J Vachtsevanos, New York, Springer, Boston, Massachusetts : Credo Reference, 2014. 2016.

Reference Books:

1. Jan Holler, VlasiosTsiatsis, Catherine Mulligan, Stefan Avesand, Stamatis Karnouskos, David Boyle, — From Machine-to-Machine to the Internet of Things: Introduction to a New Age of Intelligence||, 1st Edition, Academic Press, 2014.
2. ArshdeepBahga, Vijay Madiseti - Internet of Things: A Hands-On Approach, Universities Press, 2014.
3. The Internet of Things, Enabling technologies and use cases – Pethuru Raj, Anupama C. Raman, CRC Press.
4. Francis daCosta, —Rethinking the Internet of Things: A Scalable Approach to Connecting Everything||, 1st Edition, Apress Publications, 2013
5. Cuno Pfister, Getting Started with the Internet of Things, O'Reilly Media, 2011,ISBN: 9781-4493- 9357-1
6. DGCA RPAS Guidance Manual, Revision 3 – 2020
7. Building Your Own Drones: A Beginners' Guide to Drones, UAVs, and ROVs, John Baichtal

Online Learning Resources:

1. <https://www.arduino.cc/>
2. <https://www.raspberrypi.org/>
3. <https://nptel.ac.in/courses/106105166/5>
4. <https://nptel.ac.in/courses/108108098/4>

ANNAMACHARYA INSTITUTE OF TECHNOLOGY AND SCIENCES RAJAMPET
(An Autonomous Institution)

Department of Electrical and Electronics Engineering

Title of the Course	Financial Mathematics
Category	OEC-IV
Couse Code	23AHS75T
Year	IV
Semester	I
Branch	EEE

Lecture Hours

3

Tutorial Hours

0

Practice Hours

0

Credits

3

Course Objectives:

1. To provide mathematical foundations for financial modeling, risk assessment and asset pricing.
2. To introduce stochastic models and their applications in pricing derivatives and interest rate modeling.
3. To develop analytical skills for fixed-income securities, credit risk, and investment strategies.
4. To equip students with computational techniques for pricing financial derivatives.

Course Outcomes:

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

1. Explain fundamental financial concepts, including arbitrage, valuation, and risk.
2. Apply stochastic models, including Brownian motion and Stochastic Differential Equations (SDEs), in financial contexts.
3. Analyze mathematical techniques for pricing options and financial derivatives.
4. Evaluate interest rate models and bond pricing methodologies.
5. Utilize computational techniques such as Monte Carlo simulations for financial modeling.

Unit 1 Asset Pricing and Risk Management

8

Fundamental financial concepts: Returns, arbitrage, valuation, and pricing. Asset/Liability management, investment income, capital budgeting, and contingent cash flows. One-period model: Securities, payoffs, and the no-arbitrage principle. Option contracts: Speculation and hedging strategies, CAP(Capital Asset Pricing) Model, Efficient market hypothesis.

Unit 2 Stochastic Models in Finance

8

Random Walks and Brownian Motion. Introduction to Stochastic Differential Equations (SDEs): Drift and diffusion. Ito(stochastic processes) calculus: Ito's(stochastic processes) Lemma, Ito(stochastic processes) Integral, and Ito(stochastic processes) Isometry.

Unit 3 Interest Rate and Credit Modelling

8

Interest rate models and bond markets. Short-rate models: Vasicek, Cox-Ingersoll-Ross (CIR), Hull & White models, Credit risk modelling: Hazard function and hazard rate.

Unit 4 Fixed-Income Securities and Bond Pricing

8

Characteristics of fixed-income products: Yield, duration, and convexity. Yield curves, forward rates, and zero-coupon bonds. Stochastic interest rate models and bond pricing PDE. Yield curve fitting and calibration techniques, Mortgage Backed Securities.

Unit 5 Exotic Options and Computational Finance

8

Stochastic volatility models and the Feynman-Kac theorem. Exotic options: Barriers, Asians, and Look backs. Monte Carlo methods for derivative pricing, Black-Scholes-Merton model: Derivation and applications.

Prescribed Textbooks:

1. Ales Cerny, Mathematical Techniques in Finance: Tools for Incomplete Markets, Princeton University Press.
2. S.R. Pliska, Introduction to Mathematical Finance: Discrete-Time Models, Cambridge University Press.

Reference Books:

1. Ioannis Karatzas & Steven E. Shreve, Methods of Mathematical Finance, Springer, New York.
2. John C. Hull, Options, Futures, and Other Derivatives, Pearson.

Web References:

1. MIT – Mathematics for Machine Learning <https://ocw.mit.edu>
2. Coursera – Financial Engineering and Risk Management (Columbia University) <https://www.coursera.org/>
3. National Stock Exchange (NSE) India – Financial Derivatives <https://www.nseindia.com/>

CO-PO Mapping:

Course Outcomes	Engineering Knowledge	Problem Analysis	Design/Development of Solutions	Conduct Investigations of Complex Problems	Modern Tool Usage	The Engineer and Society	Environment And Sustainability	Ethics	Individual And Team Work	Communication	Project Management And Finance	Life-Long Learning	PSO1	PSO2
23AHS75T.1	3	2	-	-	1	-	-	-	-	-	2	1	-	-
23AHS75T.2	3	3	2	2	2	-	-	-	-	-	1	1	-	-
23AHS75T.3	3	3	3	3	2	1	-	-	-	-	3	2	-	-
23AHS75T.4	3	3	3	3	1	-	-	-	-	-	2	1	-	-
23AHS75T.5	3	3	3	3	3	-	-	-	-	-	2	2	-	-

(An Autonomous Institution)

Department of Electrical and Electronics Engineering

Title of the Course: Sensor and Actuators for Engineering Applications
Category: OEC-IV
Couse Code: 23AHS76T
Year: IV
Semester I
Branch/es: EEE

Lecture Hours

3

Tutorial Hours

0

Practice Hours

0

Credits

3

Course Objectives:

1. To provide exposure to various kinds of sensors and actuators and their engineering applications.
2. To impart knowledge on the basic laws and phenomenon behind the working of sensors and actuators
3. To explain the operating principles of various sensors and actuators
4. To educate the fabrication of sensors
5. To explain the required sensor and actuator for interdisciplinary application

Course Outcomes:

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

1. Classify different types of Sensors and Actuators along with their characteristics
2. Summarize various types of Temperature and Mechanical sensors
3. Illustrates various types of optical and mechanical sensors
4. Analyze various types of Optical and Acoustic Sensors
5. Interpret the importance of smart materials in various devices

Unit 1 Introduction to Sensors and Actuators

9

Sensors: Types of sensors: temperature, pressure, strain, active and passive sensors, General characteristics of sensors (Principles only), Deposition: Chemical Vapor Deposition, Pattern: photolithography and Etching: Dry and Wet Etching.

Actuators: Functional diagram of actuators, Types of actuators and their basic principle of working: Pneumatic, Electromagnetic, Piezo-electric and Piezo-resistive actuators, Applications of Actuators.

Unit 2 Temperature and Mechanical Sensors

9

Temperature Sensors: Types of temperature sensors and their basic principle of working: Thermo- resistive sensors: Thermistors, Thermo-electric sensors: Thermocouples, PN junction temperature sensors

Mechanical Sensors: Types of Mechanical sensors and their basic principle of working: Force sensors: Strain gauges, Tactile sensors, Pressure sensors: Piezoresistive, Variable Reluctance Sensor (VRP).

Unit 3 Optical and Acoustic Sensors

9

Optical Sensors: Basic principle and working of: Photodiodes, Phototransistors and Photo resistors based sensors, Photomultipliers, Infrared sensors: thermal, Passive Infra-Red, Fiber based sensors and Thermopiles

Acoustic Sensors: Principle and working of Ultrasonic sensors, Piezo-electric resonators, Microphones

Unit 4 Magnetic and Electromagnetic Sensors

9

Motors as actuators (linear, rotational, stepping motors), magnetic valves, inductive sensors (LVDT, RVDT, and Proximity), Hall Effect sensors, Magneto-resistive sensors, Magnetostrictive sensors and actuators.

Unit 5 Chemical and Radiation Sensors

9

Chemical Sensors: Principle and working of Electro-chemical, Thermo-chemical, Gas, pH, Humidity and moisture sensors.

Radiation Sensors: Principle and working of Ionization detectors, Scintillation detectors, Semiconductor radiation detectors and Microwave sensors (resonant, reflection, transmission)

Prescribed Textbooks:

1. Sensors and Actuators – Clarence W. de Silva, CRC Press, 2nd Edition, 2015
2. Sensors and Actuators, D.A.Hall and C.E.Millar, CRC Press, 1999

Reference Books:

1. Sensors and Transducers- D.Patranabis, Prentice Hall of India (Pvt) Ltd. 2003
2. Measurement, Instrumentation, and Sensors Handbook-John G.Webster, CRC press 1999
3. Sensors – A Comprehensive Sensors- Henry Bolte, John Wiley.
4. Handbook of modern sensors, Springer, Stefan Johann Rupitsch.

NPTEL course link: https://onlinecourses.nptel.ac.in/noc21_ee32/preview

CO-PO Mapping:

Course Outcomes	Engineering Knowledge	Problem Analysis	Design/Development of Solutions	Conduct Investigations of Complex Problems	Modern Tool Usage	The Engineer and Society	Environment And Sustainability	Ethics	Individual And Team Work	Communication	Project Management And Finance	Life-Long Learning	PSO1	PSO2
23AHS76T.1	3	3	2	2	1	-	-	-	-	-	-	-	-	-
23AHS76T.2	3	3	2	1	1	-	-	-	-	-	-	-	-	-
23AHS76T.3	3	3	1	1	1	-	-	-	-	-	-	-	-	-
23AHS76T.4	3	2	1	1	-	-	-	-	-	-	-	-	-	-
23AHS76T.5	3	3	1	1	-	-	-	-	-	-	-	-	-	-

(An Autonomous Institution)

Department of Electrical and Electronics Engineering

Title of the Course:	Chemistry Of Nanomaterials and Applications
Category:	OEC-IV
Couse Code:	23AHS77T
Year:	IV
Semester:	I
Branch/es:	EEE

Lecture Hours

3

Tutorial Hours

0

Practice Hours

0

Credits

3

Course Objectives:

1. To understand basics and characterization of nanomaterials.
2. To understand synthetic methods of nanomaterials.
3. To apply various techniques for characterization of nanomaterials.
4. To understand Studies of Nano-structured Materials
5. To enumerate the applications of advanced nanomaterials in engineering

Course Outcomes:

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

1. Classify the nanostructure materials; describe scope of nanoscience and importance technology.
2. Describe the top-down approach, explain aerosol synthesis and plasma arc technique, differentiate chemical vapor deposition method and electrode position method, Discuss about high energy ball milling.
3. discuss different technique for characterization of nanomaterial, explain electron microscopy techniques for characterization of nanomaterial, Describe BET method for surface area analysis
4. Explain synthesis and properties and applications of nanomaterials, discuss about fullerenes and carbon nanotubes, Differentiate nanomagnetic materials and thermoelectric materials, nonlinear optical materials.
5. Illustrate advance engineering applications of Water treatment, sensors, electronic devices, medical domain, civil engineering, chemical engineering, metallurgy and mechanical engineering, food science, agriculture, pollutants degradation

Unit 1 Basics of Nanomaterials

9

Introduction, Scope of nanoscience and nanotechnology, nanoscience in nature, classification of nanostructured materials, importance of nanomaterials.

Unit 2 Synthesis of nanomaterials

9

Top-Down approach, Inert gas condensation, arc discharge method, aerosol synthesis, plasma arc technique, ion sputtering, laser ablation, laser pyrolysis, and chemical vapour deposition method, electrodeposition method, high energy ball milling method. Synthetic Methods: Bottom-Up approach, Sol-gel synthesis, microemulsions or reverse micelles, co-precipitation method, solvothermal synthesis, hydrothermal synthesis, microwave heating synthesis and sono chemical synthesis.

Unit 3 Techniques for characterization

9

Diffraction technique (XRD), spectroscopy techniques- (UV and IR), electron microscopy techniques (EDAX, SEM and TEM) for the characterization of nanomaterials, BET method for surface area analysis, dynamic light scattering for particle size determination.

Unit 4 Studies of Nano-structured Materials

9

Synthesis, properties and applications of the following nanomaterials -fullerenes, carbon nanotubes, 2D-nanomaterial (Graphene), core-shell, magnetic nanoparticles, thermoelectric materials, non-linear optical materials.

Unit 5 Advanced Engineering Applications of Nanomaterials

9

Applications of Nano Particle, nanorods, nano wires, Water treatment, sensors, electronic devices, medical domain, civil engineering, chemical engineering, metallurgy and mechanical engineering, food science, agriculture, pollutants degradation.

Prescribed Textbooks:

1. NANO: The Essentials: T Pradeep, McGraw-Hill, 2007.
2. Textbook of Nanoscience and nanotechnology: B S Murty, P Shankar, BaldevRai, BB Rath and James Murday, Univ. Press, 2012

Reference Books:

1. Concepts of Nanochemistry; LudovicoCademrtiri and Geoffrey A. Ozin& Geoffrey A. Ozin, Wiley-VCH, 2011.
2. Nanostructures & Nanomaterials; Synthesis, Properties & Applications: Guozhong Cao, Imperial College Press, 2007.

CO-PO Mapping:

Course Outcomes	Engineering Knowledge	Problem Analysis	Design/Development of Solutions	Conduct Investigations of Complex Problems	Modern Tool Usage	The Engineer and Society	Environment And Sustainability	Ethics	Individual And Team Work	Communication	Project Management And Finance	Life-Long Learning	PSO1	PSO2
23AHS77T.1	3	3	2	1	-	-	2	-	-	-	-	3	-	-
23AHS77T.2	3	3	2	1	-	-	2	-	-	-	-	3	-	-
23AHS77T.3	3	3	2	1	-	-	2	-	-	-	-	3	-	-
23AHS77T.4	3	2	1	1	-	-	2	-	-	-	-	3	-	-
23AHS77T.5	3	2	1	1	-	-	2	-	-	-	-	3	-	-

ANNAMACHARYA INSTITUTE OF TECHNOLOGY AND SCIENCES RAJAMPET
(An Autonomous Institution)
Department of Electrical & Electronics Engineering

Title of the Course: Literary Vibes
Category: OEC-IV
Couse Code: 23AHS78T
Year: IV
Semester: I
Branch/es: EEE

Lecture Hours	Tutorial Hours	Practice Hours	Credits
3	0	0	3

Course Objectives:

1. To inculcate passion for aesthetic sense and reading skills
2. To foster humane attitude and creative thinking
3. To promote emotional intelligence, enhance communication skills, and foster critical thinking.
4. To inculcate social responsibility and sense of history
5. To provide practical wisdom and duty of responding to events of the times

Course Outcomes:

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

1. Identify genres, literary techniques and creative uses of language in literary texts
2. Explain the relevance of themes found in literary texts to contemporary, personal and cultural values and to historical forces
3. Apply knowledge and understanding of literary texts when responding to others' problems and their own and make evidence-based arguments
4. Analyze the underlying meanings of the text by using the elements of literary texts
5. Critically evaluate their own and others' work while developing creativity, independence, and the ability to make informed decisions

Unit 1 Poetry 9

Ulysses- Alfred Lord Tennyson
 "If"- Rudyard Kipling
 The Second Coming- W.B. Yeats
 Where the Mind is Without Fear- Rabindranath Tagore

Unit 2 Drama: Twelfth Night- William Shakespeare 9

Shakespeare -life and works
 Plot & sub-plot and Historical background of the play
 Themes and Criticism
 Style and literary elements
 Characters and characterization

Unit 3 Short Story 9

The Luncheon - Somerset Maugham
 The Happy Prince-Oscar Wilde
 Three Questions – Leo Tolstoy
 Engine Trouble- R.K. Narayan

Unit 4 Prose: Essay and Autobiography

9

Ignited Minds- A.P.J. Abdul Kalam

The Essentials of Education-Richard Livingston

The story of My Life-Helen Keller

Knowledge and Wisdom- Bertrand Russell

Unit 5 Novel: Hard Times- Charles Dickens

9

Charles Dickens-Life and works-Plot and Historical background of the novel, Themes and criticism- Style and literary elements- Characters and characterization

Prescribed Textbooks:

1. Charles Dickens.Hard Times.(Sangam Abridged Texts) Vantage Press, 1983
2. DENT JC.William Shakespeare. Twelfth Night. Oxford University Press,2016.

Reference Books:

1. WJ Long.History of English Literature, Rupa Publications India; First Edition (4 October 2015)
2. RK Kaushik And SC Bhatia. Essays, Short Stories and One Act Plays, Oxford University Press .2018.
3. Dhanvel, SP. English and Soft Skills, Orient Blackswan,2017.
4. New Horizon, Pearson publications, New Delhi 2014
5. Vimala Ramarao, Explorations Volume-II, Prasaraanga Bangalore University,2014.
6. Dev Neira, Anjana & Co. Creative Writing: A Beginner's Manual.Pearson India, 2008

Online Learning Resources:

1. <https://www.litcharts.com/poetry/alfred-lord-tennyson/ulysses>
2. <https://www.litcharts.com/lit/ain-t-i-a-woman/summary-and-analysis>
3. https://englishliterature.education/articles/poetry-analysis/the-second-coming-by-w-b-yeats-critical-analysis-summary-and-line-by-line-explanation/#google_vignette
4. <https://sirjitutorials.com/where-the-mind-is-without-fear-poem-notes-explanation/>
5. <https://www.litcharts.com/lit/twelfth-night/themes>
6. <https://smartenglishnotes.com/2021/11/28/the-luncheon-summary-characters-themes-and-irony/>

CO-PO Mapping:

Course Outcomes	Engineering Knowledge	Problem Analysis	Design/Development of Solutions	Conduct Investigations of Complex Problems	Modern Tool Usage	The Engineer and Society	Environment And Sustainability	Ethics	Individual And Team Work	Communication	Project Management And Finance	Life-Long Learning	PSO1	PSO2
23AHS78T.1	-	-	-	-	-	-	-	-	-	3	-	3	-	-
23AHS78T.2	-	-	-	-	-	-	-	-	-	3	-	3	-	-
23AHS78T.3	-	-	-	-	-	-	-	-	-	3	-	3	-	-
23AHS78T.4	-	-	-	-	-	-	-	-	-	3	-	3	-	-
23AHS78T.5	-	-	-	-	-	-	-	-	-	3	-	3	-	-

ANNAMACHARYA INSTITUTE OF TECHNOLOGY AND SCIENCES RAJAMPET
(An Autonomous Institution)
Department of Electrical & Electronics Engineering

Title of the Course: Introduction to Quantum Computing
Category: OEC-IV
Couse Code: 23A057MT
Year: IV
Semester: I
Branch/es: EEE

Lecture Hours	Tutorial Hours	Practice Hours	Credits
4	0	0	3

Course Objectives:

1. To introduce the principles and mathematical foundations of quantum computation.
2. To understand quantum gates, circuits, and computation models.
3. To explore quantum algorithms and their advantages over classical ones.
4. To develop the ability to simulate and write basic quantum programs.
5. To understand real-world applications and the future of quantum computing in AI, cryptography, and optimization.

Course Outcomes:

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

1. Explain the fundamental concepts of quantum mechanics used in computing.
2. Construct and analyze quantum circuits using standard gates.
3. Apply quantum algorithms like Deutsch-Jozsa, Grover's, and Shor's.
4. Develop simple quantum programs using Qiskit or similar platforms.
5. Analyze applications and challenges of quantum computing in real-world domains.

UNIT I: Fundamentals of Quantum Mechanics and Linear Algebra

Classical vs Quantum Computation, Complex Numbers, Vectors, and Matrices, Hilbert Spaces and Dirac Notation, Quantum States and Qubits, Superposition and Measurement, Tensor Products and Multi-Qubit Systems.

UNIT II: Quantum Gates and Circuits

Quantum Logic Gates: Pauli, Hadamard, Phase, Controlled Gates and CNOT, Unitary Operations and Reversibility, Quantum Circuit Representation, Quantum Teleportation, Simulation of Quantum Circuits.

UNIT III: Quantum Algorithms and Complexity

Quantum Parallelism and Interference, Deutsch and Deutsch-Jozsa Algorithms, Grover's Search Algorithm, Shor's Factoring Algorithm, Quantum Fourier Transform, Complexity Classes: BQP, P, NP, and QMA.

UNIT IV: Quantum Programming and Simulation Platforms

Introduction to Qiskit and IBM Quantum Experience, Writing Quantum Circuits in Qiskit, Measuring Qubits and Results, Classical-Quantum Hybrid Programs, Noisy Intermediate-Scale Quantum (NISQ) Systems, Limitations and Current State of Quantum Hardware.

UNIT V: Applications and Future of Quantum Computing

Quantum Machine Learning: Basics and Models, Quantum Cryptography and Quantum Key Distribution, Quantum Algorithms in AI and Optimization, Quantum Advantage and Supremacy, Ethical and Societal Impact of Quantum Technologies, Future Trends and Research Directions.

Prescribed Textbooks:

1. Michael A. Nielsen, Isaac L. Chuang, Quantum Computation and Quantum Information, Cambridge University Press, 10th Anniversary Edition, 2010.
2. Eleanor Rieffel and Wolfgang Polak, Quantum Computing: A Gentle Introduction, MIT Press, 2011.
3. Chris Bernhardt, Quantum Computing for Everyone, MIT Press, 2019.

Reference Books:

1. David McMahon, Quantum Computing Explained, Wiley, 2008.
2. Phillip Kaye, Raymond Laflamme, Michele Mosca, An Introduction to Quantum Computing, Oxford University Press, 2007.
3. Scott Aaronson, Quantum Computing Since Democritus, Cambridge University Press, 2013.

Online Learning Resources:

1. IBM Quantum Experience and Qiskit Tutorials
2. Coursera – Quantum Mechanics and Quantum Computation by UC Berkeley
3. edX – The Quantum Internet and Quantum Computers
4. YouTube – Quantum Computing for the Determined by Michael Nielsen
5. Qiskit Textbook – IBM Quantum