SANTHIRAM
ENGINEERING COLLEGE,
NANDYAL

(AUTONOMOUS)

Approved by A.I.C.T.E., New Delhi, Permanently Affiliated to JNT University, Ananthapuramu;
Accredited by NAAC with Grade-A, Accredited by NBA (ECE & CSE),
An ISO 9001:2015 Certified Institution, 2(f) & 12(B) recognition by UGC Act, 1956
NH-40, Nandyal-518501, Nandyal (Dist), A.P.

ACADEMIC REGULATIONS
COURSE STRUCTURE
AND
DETAILED SYLLABI

M.TECH (ECE-EMBEDDED SYSTEMS)

REGULAR TWO YEAR PG DEGREE COURSE

(APPLICABLE FOR THE ADMITTED BATCH 2024-25)

REGULATIONS: R-23

Learn - Grow - Empower

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NANDYAL(Dist), A.P

SANTHIRAM ENGINEERING COLLEGE

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DEPARTMENT OF ECE - EMBEDDED SYSTEMS

M.Tech
III & IV-Semester
Course Structure

SANTHIRAM ENGINEERING COLLEGE

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DEPARTMENT OF ECE - EMBEDDED SYSTEMS

M.Tech. III Sem. - Course Structure

S.No	Subject Code	Course Category	Name of the Subject	Hours/Week				Marks		
				Lecture	Tutorial	Practical	Credits	Internal	External	Total
1	23D58203	PE	INTRODUCTION TO INDUSTRY 4.0 AND INTERNET OF THINGS	3	0	0	3	40	60	100
2	23D57301C	PE	SOC ARCHITECTURE	3	0	0	3	40	60	100
3	23D55301A	PE	DEVICE DRIVERS OF EMBEDDED SYSTEMS	3	0	0	3	40	60	100
4	23D55301B	PE	FOG AND EDGE COMPUTING	3	0	0	3	40	60	100
5	23D57302A	PE	INDUSTRIAL SAFETY	3	0	0	3	40	60	100
6	23D57302B	PE	BUSINESS ANALYTICS	3	0	0	3	40	60	100
7	23D57302C	PE	WASTE TO ENERGY	3	0	0	3	40	60	100

M.Tech. IV Sem. - Course Structure

S. No	Subject Code	Name of the Subject	Hours/Week			Credits	Marks		
			Lecture	Tutorial	Practical		Internal	External	Total
1.	23D55401	INDUSTRIAL INTERNSHIP	0	0	0	2	100	0	100
2.	23D55402	CO-CURRICULAR ACTIVITIES	0	0	0	2	100	0	100
3.	23D55403	DISSERTATION PHASE-II	0	0	32	16	100	100	200

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DEPARTMENT OF ECE - EMBEDDED SYSTEMS

M.Tech. III Sem.

L	T	P	C
3	0	0	3

(23D58203) INTRODUCTION TO INDUSTRY 4.0 AND INTERNET OF THINGS

Course Category	**Professional Elective (PE)**
Course Enrichment Relevance	**Employability**

COURSE OBJECTIVES:

UNIT-I INTRODUCTION

Introduction: Sensing & actuation, Communication-Part I, Part II, Networking-Part I, Part II

Industry 4.0: Globalization and Emerging Issues, The Fourth Revolution, LEAN Production Systems, Smart and Connected Business Perspective, Smart Factories. Cyber Physical Systems and Next Generation Sensors, Collaborative Platform and Product Lifecycle Management, Augmented Reality and Virtual Reality, Artifical Intelligence, Big Data and Advanced Analysis

UNIT-II UNIT - II CYBERSECURITY IN INDUSTRY 4.0

Cybersecurity in Industry 4.0, Basics of Industrial IoT: Industrial Processes-Part I, Part II, Industrial Sensing & Actuation, Industrial Internet Systems.

IIoT-Introduction, Industrial IoT: Business Model and Referece Architerture: IIoT-Business Models-Part I, Part II, IIoT Reference Architecture-Part I, Part II

UNIT-III INDUSTRIAL IOT

Industrial IoT- Layers: IIoT Sensing-Part I, Part II, IIoT Processing-Part I, Part II, IIoT Communication-Part I.

Layers: IIoT Communication-Part II, Part III, IIoT Networking-Part I, Part II, Part III.

Big Data Analytics and Software Defined Networks: IIoT Analytics - Introduction, Machine Learning and Data Science - Part I, Part II, R and Julia Programming, Data Management with Hadoop.

UNIT-IV SOFTWARE DEFINED NETWORKS -SDN

Big Data Analytics and Software Defined Networks: SDN in IIoT-Part I, Part II, Data Center Networks, Industrial IoT: Security and Fog Computing: Cloud Computing in IIoT-Part I, Part II.

Security and Fog Computing - Fog Computing in IIoT, Security in IIoT-Part I, Part II, Industrial IoT- Application Domains: Factories and Assembly Line, Food Industry.

Application Domains: Healthcare, Power Plants, Inventory Management & Quality Control, Plant Safety and Security (Including AR and VR safety applications), Facility Management.

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UNIT-V INDUSTRIAL IOT- APPLICATION DOMAINS LECTURE HRS

Industrial IoT- Application Domains: Oil, chemical and pharmaceutical industry, Applications of UAVs in Industries, Real case studies :Case study - I : Milk Processing and Packaging Industries,Case study - II: Manufacturing Industries - Part I,Case study - III : Manufacturing Industries - Part II,Case study - IV : Student Projects - Part I,Case study - V : Student Projects - Part II,Case study - VI : Virtual Reality Lab,Case study - VII : Steel Technology Lab

TEXT BOOKS:

1. S. Misra, A. Mukherjee, and A. Roy, 2020. Introduction to IoT. Cambridge University
2. S. Misra, C. Roy, and A. Mukherjee, 2020. Introduction to Industrial Internet of Things and Industry 4.0.

REFERENCE BOOKS:

1. https://www.amazon.in/dp/1032146753/ref=sr_1_3?dchild=1&keywords=sudip+misra&qid=1627359971&sr=8-3
2. https://www.amazon.in/Introduction-IoT-Sudip-Misra/dp/1108959741/ref=sr_1_1?dchild=1&keywords=sudip+misra&qid=1627359928&s r=8-1

COURSE OUTCOMES:

1. Understand the fundamental concepts and key technologies driving Industry 4.0, including Cyber-Physical Systems (CPS), Internet of Things (IoT), and Industrial IoT (IIoT).
2. Explain the role of sensors, communication technologies, and computational processing in the transformation of traditional industrial processes.
3. Analyze the architecture and integration of Industrial IoT with enterprise systems, planning tools, and product lifecycle management
4. Apply concepts of data analytics, cloud computing, and machine learning to optimize industrial operations and decision-making processes.
5. Create strategies to address the challenges and leverage the opportunities in deploying Industry 4.0 solutions across various sectors, with emphasis on system interoperability, data security, and scalability

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M.Tech. III Sem.

L	T	P	C
3	0	0	3

(23D57301C) SOC ARCHITECTURE

Course Category	**Professional Elective (PE)**
Course Enrichment Relevance	**Employability**

COURSE OBJECTIVES:

UNIT-I INTRODUCTION TO THE SYSTEM APPROACH

System Architecture, Components of the system, Hardware & Software, Processor Architectures, Memory &Addressing. System level interconnection, Anapproach for SOC Design, System Architecture and Complexity

UNIT-II PROCESSORS

Introduction, Processor Selection for SOC, Basic concepts in Processor Architecture, Basic concepts in Processor Microarchitecture, Basic elements in Instruction handling. Buffers: minimizing Pipeline Delays, Branches, More Robust Processors, Vector Processors and
Vector Instruction extensions, VLIW Processors, Superscalar Processors

UNIT-III MEMORY DESIGN FOR SOC

Overview: SOC external memory, SOC Internal Memory, Size, Scratchpads and Cache memory, Cache Organization, Cache data, Write Policies, Strategies for line replacement at miss time, Other Types of Cache, Split – I, and D – Caches, Multilevel Caches, SOC Memory System, Models of
Simple Processor – memory interaction

UNIT-IV INTERCONNECT, CUSTOMIZATION AND CONFIGURABILITY & SOC

Interconnect Architectures, Bus: Basic Architectures, SOC Standard Buses , Analytic Bus Models, Using the Bus model, Effects of Bus transactions and contention time.
SOC Customization: An overview, Customizing Instruction Processor, Reconfigurable Technologies, Mapping design onto Reconfigurable devices, Instance- Specific design, Customizable Soft Processor, Reconfiguration - overhead analysis and trade-off analysis on reconfigurable Parallelism.

UNIT-V APPLICATION STUDIES / CASE STUDIES

SOC Design approach; AES-algorithms, Design and evaluation; Image compression–JPEG compression

TEXT BOOKS:

1. 1. Computer System Design System-on-Chip - Michael J. Flynn and Wayne Luk, Wiely India Pvt. Ltd.
2. 2. ARM System on Chip Architecture – Steve Furber, 2ndEdition, 2000, Addison Wesley Professional

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DEPARTMENT OF ECE - EMBEDDED SYSTEMS

REFERENCE BOOKS:

1. Design of System on a Chip: Devices and Components – Ricardo Reis, 1st Ed., 2004, Springer
2. Co-Verification of Hardware and Software for ARM System on Chip Design (Embedded Technology) – Jason Andrews – Newnes, BK and CDROM.
3. System on Chip Verification – Methodologies and Techniques –Prakash Rashinkar, Peter Paterson and Leena Singh L, 2001, Kluwer Academic Publishers

COURSE OUTCOMES:

1. Understand the basics related to SoC architecture and different approaches related to SoC Design.
2. Select an appropriated robust processor for SoC Design
3. Select an appropriate memory for SoC Design.
4. Understand about Interconnect, Customization and Configurability
5. Realize real time case studies

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DEPARTMENT OF ECE - EMBEDDED SYSTEMS

M.Tech. III Sem.

L	T	P	C
3	0	0	3

(23D55301A) DEVICE DRIVERS OF EMBEDDED SYSTEMS

Course Category	**Professional Elective (PE)**
Course Enrichment Relevance	**Employability**

COURSE OBJECTIVES:

UNIT-I INTRODUCTION

Embedded System Architecture fundamentals- Hardware and Software abstraction models - Operating Systems fundamentals- Process Creation-Scheduling-Memory Management-Inter Process Synchronization Inter Process Communication - Real time OS overview

UNIT-II RTOS FUNDAMENTALS

Study of Real time OS principles and requirements, Application specific requirements, Throughput and latency requirements - Schedulers, tasks and processes - Memory management - Code and footprint optimization - Study of current and emerging RTOS.

UNIT-III OS INTERNALS AND KERNELS

Internal components of Operating systems, study, compare and contrast of various OS platforms. Unix/Linux kernel fundamentals-Process Scheduling-Kernel Synchronization, I/O devices-Architecture-Character, Block Device handling, file systems- The Ext2 file System-The Virtual File System and peripheral devices.

UNIT-IV DEVICE DRIVERS

Fundamentals of device drivers-Character and Block Devices -Polling and Interrupts-The Hardware, device enumeration and configuration, Data transfer and management mechanisms

UNIT-V CASE STUDIES

Study and Implementation of RTOS -Study and Implementation of Kernel modification - Study and
Implementation of Device Driver development – Kernel Module Development – Simple Character Device Driver Development

TEXT BOOKS:

1. Product documentation from ARM (KEIL), Cypress, Windows Mobile, VxWorks, Symbian
2. . Charles Crowley, ???Operating Systems: A Design-Oriented Approach???, Irwin Professional Publishing, 1996.

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DEPARTMENT OF ECE - EMBEDDED SYSTEMS

REFERENCE BOOKS:

1. Abrah Silberschatz, Peter B. Galvin and Greg Gagne, "Operating system concepts", Wiley, 9th edition, 2012.
2. Robert Love, "Linux Kernel Development", Addison Wesley, 3rd edition, 2010
3. Daniel P. Bovet, Marco Cesati, "Understanding the Linux Kernel", O'Reilly, 3rd edition, 2005
4. Wolfgang Mauerer , "Professional Linux Kernel Architecture", Wrox, 2008.
5. M Beck, H Bohme M Dziadzka, U Kunitz, R Magnus, D Verworner, "Linux Kernel – Internals", Addision Wesley, Second Edition, 1998

COURSE OUTCOMES:

1. Explain embedded system architecture and real-time OS fundamentals.
2. Analyze RTOS requirements like scheduling, latency, and memory
3. Compare OS internals, especially Unix/Linux kernel and file systems.
4. Apply concepts of device driver development and hardware interfacing
5. Develop basic RTOS applications, kernel modules, and device drivers

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DEPARTMENT OF ECE - EMBEDDED SYSTEMS

M.Tech. III Sem.

L	T	P	C
3	0	0	3

(23D55301B) FOG AND EDGE COMPUTING

Course Category	**Professional Elective (PE)**
Course Enrichment Relevance	**Employability**

COURSE OBJECTIVES:

UNIT-I EDGE COMPUTING

Fog computing requirements when applied to IoT: Scalability, Interoperability, Fog IoT architectural model, Challenges on IoT Stack Model via TCP/IP Architecture, Data Management, filtering, Event Management, Device Management, cloudification, virtualization, security and privacy issues. Integrating IoT, Fog Cloud Infrastructures: Methodology , Integrated C2F2T Literature by Modelling Technique re by Use-Case Scenarios, Integrated C2F2T Literature by Metrics.

UNIT-II FOG COMPUTING IN HEALTH MONITORING

Exploiting Fog Computing in Health Monitoring : An Architecture of a Health Monitoring IoT-Based System with Fog Computing , Fog Computing Services in Smart E-Health Gateways, Discussion of Connected Components. Fog Computing Model for Evolving Smart Transportation Applications: Introduction , Data-Driven Intelligent Transportation Systems , Fog Computing for Smart Transportation Applications Case Study: Intelligent Traffic Lights Management (ITLM) System.

UNIT-III FOG COMPUTING APPLICATION

Software Defined Networking and application in Fog Computing: Open Flow Protocol, Open Flow Switch, SDN in Fog Computing, Home Network using SDN. Security and Privacy issues: Trust and privacy issues in IoT Network, web Semantics and trust Management for Fog Computing, Machine Learning based security in Fog Computing, Cyber- Physical Energy Systems over Fog Computing

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DEPARTMENT OF ECE - EMBEDDED SYSTEMS

UNIT-IV INTRODUCTION TO EDGE COMPUTING

Introduction to Edge Computing Scenarios and Use cases - Edge computing purpose and definition,
Edge computing use cases, Edge computing hardware architectures, Edge platforms, Edge vs Fog
Computing, Communication Models - Edge, Fog, and M2M.

UNIT-V IOT ARCHITECTURE AND CORE IOT MODULES

IoT Architecture and Core IoT Modules-A connected ecosystem, IoT versus machine-to-machine
versus, SCADA, The value of a network and Metcalfe's and Beckstrom's laws, IoT and edge architecture, Role of an architect, Understanding Implementations with the examples- Edge
computing with RaspberryPi, Industrial, and Commercial IoT and Edge, and Edge computing
and solutions.

TEXT BOOKS:

1. Fog and Edge Computing: Principles and Paradigms (Wiley Series on Parallel and Distributed Computing) by RajkumarBuyya and Satish Narayana Srirama
2. FlavioBonomi, Rodolfo Milito, Jiang Zhu, SateeshAddepalli, ???Fog Computing and Its Role in the Internet of Things??, MCC???12, August 17, 2012, Helsinki, Finland

REFERENCE BOOKS:

1. Abrah Silberschatz, Peter B. Galvin and Greg Gagne, "Operating system concepts", Wiley, 9th edition, 2012
2. Robert Love, "Linux Kernel Development", Addison Wesley, 3rd edition, 2010.

COURSE OUTCOMES:

1. Explain fog and edge computing concepts and IoT integration
2. Describe fog computing in health and smart transportation systems.
3. Analyze SDN applications and security issues in fog computing
4. Compare edge and fog computing architectures and models.
5. Demonstrate IoT and edge implementations using platforms like Raspberry Pi.

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DEPARTMENT OF ECE - EMBEDDED SYSTEMS

M.Tech. III Sem.

L	T	P	C
3	0	0	3

(23D57302A) INDUSTRIAL SAFETY

Course Category	**Professional Elective (PE)**
Course Enrichment Relevance	**Employability**

COURSE OBJECTIVES:

UNIT-I INDUSTRIAL SAFETY

Accident, causes, types, results and control, mechanical and electrical hazards, types,causes and preventive steps/procedure, describe salient points of factories act 1948 for health and safety,
wash rooms, drinking water layouts, light, cleanliness, fire, guarding, pressure vessels, etc, Safety color codes. Fire prevention and firefighting, equipment and methods.

UNIT-II FUNDAMENTALS OF MAINTENANCE ENGINEERING

Definition and aim of maintenance engineering, Primary and secondary functions and responsibility of maintenance department, Types of maintenance, Types and applications of tools used for maintenance, Maintenance cost & its relation with replacement economy,
Service life of equipment

UNIT-III WEAR AND CORROSION AND THEIR PREVENTION

Wear- types, causes, effects, wear reduction methods, lubricants- types and applications, Lubrication methods, general sketch, working andapplications, i. Screw down grease cup, ii. Pressure grease gun, iii. Splash lubrication, iv. Gravity lubrication, v. Wick feed lubrication vi. Side feed lubrication, vii. Ring
lubrication, Definition, principle and factors affecting the corrosion. Types of corrosion, corrosion prevention methods

UNIT-IV FAULT TRACING

Fault tracing-concept and importance, decision treeconcept, need and applications, sequence of fault finding activities, show as decision tree, draw decision tree for problems in machine tools, hydraulic, pneumatic, automotive, thermal and electrical equipment‟s like, I. Any one machine tool, ii.Pump
iii. Air compressor, iv. Internal combustion engine, v. Boiler, vi. Electrical motors, Types of faults in machine tools and their general causes

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DEPARTMENT OF ECE - EMBEDDED SYSTEMS

UNIT-V PERIODIC AND PREVENTIVE MAINTENANCE

Periodic inspection-concept and need, degreasing, cleaning and repairing schemes, overhauling of mechanical components, overhauling of electrical motor, common troubles and remedies of electric motor, repair complexities and its use, definition, need, steps and advantages of preventive maintenance. Steps/procedure for periodic and preventive maintenance of: I. Machine tools, ii. Pumps, iii. Air compressors, iv. Diesel generating (DG) sets, Program and schedule of preventive maintenance of mechanical and electrical equipment, advantages of preventive maintenance.

Repair cycle concept and importance

TEXT BOOKS:

1. Maintenance Engineering Handbook, Higgins & Morrow, Da Information Services.
2. Maintenance Engineering, H. P. Garg, S. Chand and Company

REFERENCE BOOKS:

1. Pump-hydraulic Compressors, Audels, Mcgrew Hill Publication.
2. Foundation Engineering Handbook, Winterkorn, Hans, Chapman & Hall London

COURSE OUTCOMES:

1. To list out important legislations related to health, Safety and Environment
2. To list out requirements mentioned in factories act for the prevention of accidents.
3. To understand the health and welfare provisions given in factories act.
4. To analyze the fault tracing in the industry safety
5. To apply the procedures of periodic and preventive maintenance methods in the industry safety

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DEPARTMENT OF ECE - EMBEDDED SYSTEMS

M.Tech. III Sem.

L	T	P	C
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(23D57302B) BUSINESS ANALYTICS

Course Category	**Professional Elective (PE)**
Course Enrichment Relevance	**Employability**

COURSE OBJECTIVES:

UNIT-I BUSINESS ANALYSIS

Overview of Business Analysis, Overview of Requirements, Role of the BusinessAnalyst. Stakeholders: the project team, management, and the front line, Handling Stakeholder Conflicts

UNIT-II LIFE CYCLES

Systems Development Life Cycles, Project Life Cycles, Product Life Cycles, RequirementLife Cycles

UNIT-III FORMING REQUIREMENTS

Overview of Requirements, Attributes of Good Requirements, Types ofRequirements, Requirement Sources, Gathering Requirements from Stakeholders, Common RequirementsDocuments.Transforming

Requirements: Stakeholder Needs Analysis, Decomposition Analysis, Additive/Subtractive Analysis, Gap Analysis, Notations (UML & BPMN), Flowcharts, Swim Lane

Flowcharts, Entity-Relationship Diagrams, State-Transition Diagrams, Data Flow Diagrams, Use Case Modeling, Business Process Modeling

UNIT-IV FINALIZING REQUIREMENTS

Presenting Requirements, Socializing Requirements and Gaining Acceptance,Prioritizing Requirements. Managing Requirements Assets: Change Control, Requirements Tools

UNIT-V RECENT TRANDS

Embedded and colleborative business intelligence, Visual data recovery, DataStorytelling and Data Journalism

TEXT BOOKS:

1. Business Analysis by James Cadle et al.
2. Project Management: The Managerial Process by Erik Larson and, Clifford Gray

REFERENCE BOOKS:

1. Business analytics Principles, Concepts, and Applications by Marc J. Schniederjans, Dara G. Schniederjans, Christopher M. Starkey, Pearson FT Press.
2. Business Analytics by James Evans, persons Education

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DEPARTMENT OF ECE - EMBEDDED SYSTEMS

COURSE OUTCOMES:

1. Students will demonstrate knowledge of data analytics
2. Students will demonstrate the ability of think critically in making decisions based on data and deep analytics
3. Students will demonstrate the ability to use technical skills in predicative and prescriptive modeling to support business decision-making
4. Students will demonstrate the ability to translate data into clear, actionable insights

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DEPARTMENT OF ECE - EMBEDDED SYSTEMS

M.Tech. III Sem.

L	T	P	C
3	0	0	3

(23D57302C) WASTE TO ENERGY

Course Category	**Professional Elective (PE)**
Course Enrichment Relevance	**Employability**

COURSE OBJECTIVES:

UNIT-I INTRODUCTION TO ENERGY FROM WASTE

Classification of waste as fuel – Agro based, Forest residue,Industrial waste - MSW – Conversion devices – Incinerators, gasifiers, digestors

UNIT-II BIOMASS PYROLYSIS

Pyrolysis – Types, slow fast – Manufacture of charcoal – Methods - Yieldsand application – Manufacture of pyrolytic oils and gases, yields and applications.

UNIT-III BIOMASS GASIFICATION

Gasifiers – Fixed bed system – Downdraft and updraft gasifiers – Fluidized bed gasifiers – Design, construction and operation – Gasifier burner arrangement for thermal heating – Gasifier engine arrangement and electrical power – Equilibrium and kinetic considerationin gasifier operation

UNIT-IV BIOMASS COMBUSTION

Biomass stoves ??? Improved chullahs, types, some exotic designs, Fixed bed combustors, Types, inclined grate combustors, Fluidized bed combustors, Design, construction andoperation - Operation of all the above biomass combustors.

UNIT-V BIOGAS

Properties of biogas (Calorific value and composition) - Biogas plant technology and status - Bio energy system - Design and constructional features - Biomass resources and their classification - Biomass conversion processes - Thermo chemical conversion - Direct combustion - biomass gasification- pyrolysis and liquefaction - biochemical conversion - anaerobic digestion - Types of biogas Plants – Applications - Alcohol production from biomass - Bio diesel production -
Urban waste to energy conversion - Biomass energy programme in India

TEXT BOOKS:

1. Non Conventional Energy, Desai, Ashok V., Wiley Eastern Ltd., 2018
2. Biogas Technology - A Practical Hand Book - Khandelwal, K. C. and Mahdi, S. S., TMH, 2017

REFERENCE BOOKS:

1. Food, Feed and Fuel from Biomass, Challal, D. S., IBH Publishing Co. Pvt. Ltd., 1991

2. Biomass Conversion and Technology, C. Y. WereKo-Brobby and E. B. Hagan, John Wiley & Sons, 1996

COURSE OUTCOMES:

1. To know about overview of Energy to waste and classification of waste.
2. To acquire knowledge on bio mass pyrolysis, gasification, combustion and conversion process in detail
3. To acquire knowledge on bio mass gasification processin detail.
4. To understand the Biomass Combustion Process
5. To gain knowledge on properties of biogas, biomass resources and programmes to convert waste to energy in India

SANTHIRAM ENGINEERING COLLEGE, NANDYAL (AUTONOMOUS)

R-23

M.TECH (ECE-EMBEDDED SYSTEMS)

VISION

- To become a nucleus for pursuing technical education and pool industrial research and developmental activities with social-conscious and global standards.

MISSION

M1: To provide Advanced Educational Programs and prepare students to achieve success and take leading roles in their chosen fields of specialization by arising a self-sustained University.

M2: To establish postgraduate programs in the current and Advanced Technologies.

M3: To establish an R&D Consultancy through developing Industry Institute Interaction, building up exceptional infrastructure.

M4: To propel every individual, realize and act for the technical development of the society.

MOTTO

- Education for Peace and Progress

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