

KRISHNA UNIVERSITY COLLEGE OF ENGINEERING & TECHNOLOGY

B.TECH. – CSE Course Structure (R23) – IV year

IV Year VII Semester

S. No.	Course Code	Category	Title	L	T	P	Credits
1		Professional Core	Cloud Computing	2	1	0	3
2		Management Course- II	Human Resources & Project Management	2	0	0	2
3		Professional Elective-IV	1. Software Architecture & Design Patterns 2. Internet of Things 3. Generative AI 4. 12 week MOOC Swayam/NPTEL course recommended by the BoS	3	0	0	3
4		Professional Elective-V	1. Agile methodologies 2. Block chain Technology 3. Deep Learning 4. 12-week MOOC Swayam/NPTEL course recommended by the BoS	3	0	0	3
5		Open Elective-III	1.Wireless Sensor Networks 2.Principles of Communication Systems 3. Sensors and Actuators for Engineering Applications	3	0	0	3
6		Open Elective-IV	1.Renewable Energy Systems 2. Principles of Cellular and Mobile Communications 3.Smart Materials and Devices	3	0	0	3
7		Skill Enhancement Course	Prompt Engineering/ SWAYAM Plus - Certificate program in Prompt Engineering and ChatGPT / IOT LAB	0	1	2	2
8		Audit Course	1.Constitution of India 2. Entrepreneur + career Management Essentials (IBM)	2	0	0	-
9		Internship	Evaluation of Industry Internship / Mini Project	-	-	-	2
		Total		18	2	02	21

B.Tech IV Year VIII Semester

S.No.	Course Code	Category	Title	L	T	P	Credits
1		Internship & Project Work	Full semester Internship & Project Work	0	0	24	12

Open Electives to other Departments

S.No	Course Code	Category	Title	L	T	P	Credits
1	23EC705A	OE-III	Internet of Things	3	0	0	3
2	23EC705B	OE-III	Web Technologies	3	0	0	3
3	23EC705C	OE-III	Cyber Security (IBM)	3	0	0	3
4	23EC706A	OE-IV	Multimedia and its Applications	3	0	0	3
5	23EC706B	OE-IV	Data Science / Data Analytics (IBM)	3	0	0	3
6	23EC706C	OE-IV	Cloud Computing	3	0	0	3

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B. TECH(CSE) IV-VII SEM
CLOUD COMPUTING

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Course Objectives:

- To explain the evolving computer model called cloud computing.
- To introduce the various levels of services that can be achieved by cloud.
- To describe the security aspects in cloud.

Course Outcomes (CO):

After completion of the course, students will be able to

- Ability to create cloud computing environment
- Ability to design applications for Cloud environment
- Design & develop backup strategies for cloud data based on features.
- Use and Examine different cloud computing services.
- Apply different cloud programming model as per need.

UNIT I

Cloud Computing Fundamentals

Introduction to cloud computing; characteristics; cloud service and deployment models; virtualization; scalability; load balancing; cloud services; service level agreements; identity and access management.

UNIT II

Hadoop and Cloud Application Design

Hadoop architecture; MapReduce; Hadoop cluster; cloud application architecture; data storage approaches; Python fundamentals; data types; control structures; functions; file handling; object-oriented programming.

UNIT III

Python for Cloud Computing

Python for cloud platforms; AWS, Google Cloud and Azure; RESTful web APIs; cloud application development; document storage; image processing; MapReduce; social media analytics.

UNIT IV

Big Data Analytics and Performance

Big data analytics; clustering; classification; recommendation systems; cloud benchmarking; workload characteristics; performance metrics; benchmarking tools; deployment and tuning.

UNIT V

Cloud Security and Applications

Cloud security; authentication; authorization; identity and access management; data security; cloud applications in healthcare, education and industry; cloud migration; legal, privacy and security issues

Text Books

1. Arshdeep Bahga and Vijay Madisetti, Cloud Computing: A Hands-on Approach, Universities Press, 2016. ISBN: 9788173719541.
2. Rajkumar Buyya, James Broberg and Andrzej Goscinski, Cloud Computing: Principles and Paradigms, Wiley India, 2016. ISBN: 9788126525809.

Reference Books

1. Rajkumar Buyya, Christian Vecchiola and S. Thamarai Selvi, Mastering Cloud Computing, McGraw-Hill Education, 2013. ISBN: 9781259029954.
2. Anthony T. Velte, Toby J. Velte and Robert Elsenpeter, Cloud Computing: A Practical Approach, McGraw-Hill Education, 2010. ISBN: 9780071626945.


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HUMAN RESOURCES AND PROJECT ADMINISTRATION

(Management Course-II)

Course Objectives

- To provide students with a foundational understanding of Human Resource Management concepts and functions relevant to organizational effectiveness.
- To develop knowledge of human resource development practices, performance appraisal, and compensation systems in organizations.
- To familiarize students with basic principles, tools, and techniques of Project Management for planning, implementation, and evaluation of projects.

Course Outcomes

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

- understand and explain the nature, scope, functions, and planning processes of Human Resource Management in organizations.
- apply Human Resource Development practices including training, performance appraisal, and career development in organizational settings.
- analyze performance appraisal systems and compensation structures for effective employee management.
- identify different types of projects and explain basic project planning concepts, project environment, and project life cycle.
- demonstrate understanding of project implementation, control, appraisal, and review techniques for evaluating project success.

Course Content

UNIT - I: Human Resource Management

Nature, scope, and concept of Human Resource Management - Functions of HRM and role of the HR Manager - Emerging trends in HRM and E-HRM - Human Resource Planning: demand and supply forecasting - Job design, job analysis - Recruitment: sources of recruitment - Selection: selection procedure.

UNIT - II: Human Resource Development

Concept of Human Resource Development (HRD) - Training and Development: concept, objectives, and methods of training - Career development and counselling - Human Resource Accounting: concept and models.

UNIT - III: Performance Appraisal and Compensation

Performance Appraisal: process, and methods - Compensation: concept and importance. Components of compensation, Concept and importance of employee relations.

UNIT - IV: Basics of Project Management

Concept and importance of Project Management - Project environment and types of projects -Project Life Cycle - Project proposals and Detailed Project Report (DPR) - Pareto Principle (80-20 rule) -Project networks: types.

UNIT - V: Project Implementation and Review

Project implementation: forms of project organization - Project planning and control-Project review, performance evaluation and abandonment analysis - Prerequisites for successful project implementation.

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Textbooks

1. Human Resource Management: Text and Cases - K. Aswathappa, McGraw-Hill Education, India, Revised Edition, 2021, ISBN: 9789354608933
2. Projects: Planning, Analysis, Selection, Financing, Implementation, and Review - Prasanna Chandra, McGraw-Hill Education, India, 10th Edition, 2023, ISBN: 9789355320667
3. Human Resource Management: Text and Cases - V.S.P. Rao, Excel Books, New Delhi, 2007, ISBN: 9788174464316

Reference Books

1. Essentials of Human Resource Management and Industrial Relations - P. Subba Rao, Himalaya Publishing House, Mumbai, 5th Edition, 2010, ISBN: 9789350244548
2. Project Management - Vasant Desai, Himalaya Publishing House, 4th Edition, 2018, ISBN: 9789352734658
3. Project Management - Lalitha Balakrishnan Gowri, Himalaya Publishing House, New Delhi, 2022, ISBN: 9789355961358

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SOFTWARE ARCHITECTURE AND DESIGN PATTERNS

(Professional Elective-IV)

Course Objectives

- Understand the basic concepts to identify state behavior of real world objects.
- Apply Object Oriented Analysis and Design concepts to solve complex problems.
- Construct various UML models using the appropriate notation for specific problem context.

Course Outcomes

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

- explain fundamental design patterns and object-oriented concepts, including their benefits and drawbacks.
- analyze requirements and construct conceptual class diagrams for problem domains.
- differentiate and apply structural patterns (Adapter, Bridge, Composite, Decorator, Facade, Flyweight, Proxy).
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Course Content

UNIT I

Introduction to Software Architecture

Software architecture fundamentals; object-oriented concepts; design principles; design patterns; pattern selection; benefits and limitations of object-oriented design.

UNIT II

Object-Oriented Analysis and Design

Requirements analysis; functional requirements; conceptual classes; relationships; UML diagrams; object-oriented design and implementation.

UNIT III

Structural Design Patterns

Structural design patterns; Adapter; Bridge; Composite; Decorator; Facade; Flyweight; Proxy.

UNIT IV

MVC Architecture and Interactive Systems

MVC architecture; interactive system design; subsystem design; implementation; undo operations; feature enhancement using design patterns.

UNIT V

Distributed Software Architecture

Client-server architecture; Java RMI; web services; SOAP; RESTful services; Enterprise Service Bus (ESB)

Text Books

1. Object-Oriented Analysis, Design and Implementation - Brahma Dathan and Sarnath Ramnath, Universities Press, 2013, ISBN: 9788173717567
2. Design Patterns: Elements of Reusable Object-Oriented Software - Erich Gamma, Richard Helm, Ralph Johnson, John Vlissides, Pearson Publication, 2013, ISBN: 9789332555402

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Reference Books

1. Pattern-Oriented Software Architecture Volume 1: A System of Patterns - Frank Buschmann, Regine Meunier, Hans Rohnert, Peter Sommerlad, Michael Stal, Wiley, 1996, ISBN: 9780471958697
2. AntiPatterns: Refactoring Software, Architectures, and Projects in Crisis - William J. Brown, Raphael C. Malveau, Hays W. McCormick III, Thomas J. Mowbray, John Wiley & Sons, 1998, ISBN: 9780471197133

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GENERATIVE AI (Professional Elective-V)

Course Objectives

1. Understand the fundamentals of Generative AI and its underlying models.
2. Learn techniques for generating text, images, and multimedia content using modern AI models.
3. Explore large language models, open-source frameworks, and applications of Generative AI.

Course Learning Outcomes

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

1. Explain the concepts, architectures, and applications of Generative AI models.
2. Apply transformer models, GANs, and diffusion models for content generation tasks.
3. Develop Generative AI applications using large language models and open-source frameworks.

UNIT I

Introduction to Generative AI

Overview of Generative AI; generative and discriminative models; probabilistic modeling; GANs; VAEs; autoregressive models; diffusion models; applications and challenges.

UNIT II

Generative Models for Text

Language models; transformer architecture; attention mechanism; BERT; GPT; text generation; prompt engineering; reinforcement learning from human feedback (RLHF).

UNIT III

Image Generation Models

Generative Adversarial Networks (GANs); adversarial training; Variational Autoencoders (VAEs); stable diffusion; transformer-based image generation; CLIP.

UNIT IV

Generative AI for Multimedia

GAN variants; CycleGAN; neural style transfer; music generation; MuseGAN; autonomous agents; reinforcement learning concepts.

UNIT V

Large Language Models and Frameworks

Training and fine-tuning; transfer learning; GPT4All; Llama; LangChain; Hugging Face; programming LLMs; deployment of Generative AI applications.

Text Books

1. Denis Rothman, Transformers for Natural Language Processing and Computer Vision, 3rd Edition, Packt Publishing, 2024. ISBN: 9781835885000.
2. Lewis Tunstall, Leandro von Werra and Thomas Wolf, Natural Language Processing with Transformers, O'Reilly Media, 2022. ISBN: 9781098103248.

Reference Books

1. Jay Alamar and Maarten Grootendorst, Hands-On Large Language Models, O'Reilly Media, 2024. ISBN: 9781098150969.
2. David Foster, Generative Deep Learning, 2nd Edition, O'Reilly Media, 2024. ISBN: 9781098134181.
3. Ian Goodfellow, Yoshua Bengio and Aaron Courville, Deep Learning, MIT Press, 2016. ISBN: 9780262035613.

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INTERNET OF THINGS

(Professional Elective-IV)

Course Objectives

- To explore the application areas of IoT.
- To examine the revolution of the Internet in Mobile Devices, Cloud & Sensor Networks
- To learn about the building blocks of the Internet of Things and its characteristics

Course Outcomes

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

- explain IoT's evolution, key components, and the interdependencies of IoT technologies like Wireless Sensor Networks and Cyber Physical Systems.
- analyze IoT sensing and actuation systems, sensor/actuator characteristics, and IoT device design considerations.
- evaluate IoT connectivity and communication technologies, standards, and protocols for network and device interoperability.
- explain IoT interoperability, standards, frameworks, and the applications of Fog Computing in IoT systems.
- identify emerging IoT paradigms, challenges, and apply knowledge to real-world IoT case studies like agriculture and vehicular IoT.

Course Content

UNIT – I:

Predecessors of IoT : Introduction, Wireless Sensor Networks, Machine-to-Machine Communications, Cyber Physical Systems

Emergence of IoT: Introduction, Evolution of IoT, Enabling IoT and the Complex Interdependence of Technologies, IoT Networking Components, Addressing Strategies in IoT

UNIT – II:

IoT Sensing and Actuation: Introduction, Sensors, Sensor Characteristics, Sensorial Deviations, Sensing Types, Sensing Considerations, Actuators, Actuator Types, Actuator Characteristics

IoT Processing Topologies and Types: Data Format, Importance of Processing in IoT, Processing Topologies, IoT Device Design and Selection Considerations, Processing Offloading.

UNIT – III:

IoT Connectivity Technologies: Introduction, IEEE 802.15.4, Zigbee, Thread, ISA100.11A, Wireless HART, RFID, NFC, DASH7, Z-Wave, Weightless, Sigfox, LoRa, NB-IT, Wi-Fi, Bluetooth

IoT Communication Technologies: Introduction, Infrastructure Protocols, Discovery Protocols, Data Protocols, Identification Protocols, Device Management, Semantic Protocols.

UNIT – IV:

IoT Interoperability: Introduction, Standards, Frameworks

Fog Computing and Its Applications: Introduction, View of Fog Computing Architecture, Fog Computing in IoT, Selected Applications of Fog Computing.

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UNIT – V:

Paradigms, Challenges, and the Future: Introduction, Evolution of New IoT Paradigms, Challenges Associated with IoT, Emerging Pillars of IoT

IoT Case Studies: Agricultural IoT, Vehicular IoT

Text Books

1. Introduction to IoT - Sudip Misra, Anandarup Mukherjee, Arijit Roy, Cambridge University Press, 2021, ISBN: 9781108842959
2. Internet of Things: Architecture, Design Principles and Applications - Rajkamal, McGraw Hill Higher Education, 2017, ISBN: 9789352605224
3. Internet of Things: A Hands-On Approach - Arshdeep Bahga and Vijay Madisetti, Universities Press, 2015, ISBN: 9788173719547

Reference Books

1. Fog and Edge Computing: Principles and Paradigms - Rajkumar Buyya and Satish Narayana Srirama (Editors), Wiley, 2019, ISBN: 9781119524984
2. Getting Started with the Internet of Things - Cuno Pfister, O'Reilly Media, 2011, ISBN: 9781449393571
3. Building the Internet of Things - Maciej Kranz, Wiley, 2016, ISBN: 9781119285687

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AGILE METHODOLOGIES
(Professional Elective-V)

Course Objectives

1. Understand the principles, values, and practices of Agile software development.
2. Apply Agile methodologies such as Scrum and Extreme Programming (XP) in software projects.
3. Develop skills to improve software quality, collaboration, and project delivery using Agile practices.

Course Learning Outcomes

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

1. Explain Agile principles, Scrum framework, and Extreme Programming practices.
2. Apply Agile planning, development, and collaboration techniques in software development.
3. Evaluate Agile methods to improve software quality, team productivity, and project outcomes.

UNIT I

Introduction to Agile

Agile fundamentals; Agile Manifesto; Agile values and principles; benefits of Agile; Agile software development lifecycle.

UNIT II

Agile Principles and Project Management

Twelve Agile principles; customer collaboration; communication; project planning; Agile project execution; iterative development.

UNIT III

Scrum Framework

Scrum roles; Scrum artifacts; Scrum events; product backlog; sprint planning; daily Scrum; sprint review; sprint retrospective; self-organizing teams.

UNIT IV

Extreme Programming (XP)

XP practices; pair programming; test-driven development; continuous integration; refactoring; planning game; coding standards; Agile teamwork.

UNIT V

Lean Software Development and Agile Coaching

Lean principles; value stream mapping; waste elimination; continuous improvement; Agile coaching; change management; Agile best practices.

Text Books

1. Andrew Stellman and Jennifer Greene, Learning Agile, O'Reilly Media, 2014. ISBN: 9781449331924.
2. Ken Schwaber, Agile Project Management with Scrum, Microsoft Press, 2004. ISBN: 9780735619937.

Reference Books

1. Mike Cohn, User Stories Applied: For Agile Software Development, Addison-Wesley Professional, 2004. ISBN: 9780321205681.
2. Kenneth S. Rubin, Essential Scrum: A Practical Guide to the Most Popular Agile Process, Addison-Wesley Professional, 2013. ISBN: 9780137043293

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BLOCK CHAIN TECHNOLOGY

(Professional Elective-V)

Course Objectives

1. Understand the fundamentals, architecture, and consensus mechanisms of blockchain technology.
2. Learn blockchain platforms, smart contracts, cryptocurrencies, and enterprise blockchain systems.
3. Explore blockchain security, challenges, and real-world applications across various domains.

Course Learning Outcomes

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

1. Explain blockchain architecture, consensus mechanisms, cryptocurrencies, and smart contracts.
2. Analyze public, private, and consortium blockchain platforms for enterprise applications.
3. Apply blockchain concepts to develop secure and decentralized solutions for real-world applications.

UNIT I

Introduction to Blockchain

Blockchain fundamentals; blockchain architecture; blocks and transactions; decentralization; blockchain types; consensus mechanisms; distributed ledger technology.

UNIT II

Cryptocurrencies and Public Blockchain

Cryptocurrency fundamentals; Bitcoin; Altcoins; tokens; public blockchain; Bitcoin blockchain; Ethereum blockchain; blockchain transactions.

UNIT III

Smart Contracts and Private Blockchain

Smart contracts; Ethereum smart contracts; blockchain oracles; private blockchain; enterprise blockchain; Hyperledger basics; blockchain applications.

UNIT IV

Consortium Blockchain and Enterprise Platforms

Consortium blockchain; Hyperledger Fabric; Ripple; Corda; Initial Coin Offering (ICO); blockchain fundraising; enterprise blockchain solutions.

UNIT V

Blockchain Security and Applications

Blockchain security; privacy; identity management; smart contract security; scalability; blockchain in banking, healthcare, education, supply chain, IoT; challenges and future trends.

Text Books

1. Chandramouli Subramanian, Asha A. George, Abhilash K. A. and Meena Karthikeyan, Blockchain Technology, Universities Press, 2020. ISBN: 9789389165708.
2. Imran Bashir, Mastering Blockchain, 4th Edition, Packt Publishing, 2023. ISBN: 9781803239910.

Reference Books

1. Daniel Drescher, Blockchain Basics: A Non-Technical Introduction in 25 Steps, Apress, 2017. ISBN: 9781484226032.
2. Melanie Swan, Blockchain Blueprint for a New Economy, O'Reilly Media, 2015. ISBN: 9781491920497.

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**DEEP LEARNING
(Professional Elective-V)**

Course Objectives

1. Understand the fundamentals of deep learning and neural network architectures.
2. Learn deep learning models for image, text, and sequential data processing.
3. Apply deep learning techniques to solve real-world artificial intelligence problems.

Course Learning Outcomes

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

1. Explain deep learning concepts, neural networks, and deep learning frameworks.
2. Develop deep learning models using CNNs, RNNs, and modern deep learning libraries.
3. Apply deep learning techniques for computer vision, natural language processing, and intelligent applications.

UNIT I

Fundamentals of Deep Learning

Introduction to artificial intelligence; machine learning fundamentals; supervised and unsupervised learning; neural networks; model evaluation; overfitting and underfitting.

UNIT II

Deep Learning Foundations

Artificial neural networks; deep neural networks; training deep networks; activation functions; optimization techniques; improving deep learning models.

UNIT III

Deep Learning Frameworks

Neural network architecture; TensorFlow; Keras; PyTorch basics; binary and multiclass classification; model development and evaluation.

UNIT IV

Convolutional and Recurrent Neural Networks

Convolutional Neural Networks (CNNs); feature extraction; pooling; Recurrent Neural Networks (RNNs); sequence modeling; CNN and RNN implementation using PyTorch.

UNIT V

Applications of Deep Learning

Computer vision; natural language processing; Generative Adversarial Networks (GANs); deep reinforcement learning; autoencoders; deep generative models; recent trends in deep learning.

Text Books

1. Ian Goodfellow, Yoshua Bengio and Aaron Courville, Deep Learning, MIT Press, 2016. ISBN: 9780262035613.
2. François Chollet, Deep Learning with Python, Manning Publications, 2017. ISBN: 9781617294433.

Reference Books

1. Jon Krohn, Grant Beyleveld and Aglaé Bassens, Deep Learning Illustrated: A Visual, Interactive Guide to Artificial Intelligence, Addison-Wesley Professional, 2019. ISBN: 9780135116821.
2. Seth Weidman, Deep Learning from Scratch, O'Reilly Media, 2019. ISBN: 9781492041412.

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PROMPT ENGINEERING

(Skill Enhancement Course)

Course Objectives

1. Understand the fundamentals of prompt engineering and large language models (LLMs).
2. Learn advanced prompting techniques, retrieval-augmented generation, and LLM application development.
3. Develop prompt-driven AI solutions while considering evaluation, security, and ethical aspects.

Course Learning Outcomes

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

1. Explain prompt engineering concepts, prompting techniques, and LLM architectures.
2. Design effective prompts and develop retrieval-augmented applications using modern frameworks.
3. Evaluate prompt-based AI systems for accuracy, security, robustness, and ethical compliance.

UNIT I

Foundations of Prompt Engineering

Introduction to prompt engineering; prompt anatomy; LLM fundamentals; prompt design principles; iterative prompting; Python environment; prompt refinement; common prompting issues.

UNIT II

Advanced Prompting Techniques

Few-shot and zero-shot prompting; role-based prompting; prompt templates; negative prompting; constraint specification; prompt optimization and refinement.

UNIT III

Structured Prompting and Reasoning

Structured outputs; Markdown, JSON and YAML generation; chain-of-thought prompting; task decomposition; reasoning strategies; prompt validation.

UNIT IV

Retrieval-Augmented Generation

Introduction to Retrieval-Augmented Generation (RAG); LangChain; LCEL; document loading; text splitting; embeddings; vector databases; retrieval pipelines; LLM integration.

UNIT V

LLM Agents and Multimodal AI

LLM agents; multimodal AI; text-to-image prompting; prompt evaluation; LLM-as-Judge; prompt injection; AI safety; ethics; Streamlit and Gradio deployment.

Text Books

1. James Phoenix and Mike Taylor, Prompt Engineering for Generative AI, O'Reilly Media, 2024. ISBN: 9781098156145.
2. Chip Huyen, AI Engineering: Building Applications with Foundation Models, O'Reilly Media, 2025. ISBN: 9781098166304.

Reference Books

1. Angel Talamantes, Prompt Engineering for Beginners (2025 Edition): Master the Art of Talking to AI, Independently Published, 2025. ISBN: 9798348602482.
2. Sachin Jain, Rohit Singh Rajput, Rohit Chhabra and Shubham Patel, Introduction to Prompt Engineering: Concepts and Applications, Notion Press, 2024. ISBN: 9789364118170.

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Internet of Things (IoT) Laboratory (Skill Enhancement Course)

Course Objectives

- To understand the fundamentals of Arduino Uno based embedded and IoT systems.
- To interface commonly used sensors and actuators with Arduino Uno for real-time applications.
- To develop programming skills for data acquisition, processing, and control using embedded C/Arduino IDE.
- To design monitoring and automation systems using the available laboratory hardware.
- To integrate multiple sensors and actuators to develop practical IoT-based prototype applications.

Course Outcomes

- Interface sensors and actuators with Arduino Uno and acquire real-time data.
- Develop and test embedded programs for sensing and control applications.
- Design simple IoT-based automation and monitoring systems.
- Interpret sensor data for environmental and industrial applications.
- Implement prototype IoT solutions for real-life engineering problems.

List of Experiments

Part A: Introduction to Microcontroller and Software:

1. Introduction to Arduino UNO Board
2. Introduction to KEIL Software

Part B: Sensor Interfacing Experiments

1. LED interfacing and blinking patterns using Arduino Uno
2. Push Button interfacing for digital input applications
3. Detect an object using an IR Sensor and indicate it with an LED.
4. Fire detection and buzzer alert using IR Flame Sensor
5. Display atmospheric humidity and temperature on press of a button.
6. Automatic lighting system using LDR and LED
7. Water level monitoring with buzzer indication.
8. Harmful gas detection using MQ-2 Sensor with Buzzer alert
9. Measure soil moisture level on pressing a button
10. Design a Digital counter using 7-Segment Display
11. Display Your Name and Roll Number using LCD module
12. Display any two Sensor values using LCD module.

Part C: IoT Application Experiments

1. IoT-based Smart Energy Meter
2. Smart Agriculture System
3. Home Automation Controller via available sensors and relay
4. Temperature Control using Fan Controller
5. Automatic Street Light System
6. Smart Baggage Tracker
7. IoT-based Air Quality Monitoring System

Text Books

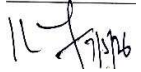
4. Introduction to IoT - Sudip Misra, Anandarup Mukherjee, Arijit Roy, Cambridge University Press, 2021, ISBN: 9781108842959
5. Internet of Things: Architecture, Design Principles and Applications - Rajkamal, McGraw Hill Higher Education, 2017, ISBN: 9789352605224

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7. Internet of Things: A Hands-On Approach - Arshdeep Bahga and Vijay Madisetti, Universities Press, 2015, ISBN: 9788173719547

Reference Books

4. Fog and Edge Computing: Principles and Paradigms - Rajkumar Buyya and Satish Narayana Srirama (Editors), Wiley, 2019, ISBN: 9781119524984
5. Getting Started with the Internet of Things - Cuno Pfister, O'Reilly Media, 2011, ISBN: 9781449393571
6. Building the Internet of Things - Maciej Kranz, Wiley, 2016, ISBN: 9781119285687

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CONSTITUTION OF INDIA

(Audit Course)

Course Objectives

- To understand the premises informing the twin themes of liberty and freedom from a civil rights perspective.
- To address the growth of Indian opinion regarding modern Indian intellectuals' constitutional role and entitlement to civil and economic rights as well as the emergence of nationhood in the early years of Indian nationalism.
- To address the role of socialism in India after the commencement of the Bolshevik Revolution in 1917 and its impact on the initial drafting of the Indian Constitution.

Course Outcomes

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

- examine the history, philosophy, and making of the Indian Constitution.
- identify and analyze Fundamental Rights, Directive Principles, and Fundamental Duties.
- examine the structure and functions of the Legislature, Executive, and Judiciary.
- explain local self-government and the importance of grass-root democracy.
- assess the role of the Election Commission and welfare institutions in India.

Course Content

UNIT-I:

History of Making of the Indian Constitution: History, Drafting Committee, (Composition & Working)

Philosophy of the Indian Constitution- Preamble, Salient, Features

UNIT-II:

Contours of Constitutional Rights & Duties: Fundamental Rights, Right to Equality, Right to Freedom, Right against Exploitation, Right to Freedom of Religion, Cultural and Educational Rights, Right to Constitutional Remedies, Directive Principles of State Policy, Fundamental Duties.

UNIT-III:

Organs of Governance: Parliament, Composition, Qualifications and Disqualifications, Powers and Functions, Executive- President, Governor, Council of Ministers, Judiciary, Appointment and Transfer of Judges, Qualifications, Powers and Functions

UNIT-IV:

Local Administration: District's Administration head: Role and Importance, Municipalities: Introduction, Mayor and role of Elected Representative CEO of Municipal Corporation, Pachayati raj: Introduction, PRI: Zila Pachayat, Elected officials and their roles, CEO Zila Pachayat: Position and role, Block level: Organizational Hierarchy (Different departments), Village level: Role of Elected and Appointed officials, Importance of grass root democracy.

UNIT-V:

Election Commission: Election Commission: Role and Functioning, Chief Election Commissioner and Election Commissioners, State Election Commission: Role and Functioning, Institute and Bodies for the welfare of SC/ST/OBC and women.

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Text Books

1. The Constitution of India (Bare Act) - Government of India Publication, 1950, ISBN: Not Available
2. Framing of Indian Constitution - Dr. S. N. Busi and Dr. B. R. Ambedkar, 1st Edition, 2015, ISBN: 9789384082895
3. Introduction to the Constitution of India - D. D. Basu, LexisNexis, 22nd Edition, 2015, ISBN: 9789351435778

Reference Books

1. Indian Constitutional Law - M. P. Jain, 7th Edition, LexisNexis, 2014, ISBN: 9789351433897
2. Our Constitution - Subhash C. Kashyap, National Book Trust, 2019, ISBN: 9788123760858
3. Constitutional Law of India - J. N. Pandey, Central Law Agency, 56th Edition, 2019, ISBN: 9789388822459

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KRISHNA UNIVERSITY COLLEGE OF ENGINEERING AND TECHNOLOGY

B. TECH(CSE) IV-VII SEM

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ENTREPRENEUR + CAREER MANAGEMENT ESSENTIALS(IBM)

Course Objectives

1. Develop entrepreneurial mindset and basic understanding of business idea generation.
2. Enable students to validate opportunities through lean canvas, market research and customer value analysis.
3. Introduce business positioning, marketing, customer segmentation and promotional channels.

Course Learning Outcomes

After completion of the course, students will be able to:

1. Explain entrepreneurship basics and identify viable business opportunities.
2. Apply lean canvas, market research and customer value principles.
3. Describe competitive advantage, marketing and customer segmentation strategies.

UNIT 1

Entrepreneurial Mindset and Opportunity Discovery: Introduction to entrepreneurship; lean canvas and iterative design; ideation; sources of opportunity; evaluating opportunities.

UNIT 2

Market Research and Customer Value: Lean market research; providing value to customers; understanding customer needs; targeting customer segments.

UNIT 3

Business Model, Marketing and Competitive Positioning: Competitive advantage; marketing a business; promotional channels; customer segment targeting; go-to-market orientation

UNIT 4

Business Operations, Costing and Financing: Cost of doing business; delivering products and services; economics of one unit of sale; financing a startup.

UNIT 5

Career Management and Professional Readiness: Workplace research; professional networking and branding; creating a professional resume; AI-powered resume preparation; interview preparation; job search tools and assessments.

Prescribed Text Books

1. S. S. Khanka, Entrepreneurial Development, 3rd Edition, S. Chand Publishing, New Delhi, 2022. ISBN: 9789352832167.
2. Alex Osterwalder and Yves Pigneur, Business Model Generation: A Handbook for Visionaries, Game Changers, and Challengers, John Wiley & Sons, 2010. ISBN: 9780470876415.
3. M. S. Rao, Soft Skills: Enhancing Employability – Connecting Campus with Corporate, 2nd Edition, I.K. International Publishing House Pvt. Ltd., 2019. ISBN: 9789386768012.

Reference Books

1. Eric Ries, The Lean Startup: How Today's Entrepreneurs Use Continuous Innovation to Create Radically Successful Businesses, Crown Business, 2011. ISBN: 9780307887898.
2. Steve Blank and Bob Dorf, The Startup Owner's Manual: The Step-by-Step Guide for Building a Great Company, K&S Ranch, 2012. ISBN: 9780984999303.
3. Alexander Osterwalder, Yves Pigneur, Gregory Bernarda and Alan Smith, Value Proposition Design: How to Create Products and Services Customers Want, John Wiley & Sons, 2014. ISBN: 9781118968059.

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OPEN ELECTIVES

WIRELESS SENSOR NETWORKS

(Open Elective-III)

UNIT I OVERVIEW OF WIRELESS SENSOR NETWORKS: Key definitions of sensor networks, Advantages of sensor Networks, Unique constraints and challenges, Driving Applications, Enabling Technologies for Wireless Sensor Networks. ARCHITECTURES: Single-Node Architecture - Hardware Components, Energy Consumption of Sensor Nodes, Operating Systems and Execution Environments.

UNIT II NETWORKING Technologies: Physical Layer and Transceiver Design Considerations, Personal area networks (PANs), hidden node and exposed node problem, Topologies of PANs, MANETs, WANETs.

UNIT-III

MAC Protocols for Wireless Sensor Networks: Issues in Designing a MAC protocol for Ad Hoc Wireless Networks, Design goals of a MAC Protocol for Ad Hoc Wireless Networks, Classifications of MAC Protocols, Contention - Based Protocols, Contention - Based Protocols with reservation Mechanisms.

UNIT-IV ROUTING PROTOCOLS: Introduction, Issues in Designing a Routing Protocol for Ad Hoc Wireless Networks, Classification of Routing Protocols, Table -Driven Routing Protocols, On - Demand Routing Protocols, Hybrid Routing Protocols, Routing Protocols with Efficient Flooding Mechanisms, Hierarchical Routing Protocols, Power - Aware Routing Protocols, Proactive Routing.

UNIT-V TRANSPORT LAYER AND SECURITY PROTOCOLS: Introduction, Issues in Designing a Transport Layer Protocol for Ad Hoc Wireless Networks, Design Goals of a Transport Layer Protocol for Ad Hoc Wireless Networks, Classification of Transport Layer Solutions, TCP Over Ad Hoc Wireless Networks, Other Transport Layer Protocol for Ad Hoc Wireless Networks,

UNIT- VI SECURITY IN WSNs: Sensor Node Hardware – Berkeley Motes, Programming Challenges, Node-level software platforms, Node-level Simulators, State-centric programming. APPLICATIONS of WSN: S Ultra wide band radio communication, Wireless fidelity systems. Future directions, Home automation, smart metering Applications.

TEXT BOOKS:

1. Ad Hoc Wireless Networks: Architectures and Protocols - C. Siva Ram Murthy and B.S.Manoj, 2004, PHI
2. Wireless Ad- hoc and Sensor Networks: Protocols, Performance and Control – Jagannathan Sarangapani, CRC Press.
3. Holger Karl & Andreas Willig, "Protocols And Architectures for Wireless Sensor Networks", John Wiley, 2005.

REFERENCES:

1. Kazem Sohraby, Daniel Minoli, & Taieb Znati, "Wireless Sensor Networks- Technology, Protocols, and Applications", John Wiley, 2007.
2. Feng Zhao & Leonidas J.Guibas, "Wireless Sensor Networks- An Information Processing Approach", Elsevier, 2007.
3. Ad- Hoc Mobile Wireless Networks: Protocols & Systems, C.K. Toh ,1 ed. Pearson Education.
4. Wireless Sensor Networks - C. S. Raghavendra, Krishna M. Sivalingam, 2004, Springer
5. Wireless Sensor Networks – S Anandamurugan , Lakshmi Publications.

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PRINCIPLES OF COMMUNICATION SYSTEMS

(Open Elective-III)

Course Objectives:

- To understand the concept of various modulation schemes and multiplexing.
- To apply the concept of various modulation schemes to solve engineering problems.
- To analyse various modulation schemes.
- To evaluate various modulation scheme in real time applications.

Course Outcomes:

- Understand the concept of various modulation schemes and multiplexing
- Apply the concept of various modulation schemes to solve engineering problems
- Analyse various modulation schemes, and evaluate various modulation scheme in real time applications

UNIT I Amplitude Modulation

Introduction to Noise and Fourier Transform. An overview of Electronic Communication Systems. Need for Frequency Translation, Amplitude Modulation: DSB-FC, DSB-SC, SSB-SC and VSB. Frequency Division Multiplexing. Radio Transmitter and Receiver.

UNIT II Angle Modulation

Angle Modulation, Tone modulated FM Signal, Arbitrary Modulated FM Signal, FM Modulation and Demodulation. Stereophonic FM Broadcasting.

UNIT III Pulse Modulation

Sampling Theorem: Low pass and Band pass Signals. Pulse Amplitude Modulation and Concept of Time Division Multiplexing. Pulse Width Modulation. Digital Representation of Analog Signals.

UNIT IV Digital Modulation

Binary Amplitude Shift Keying, Binary Phase Shift Keying and Quadrature Phase Shift Keying, Binary Frequency Shift Keying. Regenerative Repeater.

UNIT V Communication Systems

Satellite, RADAR, Optical, Mobile and Computer Communication (Block diagram approach only).

Note: The main emphasis is on qualitative treatment. Complex mathematical treatment may be avoided.

Text Books

1. Principles of Communication Systems - Herbert Taub, Donald L. Schilling and Goutam Saha, 3rd Edition, Tata McGraw-Hill Publishing Company Ltd., 2008, ISBN: 9780070648111
2. Communication Systems - Simon Haykin, Wiley India, 4th Edition, 2009, ISBN: 9788126512157
3. Electronic Communication Systems - George Kennedy and Bernard Davis, McGraw-Hill Education, 5th Edition, 2013, ISBN: 9780071077828

Reference Books

1. Modern Digital and Analog Communication Systems - B. P. Lathi, Zhi Ding and Hari M. Gupta, 4th Edition, Oxford University Press, 2017, ISBN: 9780199473809
2. Digital and Analog Communication Systems - K. Sam Shanmugam, Wiley India Edition, 2008, ISBN: 9788126513659
3. Analog and Digital Communication - Hwei P. Hsu, Schaum's Outline Series, McGraw-Hill Education, 3rd Edition, 2010, ISBN: 9780071633024

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SENSORS AND ACTUATORS FOR ENGINEERING APPLICATIONS

(Open Elective-III)

Course Objectives:

- To provide exposure to various kinds of sensors and actuators and their engineering applications.
- To impart knowledge on the basic laws and phenomenon behind the working of sensors and actuators
- To enlighten the operating principles of various sensors and actuators
- To educate the fabrication of sensors
- To identify the required sensor and actuator for interdisciplinary application

Course Outcomes:

- To recognize the need of sensors and actuators
- To understand working principles of various sensors and actuators
- To identify different type of sensors and actuators used in real life applications
- To exploit basics in common methods for converting a physical parameter into an electrical quantity
- To make use of sensors and actuators for different applications

UNIT I Introduction to Sensors and Actuators

Sensors: Types of sensors: temperature, pressure, strain, active and passive sensors, General characteristics of sensors (Principles only), Materials used and their fabrication process: 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: Hydraulic, Pneumatic, Mechanical, Electrical, Magnetic, Electromagnetic, piezo-electric and piezo-resistive actuators, Simple applications of Actuators.

UNIT II Temperature and Mechanical Sensors

Temperature Sensors: Types of temperature sensors and their basic principle of working: Thermo-resistive sensors: Thermistors, Resistance temperature sensors, Silicon resistive sensors, 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: semiconductor, piezoresistive, capacitive, VRP.

UNIT III Optical and Acoustic Sensors

Optical Sensors: Basic principle and working of: Photodiodes, Phototransistors and Photo-resistors based sensors, Photomultipliers, Infrared sensors: thermal, PIR, thermopiles

Acoustic Sensors: Principle and working of Ultrasonic sensors, Piezo-electric resonators, Microphones.

UNIT IV Magnetic, Electromagnetic Sensors and Actuators

Motors as actuators (linear, rotational, stepping motors), magnetic valves, inductive sensors (LVDT, RVDT, and Proximity), Hall Effect sensors, Magneto-resistive sensors, Magneto-strictive sensors and actuators, Voice coil actuators (speakers and speaker-like actuators).

UNIT V Chemical and Radiation Sensors

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, Geiger-Mueller counters, Semiconductor radiation detectors and Microwave sensors (resonant, reflection, transmission)

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Text Books

1. Sensors and Actuators: Control System Instrumentation - Clarence W. de Silva, CRC Press, 2nd Edition, 2015, ISBN: 9781482230000
2. Sensors and Actuators - D. A. Hall and C. E. Millar, CRC Press, 1999, ISBN: 9780750304719
3. Sensor Technology Handbook - Jon S. Wilson, Newnes / Elsevier, 2005, ISBN: 9780750677295

Reference Books

1. Sensors and Transducers - D. Patranabis, Prentice Hall of India, 2nd Edition, 2003, ISBN: 9788120327610
2. Measurement, Instrumentation, and Sensors Handbook - John G. Webster, CRC Press, 1999, ISBN: 9780849383472
3. Sensors: A Comprehensive Survey - Henry R. Bolte, Wiley-Interscience, 3rd Edition, 2000, ISBN: 9780471549383

NPTEL courses links

https://onlinecourses.nptel.ac.in/noc21_ee32/preview

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RENEWABLE ENERGY SYSTEMS

(Open Elective-IV)

Course Objectives:

- Understand various sources of Energy and the need of Renewable Energy Systems.
- Understand the concepts of Solar Radiation, Wind energy and its applications.
- Analyze solar thermal and solar PV systems
- Understand the concept of geothermal energy and its applications, biomass energy, the concept of Ocean energy and fuel cells.

Course Outcomes:

- Understand various alternate sources of energy for different suitable application requirements
- Understand the concepts of solar energy generation strategies and wind energy system
- Analyze Solar and Wind energy systems
- Understand the basics of Geothermal Energy Systems, various diversified energy scenarios of ocean, biomass and fuel cells

UNIT I SOLAR ENERGY

Solar radiation - beam and diffuse radiation, solar constant, earth sun angles, attenuation and measurement of solar radiation, local solar time, derived solar angles, sunrise, sunset and day length. flat plate collectors, concentrating collectors, storage of solar energy-thermal storage.

UNIT II PV ENERGY SYSTEMS

Introduction, The PV effect in crystalline silicon basic principles, the film PV, Other PV technologies, Electrical characteristics of silicon PV cells and modules, PV systems for remote power, Grid connected PV systems.

UNIT III WIND ENERGY

Principle of wind energy conversion; Basic components of wind energy conversion systems; windmill components, various types and their constructional features; design considerations of horizontal and vertical axis wind machines: analysis of aerodynamic forces acting on wind mill blades

UNIT IV GEOTHERMAL ENERGY

Estimation and nature of geothermal energy, geothermal sources and resources like hydrothermal, geopressured hot dry rock, magma. Advantages, disadvantages and application of geothermal energy, prospects of geothermal energy in India.

UNIT V MISCELLANEOUS ENERGY TECHNOLOGIES

Ocean Energy: Tidal Energy-Principle of working, performance and limitations. Wave Energy- Principle of working, performance and limitations. Bio mass Energy: Biomass conversion technologies, Biogas generation plants, Classification, advantages and disadvantages, constructional details, site selection.

Text Books

1. Renewable Energy Power for a Sustainable Future - Stephen Peake, Oxford University Press, International Edition, 2018, ISBN: 9780198759751
2. Non-Conventional Energy Sources - G. D. Rai, 4th Edition, Khanna Publishers, 2000, ISBN: 9788174090737
3. Renewable Energy Engineering and Technology - V. V. N. Kishore, TERI Press, 2nd Edition, 2012, ISBN: 9788179934296

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Reference Books

1. Solar Energy: Principles of Thermal Collection and Storage - S. P. Sukhatme and J. K. Nayak, 3rd Edition, Tata McGraw-Hill Education Pvt. Ltd., 2008, ISBN: 9780070148406
2. Non-Conventional Energy Resources - B. H. Khan, 2nd Edition, Tata McGraw-Hill Education Pvt. Ltd., 2011, ISBN: 9780071074667
3. Non-Conventional Energy Resources - S. Hasan Saeed and D. K. Sharma, 3rd Edition, S. K. Kataria & Sons, 2012, ISBN: 9789350140482

Online Learning Resources:

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

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PRINCIPLES OF CELLULAR AND MOBILE COMMUNICATIONS
(Open Elective-IV)

Course Objectives:

- To understand the concepts and operation of cellular systems.
- To apply the concepts of cellular systems to solve engineering problems.
- To analyse cellular systems for meaningful conclusions.
- To evaluate suitability of a cellular system in real time applications.
- To design cellular patterns based on frequency reuse factor.

Course Outcomes:

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

- Understand the concepts and operation of cellular systems (L1)
- Apply the concepts of cellular systems to solve engineering problems (L2).
- Analyse cellular systems for meaningful conclusions, Evaluate suitability of a cellular system in real time applications (L3).
- Design cellular patterns based on frequency reuse factor (L4).

UNIT I Introduction to Cellular Mobile Systems

Why cellular mobile communication systems? A basic cellular system, Evolution of mobile radio communications, Performance criteria, Characteristics of mobile radio environment, Operation of cellular systems. Examples for analog and digital cellular systems.

UNIT II Cellular Radio System Design

General description of the problem, Concept of frequency reuse channels, Co channel interference reduction.

UNIT III Handoffs and Dropped Calls

Why handoffs and types of handoffs, Initiation of handoff, delaying a handoff, forced handoffs, Queuing of handoffs, Power-difference handoffs, Mobile assisted handoff and soft handoff, Cell-site handoff, Intersystem handoff.

UNIT IV Multiple Access Techniques for Wireless Communications

Introduction, Frequency Division Multiple Access, Time Division Multiple Access, Code Division Multiple Access and Space Division Multiple Access.

UNIT V Digital Cellular Systems

Global System for Mobile Systems, Time Division Multiple Access Systems, Code Division Multiple Access Systems. Examples for 2G, 3G and 4G systems. Introduction to 5G system.

Text Books

1. Mobile Cellular Telecommunications - William C. Y. Lee, 2nd Edition, McGraw-Hill International, 1995, ISBN: 9780070373822
2. Wireless Communications: Principles and Practice - Theodore S. Rappaport, 2nd Edition, Pearson / PHI, 2004, ISBN: 9788131707388
3. Wireless Communication Systems - Simon Haykin and Michael Moher, Wiley India, 2nd Edition, 2010, ISBN: 9788126518241

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Reference Books

1. Principles of Modern Wireless Communications Systems: Theory and Practice - Aditya K. Jagannatham, McGraw-Hill Education, 2015, ISBN: 9781259029868
2. Fundamentals of Wireless Communication - David Tse and Pramod Viswanath, Cambridge University Press, 2005, ISBN: 9780521845274
3. Wireless Communications and Networking - Vijay K. Garg, Morgan Kaufmann Publishers, 2007, ISBN: 9780123735805

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KRISHNA UNIVERSITY COLLEGE OF ENGINEERING AND TECHNOLOGY
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SMART MATERIALS AND DEVICES

Course Objectives

1. Understand the fundamentals, classification, and characteristics of smart materials and smart devices.
2. Explain the working principles of sensing, actuation, and smart material technologies used in engineering applications.
3. Identify the applications of smart materials and devices in modern engineering systems.

Course Learning Outcomes

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

1. Explain the properties and classification of smart materials and their applications.
2. Describe the working principles of smart sensors, actuators, and smart devices.
3. Apply the knowledge of smart materials and devices to solve engineering problems in various application domains.

UNIT I

Introduction to Smart Materials

Introduction to smart materials; characteristics and classification; smart structures and smart systems; sensors and actuators; stimulus-response behavior; engineering applications of smart materials.

UNIT II

Types of Smart Materials

Shape memory alloys; piezoelectric materials; magneto strictive materials; electro strictive materials; smart polymers; smart composites; properties and applications.

UNIT III

Smart Sensors and Actuators

Introduction to sensors and actuators; piezoelectric sensors; MEMS sensors; fiber optic sensors; smart actuators; integration of sensors and actuators in intelligent systems.

UNIT IV

Fabrication and Characterization

Material synthesis methods; thin film deposition; sol-gel process; characterization techniques including XRD, SEM, TEM, DSC, and electrical measurements.

UNIT V

Applications of Smart Materials

Biomedical applications; aerospace and automotive applications; robotics; wearable electronics; energy harvesting; self-healing materials; smart textiles; future trends.

Prescribed Text Books

1. Mel M. Schwartz, Smart Materials, Second Edition, CRC Press, 2009. ISBN: 9781420080050.
2. M. V. Gandhi and B. S. Thompson, Smart Materials and Structures, Springer, 1992. ISBN: 9780412370100.

Reference Books

1. K. Otsuka and C. M. Wayman, Shape Memory Materials, Cambridge University Press, 1998. ISBN: 9780521444877.
2. Brian Culshaw, Smart Structures and Materials, Artech House, 1996. ISBN: 9780890066816.
3. J. W. Gardner, V. K. Varadan and O. O. Awadelkarim, Microsensors, MEMS and Smart Devices, John Wiley & Sons, 2001. ISBN: 9780471861090.

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