AR – 25

Course Structure

of

Honors / Minors

Applicable for the Batches
Admitted From 2025 – 2026

B. Tech

ADITYA INSTITUTE OF TECHNOLGY AND MANAGEMENT

(An Autonomous Institution)

Approved by AICTE, Recognized Under 2(f) 12(B) of UGC,
Permanently Affiliated to JNTGV – Vizanagaram.
K. Kotturu, Tekkali, Srikakulam – 532201, Andhra Pradesh.

https://www.adityatekkali.edu.in/

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Leaders | Entrepreneurs | Innovators

EAPCET Code: ADIT

Honors/Minors (AR25)

The curriculum provides flexibility to enable the competent students to register for B. Tech. degree with Honors by earning additional **20** credits (**18** credits in case of Minor) which are over and above 160 credits for the award of B. Tech. (Regular) degree. The students registered for B. Tech (Honors) shall not be permitted to register for Minor or vice versa. The following Honors/Minor courses are offered by the departments, but the list of specializations may be modified at any time with approval of BOS, according to current trends/technology need.

Specialization	Offered by	Honors (for students)
Artificial Intelligence and Machine Learning	CSE	CSE/IT/CSD/CSC
Data Science	IT	CSE/IT/CSC
Cyber Security	CSD	CSE/IT/CSD/CSM
Internet of Things	ECE	ECE
VLSI Design and Verification		
Electric Vehicles	EEE	EEE
Advanced Manufacturing and Additive Technologies	MECH	MECH
Smart Cities	CIVIL	CIVIL

Specialization	Offered by	Minor (for students)
Artificial Intelligence and Machine Learning	CSE	All (Except CSE & Allied)
Data Science	IT	
Cyber Security	CSD	
Quantum Technologies	CSM	All
Internet of Things	ECE	All (Except ECE)
ROBOTICS and Automation	MECH	All (Except MECH)
Innovation Entrepreneurship and venture development (IEV)	MBA	All

He/She shall register Honors/Minor during II B.Tech II semester provided he/she secures ≥ 8 CGPA in case of Honors and ≥ 7 CGPA in case of Minor and clearing all the courses in single attempt till II B.Tech I semester. In case of students admitted through lateral entry, the CGPA compliance will be considered from II B.Tech I semester onwards.

If a student is detained due to lack of attendance, he/she shall not be permitted to register the courses of Honors/Minor.

Registration for Honors/Minor degree will be limited to maximum of 35% of the total intake in a particular batch of students.

The students shall have the scope to earn these additional credits from II year II semester to IV year II semester and at any point of time if he/she wishes to withdraw from B. Tech (Honors/Minor) program, the additional credits acquired till that time will get lapsed and cannot be used to compensate with those 160 credits needed for the award of B.Tech degree.

To acquire additional credits, the students shall register under the list of the courses offered by the respective departments, **a mini project** and also acquire the balance credits by taking MOOCs NPTEL courses with 12/8 weeks' duration in case of Honors and 12/8/4 weeks duration in case of Minors.

Year		Minor	Honors
II B.Tech (II Sem)	Course – I	4 Credits	4 Credits
III B.Tech (I Sem)	Course – II	4 Credits	4 Credits
III B.Tech (II Sem)	Course – III	4 Credits	4 Credits
IV B.Tech (I Sem)	Course – IV/Mini Project	4 Credits	4 Credits
From II-II to IV-II	MOOC Course	2 Credits	4 Credits

If the student requires doing a mini project, in case of Honors each student has to complete minor project but in case of Minor, group of students (maximum of four) has to complete minor project.

The Synopsis of mini project will be evaluated for a total of 100 marks consisting of 30 marks for internal assessment and 70 marks for semester-end examination. Internal assessment for 30 marks shall be done by supervisor based on day to day observation. The semester-end examination (Presentation and Viva-Voce) shall be conducted by the committee, consisting of an External examiner, Head of the department and supervisor.

The student can complete these MOOCs NPTEL courses during II year II semester to IV year II semester course completion and these courses will be included in the IV year II Semester grade memo.

These additional courses offered by the program may change from time to time based on the demand and resources availability. The courses may be offered in different modes i.e. guided learning/taught courses/Blended mode or combination.

Evaluation methodology of Honors/Minor courses will be similar to the regular B.Tech theory course/laboratory course/integrated course.

No Supplementary examination for the courses offered in B.Tech Honors/Minor Program.

The courses passed under Honors/Minor program will not be counted for CGPA/SGPA calculation. The student who acquires **20/18** additional credits and maintained ≥ 8/7 CGPA and acquiring 160 credits in regular B.Tech course and clearing all the courses in single attempt will be awarded the B.Tech degree with Honors/Minor.

Any student who fails to fulfill these conditions will automatically get deregistered for B. Tech (Honors)/B.Tech (Minor) without any notification.

Honors/Minor shall not be awarded under any circumstances without completing the regular B. Tech program in which a student got admitted.

The student is not permitted to repeat any course offered by any department to fulfill credit requirement for Honors/Minor program.

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ARTIFICIAL INTELLEGENCE AND MACHINE LEARNING (Honors)

S. No.	Semester	Course Code	Course	L	T	P	C
1	II – II	23HAT201	Foundations of Artificial Intelligence and Machine Learning	4	0	0	4
2	III – I	23HAT302	Advanced Data Science and Big Data Analytics	4	0	0	4
3	III – II	23HAT303	Deep Learning and Generative AI	4	0	0	4
4	IV – I	23HAT404	Intelligent Systems Design and AI Applications	4	0	0	4
5	IV – II	23HAM405	MOOC Course – I	-	-	-	4
6		23HAM406	MOOC Course – II				
Total Credits							**20**

Foundations of Artificial Intelligence and Machine Learning

(Applicable for II Year II Semester)

Subject code: 25HAT201

L	T	P	C
4	0	0	4

Course Objectives

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

- Understand the principles, evolution, and applications of Artificial Intelligence and Machine Learning.
- Apply intelligent search and optimization algorithms to solve computational problems.
- Represent knowledge using logical reasoning techniques and develop simple intelligent systems.
- Design and evaluate supervised and unsupervised machine learning models.
- Analyze ethical, societal, and industrial implications of AI while developing responsible AI-based solutions.

Course Outcomes

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

1. Explain the concepts, history, intelligent agents, and applications of Artificial Intelligence and Machine Learning.
2. Apply search algorithms and knowledge representation techniques to solve AI problems.
3. Develop intelligent systems using logical reasoning and machine learning principles.
4. Build, evaluate, and compare supervised and unsupervised machine learning models.
5. Assess AI applications considering ethical, societal, and responsible AI principles.

Unit – I

Introduction to Artificial Intelligence and Intelligent Agents: Introduction to Artificial Intelligence, Evolution and History of AI, Characteristics of Intelligent Systems, AI Applications, Artificial General Intelligence (AGI) vs Narrow AI, AI Problem Domains, Intelligent Agents, Rational Agents, PEAS Representation, Environment Types, Agent Architectures, Reactive Agents, Goal-Based Agents, Utility-Based Agents, Learning Agents. AI Development Cycle, AI Programming Tools, Python Libraries for AI, AI Development Platforms.

Unit – II

Problem Formulation State Space Representation, Production Systems

Search Strategies Uninformed Search, Breadth First Search, Depth First Search, Uniform Cost Search, Iterative Deepening Search, Bidirectional Search.

Informed Search Greedy Best First Search, A* Search, Beam Search, Hill Climbing, Simulated Annealing.

Constraint Satisfaction Problems Game Playing, MiniMax Algorithm, Alpha-Beta Pruning, Introduction to Adversarial Search.

Unit – III

Knowledge Representation, Knowledge-Based Systems, Logic in AI, Propositional Logic, Predicate Logic, Inference Rules, Forward Chaining, Backward Chaining, Resolution,

Semantic Networks, Frames, Scripts, Rule-Based Systems, Expert Systems, Ontology, Reasoning Under Uncertainty, Bayesian Reasoning, Fuzzy Logic, Introduction to Explainable AI (XAI).

Unit – IV

Introduction to Machine Learning Relationship between AI, ML and Deep Learning,

Types of Learning Supervised Learning, Unsupervised Learning, Reinforcement Learning

Machine Learning Pipeline Data Collection, Data Cleaning, Feature Engineering, Feature Scaling, Feature Selection.

Training, Validation and Testing Bias-Variance Tradeoff, Overfitting, Underfitting, Cross Validation, Evaluation Metrics, Confusion Matrix, Accuracy, Precision, Recall, F1-Score, ROC Curve, AUC,

Introduction to Scikit-Learn.

Unit – V

Supervised Learning Linear Regression, Logistic Regression, k-Nearest Neighbors, Decision Trees, Naïve Bayes, Support Vector Machines

Unsupervised Learning K-Means Clustering, Hierarchical Clustering, DBSCAN, Principal Component Analysis

Applications of AI and ML Healthcare, Agriculture, Finance, Smart Cities, Autonomous Vehicles, Cyber Security, Manufacturing, Recommendation Systems,

Generative AI (Introduction) Ethics in AI, Responsible AI, Fairness, Privacy, Bias in AI, Future Trends in AI

Textbooks

1. Russell, S. J., & Norvig, P. (2021). Artificial intelligence: A modern approach (4th ed.). Pearson.
2. Géron, A. (2023). Hands-on machine learning with Scikit-Learn, Keras, and TensorFlow: Concepts, tools, and techniques to build intelligent systems (3rd ed.). O'Reilly Media.
3. Alpaydın, E. (2021). Introduction to machine learning (4th ed.). MIT Press.

Reference Books

1. Mitchell, T. M. (1997). Machine learning. McGraw-Hill Education.
2. Bishop, C. M. (2006). Pattern recognition and machine learning. Springer.
3. Rich, E., Knight, K., & Nair, S. B. (2009). Artificial intelligence (3rd ed.). McGraw-Hill Education.
4. Kaushik, S. (2011). Artificial intelligence. Cengage Learning India.
5. Poole, D. L., & Mackworth, A. K. (2017). Artificial intelligence: Foundations of computational agents (2nd ed.). Cambridge University Press.

Reference Links

- Google. (n.d.). *Google AI*. https://ai.google/
- OpenAI. (n.d.). *OpenAI documentation*. https://platform.openai.com/docs
- Python Software Foundation. (n.d.). *Python 3 documentation*. https://docs.python.org/3/
- Scikit-learn Developers. (n.d.). *Scikit-learn documentation*. https://scikit-learn.org/stable/
- TensorFlow Authors. (n.d.). *TensorFlow documentation*. https://www.tensorflow.org/

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DATA SCIENCE (Honors)

S. No.	Semester	Course Code	Course	L	T	P	C
1	II – II	23HDT201	Introduction to Data Science	4	0	0	4
2	III – I	23HDT302		4	0	0	4
3	III – II	23HDT303		4	0	0	4
4	IV – I	23HDT404		4	0	0	4
5	IV – II	23HDM405	MOOC Course – I	-	-	-	4
6		23HDM406	MOOC Course – II				
Total Credits							**20**

AR 25 – B.Tech – IT

Aditya Institute of Technology and Management (Autonomous), Tekkali

II Year B.Tech (INFORMATION TECHNOLOGY) – 2nd Sem

INTRODUCTION TO DATA SCIENCE

(Honors Degree - Data Science)

Subject Code: 25HDT201	L	T	P	C
	4	0	0	4

COURSE OBJECTIVES:

- Introduce students to the basic concepts of Data Science.
- Familiarize students with types and sources of data.
- Explain the Data Science lifecycle.
- Introduce basic data analysis and visualization.
- Understand applications of Data Science in real-world problems.

COURSE OUTCOMES:

1. Define Data Science and its importance
2. Identify types of data and data sources
3. Explain Data Science lifecycle
4. Identify tools used in Data Science
5. Perform basic data analysis and visualization

Unit-I

Fundamentals of Data Science : Definition of Data Science, Evolution of Data Science, Data Science vs Data Analytics vs Artificial Intelligence, Role of Data Scientist, Skills required for Data Scientist, Applications of Data Science.

Unit-II

Types of Data and Data Sources : Types of Data:(Structured data, Unstructured data, Semi-structured data),Data formats:(CSV, Excel, JSON),Data Sources:(Databases, Websites, Sensors, Social media). Introduction to Big Data.

Unit-III

Data Science Lifecycle : Steps in Data Science life-cycle: Problem definition, Data collection, Data cleaning, Data analysis, Data visualization, Decision making. Example case study.

Unit-IV:

Tools for Data Science : Introduction to Data Science tools:(Python, Jupyter Notebook, Excel), Introduction to Python libraries:(NumPy, Pandas),Overview of visualization tools:(Matplotlib, Power BI / Tableau).

Unit-V:

Introduction to Data Analysis and Visualization : What is Data Analysis, Basic data analysis steps, Introduction to data visualization, Types of charts:(Bar chart,Line chart, Pie chart, Histogram). Real-world examples

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Text Books:

1. Joel Grus, „"Data Science from Scratch", O'Reilly Media, 2nd Edition, 2019.
2. Jake VanderPlas,"Python Data Science Handbook", O'Reilly Media, 2016.

Reference Books:

1. Foster Provost and Tom Fawcett, "Data Science for Business", O'Reilly Media, 2013.
2. Cathy O'Neil and Rachel Schutt, "Doing Data Science", O'Reilly Media, 2013.

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CYBER SECURITY (Honors)

S. No.	Semester	Course Code	Course	L	T	P	C
1	II – II	23HCI201	Ethical Hacking	3	0	2	4
2	III – I	23HCI302	Data Analytics for Fraud Detection	3	0	2	4
3	III – II	23HCI303	Vulnerability Assessment and Penetration testing	3	0	2	4
4	IV – I	23HCP404	Mini Project	-	-	-	4
5	IV – II	23HCM405	MOOC Course – I	-	-	-	4
6		23HCM406	MOOC Course – II				
Total Credits							**20**

L	T	P	C
3	0	2	4

Subject Code:25HCI201

ETHICAL HACKING

Course Objectives

1. To understand security fundamentals, risk management principles, and ethical hacking frameworks.
2. To analyse the hacking lifecycle and technical foundations of system and network exploitation.
3. To develop skills in foot printing, scanning, enumeration, and attack surface mapping.
4. To examine system hacking techniques including password attacks and privilege escalation.
5. To study social engineering methods, malware analysis, and vulnerability assessment techniques.

Course Outcomes

CO1: Explain security principles, risk assessment models, and ethical hacking methodologies.
CO2: Apply reconnaissance and scanning techniques using standard security tools.
CO3: Analyse system vulnerabilities through enumeration and attack surface mapping.
CO4: Demonstrate controlled exploitation techniques including privilege escalation and password cracking.
CO5: Evaluate social engineering attacks and malware behaviours using structured analysis methods.

UNIT–I: Introduction to Ethical Hacking

Security Fundamentals, Security Testing, Hacker Descriptions, Cracker Descriptions, Ethical Hackers, Types of Hackers, Security Policies, Risk Management Basics, Test Plans, Keeping It Legal, Ethics, Legality, Cyber Laws Overview

Experiments:
1. Searching for Fxposed Passwords
2. Examining Security Policies

UNIT–II: The Technical Foundations of Hacking

The Hacking Process, Reconnaissance, Footprinting, Scanning, Enumeration, Gaining Access, Escalation of Privilege, Maintaining Access, Covering Tracks, Planting Backdoors, The Ethical Hacker's Process, NIST SP 800-15, OCTAVE, OSSTMM, Information Security Systems, OSI Model, TCP/IP Model, Anatomy of TCP/IP Protocols

Experiments:

Installing a Sniffer, Performing Packet Captures,
Identifying Protocols at Each Layer of OSI Model, Identifying Applications and Services at Each Layer of TCP/IP Stack

UNIT–III: Foot printing and Scanning

Overview of Seven-Step Information Gathering Process, Information Gathering Techniques, Open Source Intelligence, Determining Network Range, Identifying Active Machines, Finding Open Ports, Identifying Access Points, OS Fingerprinting, Service Fingerprinting, Banner Grabbing, Vulnerability Scanning Basics, Mapping Network Attack Surface

Experiments:
1 Performing Passive Reconnaissance
.2 Performing Active Reconnaissance

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UNIT–IV: Enumeration and System Hacking

Enumeration Concepts, Windows Enumeration, Windows Security Mechanisms, NetBIOS Enumeration, LDAP Enumeration, SNMP Enumeration, Linux Enumeration, UNIX Enumeration, NTP Enumeration, SMTP Enumeration, IPSec Enumeration, VoIP Enumeration, DNS Enumeration, System Hacking Concepts, Nontechnical Password Attacks, Technical Password Attacks, Password Guessing, Automated Password Guessing, Password Sniffing, Keylogging, Privilege Escalation, Exploiting Vulnerabilities, Exploiting Applications, Exploiting Buffer Overflow, Windows Authentication Types, Linux Authentication Mechanisms, Cracking Windows Passwords, Cracking Linux Passwords, Rootkits, Hiding Files, Covering Tracks

Experiment:

NTFS File Streaming and Hidden File Techniques.

UNIT–V: Social Engineering and Malware Threats

Social Engineering Concepts, Phishing, Spear Phishing, SMS Phishing, Voice Phishing, Whaling, Elicitation, Interrogation, Impersonation, Shoulder Surfing, USB Key Drop, Malware Concepts, Viruses, Worms, Trojan Horses, Ransomware, Spyware, Keyloggers, Types of Malware, Malware Transmission Methods, Virus Payloads, Trojan Communication Methods, Trojan Infection Mechanisms, Wrappers, Packers, Droppers, Crypters, Detecting Malware, Antivirus Mechanisms, Static Malware Analysis, Dynamic Malware Analysis

Experiments:

1. Finding Malicious Programs
2. Using Process Explorer for analyzing suspicious processes.

TEXT BOOKS:

1. Michel Gregg, Omar Santos, Certified Ethical Hacker (CEH) v12 Cert Guide, Fourth Edition, Pearson Education, 2023.
2. William Stallings, Network Security Essentials: Applications and Standards, Seventh Edition, Pearson Education, 2021.

REFERENCE BOOKS:

1. Jon Erickson, Hacking: The Art of Exploitation, Second Edition, No Starch Press, 2008.
2. Ric Messier, CEH v12 Certified Ethical Hacker Study Guide, Wiley, 2023.
3. Dafydd Stuttard, Marcus Pinto, The Web Application Hacker's Handbook: Finding and Exploiting Security Flaws, Second Edition, Wiley, 2011.
4. William Stallings, Network Security Essentials: Applications and Standards, Seventh Edition, Pearson Education, 2021.
5. Kevin Beaver, Hacking For Dummies, Sixth Edition, Wiley, 2020.

ONLINE RESOURCES:

1. https://tryhackme.com
2. https://portswigger.net/web-security.

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INTERNET OF THINGS (Honors)

S. No.	Semester	Course Code	Course	L	T	P	C
1	II – II	25HIT201	Internet of Things and IIoT	4	0	0	4
2	III – I	23HIT302	Sensor Technologies in IoT	4	0	0	4
3	III – II	23HIT303	IoT Web Development and Applications	4	0	0	4
4	IV – I	23HIP404	Mini Project	4	0	0	4
5	IV – II	23HIM405	MOOC Course – I	-	-	-	4
6		23HIM406	MOOC Course – II				
Total Credits							**20**

AR 25 – B.Tech – ECE

Aditya Institute of Technology and Management (Autonomous), Tekkali

II Year B.Tech (Electronics and Communication Engineering) – 2 nd Sem

INTERNET OF THINGS AND IIOT

(Honors Degree- Internet of Things)

Subject Code: 25HIT201	L	T	P	C
	4	0	0	4

COURSE OBJECTIVES

- To learn fundamentals of IoT such as Components, Networking and Communication technologies.
- To discuss various network configurations and topologies.
- To differentiate sensors and actuators used in IoT.
- To study different communication protocols and application scope of each connectivity protocol for IoT communication.
- Understand and analyze IIoT.

COURSE OUTCOMES

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

CO 1. Explain the evolution of different internet technologies and need for IoT.
CO 2. Identify different networking components in IoT with respect to OSI layer.
CO 3. Analyze the need of sensors and actuators used in IoT.
CO 4. Determine the requirements associated with each of these communication protocols and technologies associated with IoT connectivity in real-world solutions.
CO 5. Explore various tools and programming paradigms for IIoT applications.

UNIT – I

Introduction to IoT: Introduction, Evolution of IoT, IoT and M2M, IoT -CPS, IoT- WoT, Various enablers of IoT and Complex interdependence technologies, Networking components of IoT.

UNIT –II

Networking Components in IoT: Introduction, Network types, Network reachability, OSI model, Internet Protocol suite, Data link layer addressing, Network layer addressing, TCP/IP transport layer, Difference between TCP & UDP.

UNIT - III

IoT sensors and actuators: Introduction, Sensors and its characteristics, types of sensing, sensing considerations, Actuators, characteristics of actuators, types of actuators, Temperature monitoring system (Simple case study).

UNIT - IV

IoT software and Protocols: Introduction, data protocols, MQTT, MQTT-SN, CoAP, XMPP, HTTP. Connectivity Technologies in IoT: Introduction, IEEE 802.15.4, Zigbee, RFID, Lora, WI-Fi, Bluetooth.IoT Communication Technologies (Range, Data Rate, Power, Applications)

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UNIT-V

Industrial Internet of Things: Introduction, Definition, concept of Industry 4.0, Industrial Internet of Things (IIoT), Comparison of IoT and IIoT, IIoT Architecture, Benefits, Basic Technologies, Applications and Challenges.

TEXT BOOKS

1. Vijay Madisetti, Arshdeep Bahga, Adrian McEwen (Author), Hakim Cassimally "Internet of Things A Hands-on-Approach" University Press, 2014.
2. S. Misra, C. Roy, and A. Mukherjee, Introduction to Industrial Internet of Things and Industry 4.0.CRC Press.2020

REFERENCE BOOKS

1. Adrian McEwen, Hakim Cassimally "Designing the Internet of Things", John Wiley & Sons, 2014.
2. Joe Biron and Jonathan Follett "Foundational Elements of an IoT Solution: The Edge, The Cloud, and Application Development", First Edition. Cisco Press, 2017.

WEB LINKS

1. https://onlinecourses.nptel.ac.in/noc21_ee85/course
2. https://onlinecourses.nptel.ac.in/noc21_cs17/preview
3. https://nptel.ac.in/courses/106/105/106105166/

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VLSI DESIGN AND VERIFICATION (Honors)

S. No.	Semester	Course Code	Course	L	T	P	C
1	II – II	23HVT201	Verilog HDL for Digital Systems	4	0	0	4
2	III – I	23HVT302	Digital System Design	4	0	0	4
3	III – II	23HVT303	IC Design Principles	4	0	0	4
4	IV – I	23HVT404	Advanced VLSI Testing	4	0	0	4
5	IV – II	23HVM405	MOOC Course – I	-	-	-	4
6		23HVM406	MOOC Course – II				
Total Credits							**20**

AR 25 – B.Tech – ECE

Aditya Institute of Technology and Management (Autonomous), Tekkali

II Year B.Tech (Electronics and Communication Engineering) – 2 nd Sem

VERILOG HDL FOR DIGITAL SYSTEM

(Honors Degree- VLSI Design and Verification)

Subject Code: 25HVT201	L	T	P	C
	4	0	0	4

COURSE OBJECTIVES

- To provide the language elements to write Verilog HDL programming for various digital circuits.
- To study the concepts of Gate level and dataflow level models for writing the Verilog HDL programming for digital circuits.
- To study the concepts of Behavioral level modeling for writing the Verilog HDL programming for sequential digital circuits.
- To write the Verilog HDL programming for various combinational digital circuits.
- To write the Verilog HDL programming for various sequential digital circuits.

COURSE OUTCOMES

On completion of this course, students will be able to

CO 1. Recall the language elements concepts related to Verilog HDL programming.

CO 2. Understand the Gate and Data level models to write the Verilog HDL programming for digital circuits.

CO 3. Understand the Behavioral level models to write the Verilog HDL programming for sequential digital circuits.

CO 4. Write the Verilog HDL programming for various combinational digital circuits.

CO 5. Write the Verilog HDL programming for various sequential digital circui

UNIT – I

LANGUAGE ELEMENTS OF VERILOG HDL: Introduction, Features of Verilog HDL, Keywords, Identifiers, White Space, Characters, Comments, Numbers, Strings, Logic Values, Strengths, Data Types, Scalars and Vectors, Parameters, Memory, Operators, System Tasks, Exercises.

UNIT- II

GATE ANDDATA FLOW MODELINGS: Introduction, AND Gate Primitive, Module Structure, Other Gate Primitives, Illustrative Examples, Tri-State Gates, Array of Instances of Primitives, Continuous Assignment Structures, Delays and Continuous Assignments, Assignment to Vectors and Operators.

UNIT-III

BEHAVIORAL MODELING: Introduction, Operations and Assignments, Functional Bifurcation, Initial Construct, Always Construct, Examples, Assignments with Delays, wait construct, Multiple Always Blocks, Designs at Behavioral Level, Blocking and Non-blocking Assignments, The case statement, Simulation Flow. i*f* and i*f*-else constructs, assign-deassign construct, repeat construct, for loop, the disable construct, while loop, forever loop, parallel blocks, force-release construct, Event.

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UNIT–IV

COMBINATIONAL CIRCUITS-HDL PROGRAMMING: Adders-Half adder, Full adder, parallel adder, carry look-ahead adder, subtractors- Half subtractor, full subtractor, multiplexers, de-multiplexers, encoders, decoders, comparators-2-bit comparator, 4-bit comparator, BCD adder.

UNIT–V

SEQUENTIAL CIRCUITS-HDL PROGRAMMING: Flip flops- SR, D, JK, T, Registers- SISO, SIPO, PISO, PIPO, Universal shift register, Counters- Asynchronous counters, Synchronous Counters.

TEXT BOOKS

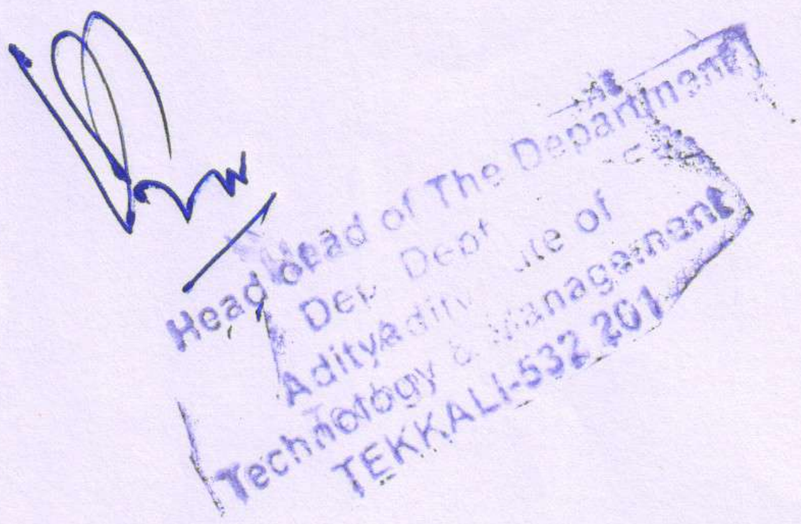
1. A Verilog Primer – J. Bhaskar, BSP, 2003.
2. Design through Verilog HDL – T.R. Padmanabhan and B. Bala Tripura Sundari, WSE, 2004, IEEE press.

REFERENCE BOOKS

1. Fundamentals of Logic Design with Verilog – Stephen. Brown and ZvonkoVranesic, TMH, 2005.
2. Digital Systems Design using VHDL – Charles H Roth, Jr. Thomson Publications,2004.

WEB LINKS

1. https://onlinecourses.nptel.ac.in/noc24_cs61/preview



AR – 25

ELECTRIC VEHICLES (Honors)

S. No.	Semester	Course Code	Course	L	T	P	C
1	II – II	23HET201	Introduction to Electrical Vehicle Technology	4	0	0	4
2	III – I	23HET302	Battery Technologies	4	0	0	4
3	III – II	23HET303	Electric Vehicle Engineering	4	0	0	4
4	IV – I	23HET404	Mini Project	-	-	-	4
5	IV – II	23HEM405	MOOC Course – I	-	-	-	4
6		23HEM406	MOOC Course – II				
Total Credits							**20**

INTRODUCTION TO ELECTRICAL VEHICLE TECHNOLOGY
(Honors Course)

Subject Code: 25HET201	L	T	P	C
	4	0	0	4

Course Objectives:

- To describe the different types of electrical and hybrid vehicles
- To discuss the basic components of Electric vehicle power train.
- To discuss the basics of different Motor Principles
- To describe the concepts of Hybrid Electric Drive Trains
- To describe and analyze different types of batteries and energy storage systems and to describe different controllers and converters in electric vehicles.

Course Outcomes:

- At the end of the course the student will able to
- Understand basics of Electric vehicle & Hybrid Electric Vehicle.
- Understand about power train drives and control in Electric Vehicles.
- Understand basics of different Motor Principles
- Understand concepts in different Electrical Drive trains
- Analyze different types of batteries and energy storage requirements and to understand different controllers and converters in Electric Vehicles

Unit-I- Introduction to Electric vehicle

Comparison of Conventional Vehicle vs Electric Vehicle, Introduction to Electric Vehicles: Types of EVs, Hybrid Electric Vehicles, Introduction to EV Technology, History of Electric Vehicle, Benefits Of Electric Vehicles, Types of Electric vehicle and Hybrid Vehicles. Norms and Standards.

Unit-II- Power Train in Electric vehicle

Working of an Electric Vehicle, Major Components in an Electric Vehicle Power train, Energy Source of an EV, Transmission configuration, Components – Motor, gears, differential, clutch, brakes regenerative braking, Battery pack, Controller. Hybrid Electric Drive-train

Unit-III- Motor-Principles of Electrical Machines

Motor-Principles of Electrical Machines, EM Fundamentals, Classification of Motors, Selection of Motor, Motor Specifications Calculations, Gear ratio Calculations.

Unit-IV- Electrical Drive trains

Concept of Hybrid Electric Drive Trains, Electric Propulsion unit, Configuration and control of DC Motor drives, Induction Motor drives, Permanent Magnet Motor drives, switched reluctancemotor

Unit-V- Energy Storage systems

Introduction to Energy Storage Requirements in Hybrid and Electric Vehicles:- Battery based energy , storage , Types of Batteries and Classification, different energy storage devices. Battery Selection Criteria, Major Components of a Battery pack, Applications. Controller & Converters, EV Controllers, DC-DC Converter, DC-AC Converter.

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Text Books:

1. Iqbal Husain, "Electric and Hybrid Vehicles Design Fundamentals", CRC Press, 2010
2. James Larminie, John Lowry, "Electric Vehicle Technology Explained", Wiley 2012.
3. Mehrdad Ehsani, Yimin Gao, Sebastien E. Gay, Ali Emadi, "Modern Electric, Hybrid Electric,and Fuel Cell Vehicles Fundamentals, Theory, and Design", CRC Press, 2004

References:

1. Mehrdad Ehsani, Yimin Gao, Ali Emadi, "Modern Electric, Hybrid Electric, and Fuel Cell Vehicles: Fundamentals", CRC Press, 2010.
2. Sandeep Dhameja, "Electric Vehicle Battery Systems", 2000.http://nptel.ac.in/courses/108103009/

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AR – 25

ADVANCED MANUFACTURING AND ADDITIVE TECHNOLOGIES (Honors)

S. No.	Semester	Course Code	Course	L	T	P	C
1	II – II	23HMT201	Manufacturing Ecosystem and Digital Fabrication	4	0	0	4
2	III – I	23HMT302	Additive Manufacturing Technologies and Process Engineering	4	0	0	4
3	III – II	23HMT303	Design for Additive and Smart Manufacturing	4	0	0	4
4	IV – I	23HMP404	Mini Project	-	-	-	4
5	IV – II	23HMM405	MOOC Course – I	-	-	-	4
6		23HMM406	MOOC Course – II				
Total Credits							**20**

AR25 - B. Tech. -ME

II Year II Semester

MANUFACTURING ECOSYSTEM AND DIGITAL FABRICATION

Subject Code: ~~25HRT201~~ 25HMT201

L	T	P	C
4	0	0	4

COURSE OBJECTIVES:

- Fundamental Understanding: To impart knowledge of both conventional and non-conventional machining processes.
- Process Selection: To enable students to choose appropriate manufacturing methods based on material properties and design complexity.
- AM Proficiency: To introduce the fundamentals of additive manufacturing, including data preparation and various 3D printing technologies.
- Technical Evaluation: To compare the capabilities, limitations, and economics of different manufacturing techniques.

COURSE OUTCOMES:

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

CO1: Distinguish between conventional and non-conventional machining and identify the need for advanced processes.

CO2: Explain the working principles and process parameters of mechanical and thermal energy-based machining.

CO3: Evaluate chemical and electrochemical machining processes for specific industrial applications

CO4: Demonstrate knowledge of the AM technology, its history and select suitable AM techniques

CO5: Demonstrate knowledge of the AM process chain, from CAD modeling to final part fabrication.

UNIT - I

Conventional vs. Non-Conventional Machining: Limitations of traditional machining; Classification of Non-Conventional Machining; Selection criteria for advanced processes

UNIT - II

Mechanical & Thermal NCM Processes: Principles of Ultrasonic Machining (USM) and Abrasive Jet Machining (AJM); Introduction to Electric Discharge Machining (EDM) and Laser Beam Machining.

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and Management, Tekkali.

UNIT - III

Chemical & Electrochemical Machining: Mechanisms of Electrochemical Machining (ECM); Chemical Milling and Abrasive Flow Machining (AFM); Environmental considerations in chemical machining.

UNIT - IV

Introduction to Additive Manufacturing (AM): Introduction, Distinction between AM and NCM; Classification of AM techniques, Basic Process of AM; History of AM,Terminology associated with rapid prototyping, Key Aspects of AM, Benefits and limitations of AM.

UNIT - V

AM Process Chain: Design aCAD model, conversion of STL file in 3D CAD software, Slicing and support generation using Cura software, and toolpath generation, Post-processing basics.

Text Books

1. Gibson, I., Rosen, D., & Stucker, B. (2021). Additive manufacturing technologies: 3D printing, rapid prototyping, and direct digital manufacturing (3rd ed.). Springer.
2. Jain, V. K. (2009). Advanced machining processes. Allied Publishers.

Reference Books

1. Chua, C. K., & Leong, K. F. (2017). 3D printing and additive manufacturing: Principles and applications (5th ed.). World Scientific Publishing Company.
2. Mishra, P. K. (1997). Nonconventional machining. Narosa Publishing House.
3. Ramkumar, J. (2023). Unconventional machining processes: Fundamental principles and recent developments. CRC Press.

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Mechanical Engineering
Aditya Institute of Technology
and Management, Tekkali.

AR – 25

SMART CITIES (Honors)

S. No.	Semester	Course Code	Course	L	T	P	C
1	II – II	23HST201	Urban Planning and Essentials of Smart Cities	4	0	0	4
2	III – I	23HST302		4	0	0	4
3	III – II	23HST303		4	0	0	4
4	IV – I	23HST404		4	0	0	4
5	IV – II	23HSM405	MOOC Course – I	-	-	-	4
6		23HSM406	MOOC Course – II				
Total Credits							**20**

AR-25-B.Tech. Civil **II Year-I Sem**

Urban Planning and Essentials of Smart Cities

Course Code: 25HST201

L	T	P	C
4	0	0	4

COURSE OBJECTIVES

Students will have

- To interpret and illustrate trends of urbanisation.
- To explain various urban development plans.
- To illustrate design and development of urban development projects.
- To comprehend essential aspects of smart and sustainable cities.
- To infer policy planning and development of smart cities.
- To recognize the role of Governance in addressing the urban challenges and key issues

COURSE OUTCOME

1. Interpret and illustrate trends of urbanisation.
2. Explain various urban development plans.
3. Illustrate design and development of urban development projects.
4. Comprehend essential aspects of smart and sustainable cities.
5. Infer policy planning and development of smart cities.
6. Recognize the role of Governance in addressing the urban challenges and key issues

UNIT I

Basics of Urbanisation:

Definition of Human settlement, Urban area, Town, City, Urbanisation, Suburbanisation, Urban sprawl, Peri - urban areas, Central Business District (CBD), Classification of urban areas, Trends of Urbanisation at International, National, Regional and State level.

UNIT II

Urban Plan Formulation:

Scope and Content of Regional Plan, Master Plan, Detailed Development Plan, Development Control Rules, Transfer of Development Rights, Special Economic Zones- Development of small town and smart cities-case studies

UNIT III

Planning and Design of Urban Development Projects:

Site Analysis, Layout Design, Planning Standards, Project Formulation – Evaluation, Plan Implementation, Constraints and Implementation, Financing of Urban Development Projects

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AITAM, TEKKALI.

UNIT IV

Overview of Smart Cities:

Defining smart cities, Dimension, components and categories of smart cities. Global Standards and performance benchmarks, Practice codes.

UNIT V

Planning of Smart Cities:

General prerequisites of smart cities, Policy frame work for smart cities. India 100 smart cities policy and mission, planning and development.

Smart Governance:

Definitions, functions, objectives and benefits of smart Governance. Infrastructure for smart governance. Initiatives and implementation stages of smart governance.

Text Books:

1. P.P. Anil Kumar, Introduction to Smart Cities, Pearson India Publisher, 2020.

References:

1. Allen G.Noble, (Eds), 'Regional Development and Planning for the 21st Century: New Priorities and New Philosophies', Aldershot, USA, 1988.
2. Andy Pike, Andres Rodriguez-Pose, John Tomaney, 'Handbook of Local and Regional Development', Taylor & Francis, 2010
3. Andreas Faludi and Sheryl Goldberg, 'Fifty years of Dutch National Physical Planning, Alexandrine Press, Oxford, 1991.
4. Daniel G. Parolek, AIA, Karen Parolek, Paul C. Crawford, FAICP, Form Based Codes: A Guide for Planners, Urban Designers, Municipalities, and Developers, John Wiley & Sons, 2008
5. Smart Cities: Big Data and the Quest for a New Utopia, Anthony M. Townsend, ISBN: 978-0-393-08287-6

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Department of Civil Engineering
AITAM, TEKKALI.

AR – 25

ARTIFICIAL INTELLIGENCE AND MACHINE LEARNING (Minor)

S. No.	Semester	Course Code	Course	L	T	P	C
1	II – II	25NAT201	Foundations of Artificial Intelligence	4	0	0	4
2	III – I	25NAT302	Machine Learning Techniques	4	0	0	4
3	III – II	25NAT303	Deep Learning and Computer Vision	4	0	0	4
4	IV – I	25NAT404	Generative AI and Large Language Models	4	0	0	4
5	IV – II	25NAM405	MOOC Course – I	-	-	-	2
6		25NAM406	MOOC Course – II	-	-	-	
Total Credits							**18**

Foundations of Artificial Intelligence

(Applicable for II Year II Semester)

Subject code: 25NAT201

L	T	P	C
4	0	0	4

Course Objectives

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

1. Understand the evolution and applications of Artificial Intelligence.
2. Apply intelligent search algorithms to solve real-world problems.
3. Understand knowledge representation and reasoning mechanisms.
4. Learn uncertain reasoning and decision-making methods.
5. Design basic intelligent systems using AI techniques.

Course Outcomes

After completing this course, students will be able to:

1. Explain AI concepts, intelligent agents, and AI applications.
2. Solve problems using classical search algorithms.
3. Apply knowledge representation and logical reasoning techniques.
4. Analyze uncertainty using probabilistic reasoning.
5. Develop simple AI-based solutions considering ethical AI principles.

Unit – I

Introduction to Artificial Intelligence: Definition and History of AI, Characteristics of Intelligent Agents, Types of AI, Applications of AI, AI Problem Solving, State Space Representation, Production Systems, AI Programming Environments, Intelligent Agents, PEAS Representation, Rationality.

Unit – II

Intelligent Search Strategies: Problem Formulation, Search Trees, Uninformed Search, Breadth First Search, Depth First Search, Uniform Cost Search, Iterative Deepening Search, Informed Search, Best First Search, Greedy Search, A* Algorithm, Hill Climbing, Local Search, Constraint Satisfaction Problems**.**

Unit – III

Knowledge Representation Logic in AI, Propositional Logic, Predicate Logic, Forward Chaining, Backward Chaining, Semantic Networks, Frames, Rule-Based Systems, Expert Systems, Ontology Basics.

Unit – IV

Reasoning Under Uncertainty, Probability Basics, Bayesian Reasoning, Bayes Theorem, Bayesian Networks, Decision Trees, Fuzzy Logic, Approximate Reasoning.

Unit – V

AI Applications: Natural Language Processing, Computer Vision, Robotics, Recommender Systems, Healthcare AI, Smart Manufacturing, AI Ethics, Responsible AI, Explainable AI

Textbooks

1. **Stuart Russell and Peter Norvig** - *Artificial Intelligence: A Modern Approach*, Pearson Education, 4th Edition, 2022.
2. **Ian Goodfellow, YoshuaBengio, and Aaron Courville** - *Deep Learning*, MIT Press, 2016.

Reference Books

1. **François Chollet** - *Deep Learning with Python*, Manning Publications, 2nd Edition, 2021.
2. **Tom Mitchell** - *Machine Learning*, McGraw-Hill, 1997.
3. **AurélienGéron** - *Hands-On Machine Learning with Scikit-Learn, Keras, and TensorFlow*, O'Reilly Media, 2nd Edition, 2019.
4. Research Papers: Google AI Blog, OpenAI Research Papers.

Reference Links

1. https://www.coursera.org/courses?query=artificial%20intelligence
2. https://pll.harvard.edu/subject/artificial-intelligence
3. https://www.udemy.com/course/how-to-use-artificial-intelligence-a-guide-for-everyone

AR – 25

DATA SCIENCE (Minor)

S. No.	Semester	Course Code	Course	L	T	P	C
1	II – II	25NDT201	Foundation to Data Science	4	0	0	4
2	III – I	25NDT302		4	0	0	4
3	III – II	25NDT303		4	0	0	4
4	IV – I	25NDP404		-	-	-	4
5	IV – II	25NDM405	MOOC Course – I	-	-	-	2
6		25NDM406	MOOC Course – II	-	-	-	
Total Credits							**18**

AR 25 – B.Tech – IT

Aditya Institute of Technology and Management (Autonomous), Tekkali

II Year B.Tech (INFORMATION TECHNOLOGY) – 2nd Sem

FOUNDATION TO DATA SCIENCE

(Minor Degree-Data Science)

Subject Code:25NDT201	L	T	P	C
	4	0	0	4

COURSE OBJECTIVES

- Understand basic concepts of data and Data Science.
- Learn basic Python programming for handling data.
- Understand the Data Science Lifecycle.
- Understand basic statistics concepts.
- Learn data handling and basic analysis.

COURSE OUTCOMES

1. Understand basic Data Science concepts
2. Write simple Python programs
3. Understand the Data Science Lifecycle.
4. Handle and analyze simple datasets
5. Perform basic data analysis using Python

UNIT-I

Introduction to Data Science and Data: Introduction to Data, Types of Data(Structured, Unstructured, Semi-structured). Introduction to Data Science, Applications of Data Science, Role of Data Scientist, Data Science lifecycle overview

UNIT-II

Basics of Python Programming: Introduction to Python, Python installation and Jupyter Notebook, Variables and data types, Operators, Control statements, List, Tuples, Dictionaries.

UNIT-III

Data Science Lifecycle : Steps in Data Science life-cycle: Problem definition, Data collection, Data cleaning, Data analysis, Data visualization, Decision making.

UNIT-IV

Basic Statistics for Data Science: Introduction to statistics, Mean, Median, Mode, Standard deviation (basic idea), Introduction to probability (basic concept).

UNIT-V

Introduction to Data Handling using Python: Introduction to datasets, CSV file format, Introduction to NumPy, Introduction to Pandas, Reading and displaying data, Basic data analysis.

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Text Books:

1. Wes McKinney," Python for Data Analysis ", O'Reilly Media, 3rd Edition, 2022.
2. Eric Matthes," Python Crash Course ",No Starch Press, 3rd Edition, 2023.

Reference Books:

1. Joel Grus, "Data Science from Scratch", O'Reilly Media, 2nd Edition 2019.
2. Allen B. Downey, "Think Python", O'Reilly Media, 2nd Edition ,2015.

AR – 25

CYBER SECURITY (Minor)

S. No.	Semester	Course Code	Course	L	T	P	C
1	II – II	25NCT201	Computer Security & Audit Assurance	4	0	0	4
2	III – I	25NCT302	Mobile Application Security	4	0	0	4
3	III – II	25NCT303	Cloud Security	4	0	0	4
4	IV – I	25NCP404	Mini Project	-	-	-	4
5	IV – II	25NCM405	MOOC Course – I	-	-	-	2
6		25NCM406	MOOC Course – II	-	-	-	
Total Credits							**18**

L	T	P	C
4	0	0	4

SubjectCode: 25NCT201

COMPUTERSECURITY&AUDITASSURANCE

Prerequisite: Basic understanding of computer networks, operating systems, information security principles, and auditing practices.

Course Objectives:

1. To introduce basicconcepts in information systems security, including security technologyand principles, software security, trusted systems, and IT security management.
2. Toexplainconceptsrelatedtovariouscryptographictoolsandtheirapplicationininformation security.

Course Outcomes:

1. Tostatetherequirementsandmechanismsforidentificationand authentication.
2. Toexplainandcomparevariousaccesscontrolpoliciesandmodelsandassuretheir effectiveness.
3. Tounderstandandapplystandardpracticesandpoliciesinconductingaudits.
4. ToanalyzethesignificanceofNetworkSecurityandControl,InternetBankingRisksand Controls.
5. To evaluate Business Continuity and Disaster Recovery Planning Control, including backup, storage, and disaster recovery strategies.

UNIT-I: SystemAudit andAssurance

Characteristics of Assurance Services, Types of Assurance Services, Certified Information System Auditor (CISA), Benefits of Audits for Organizations, COBIT Framework, Importance of System Audit (GRC).

UNIT-II:InternalControlandInformation SystemAudit

Internal Control, Detective Control, Corrective Control, Computer Assisted Audit Tools (CAAT), TechniquesforAuditingInformationSystems,RoleofInternalControlsinSecurity,Evaluationof IT Governance.

UNIT-III: ConductingAudit

Standard Practices and Policies for Auditing, Audit Planning and Risk Assessment, Information GatheringTechniques, IdentifyingVulnerabilities,SystemSecurityTesting,AuditingTechniques for Banks, Audit Reporting and Documentation.

UNIT-IV:NetworkSecurityandControl

Network Security Fundamentals, Firewalls (WAF) and Intrusion Detection Systems (IDS), Internet Banking Risks and Controls, Operating System Risks and Control, Securing Network Protocols, Operational Control Overview in Information Security.

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UNIT-V:BusinessContinuityandDisasterRecoveryPlanningControl

DataBackupandStorageTechniques,DevelopingaDisasterRecoveryStrategy,BusinessContinuity Planning (BCP), Business Impact Analysis (BIA), Role of Cloud Computing in Disaster Recovery, Risk Management in BCP.

Textbooks

1. Moeller,R.R.(2005).InformationSystemAuditandAssurance.TataMcGraw-Hill Education. ISBN: 978-0070585690
2. Stallings,W.,&Brown,L.(2017).ComputerSecurity:PrinciplesandPractice(4thed.). Pearson Education. ISBN: 978-0134794105
3. Johnson,M.(2009).AuditingITInfrastructuresforCompliance.JonesandBartlett Publishers. ISBN: 978-0763791834

ReferenceBooks

1. Stamp,M.(2005).InformationSystemsSecurity:PrinciplesandPractice.PearsonEducation. ISBN: 978-0131547292
2. Whitman,M.E.,&Mattord,H.J.(2014).PrinciplesofInformationSecurity(5thed.). Cengage Learning. ISBN: 978-1285448367

MOOCLinks:

1. https://www.coursera.org/learn/information-systems-auditing-control-assurance
2. https://www.edx.org/course/fundamentals-of-cybersecurity
3. https://www.udemy.com/course/cybersecurity-for-beginners/
4. https://www.linkedin.com/learning/auditing-it-infrastructure-for-compliance
5. https://www.futurelearn.com/courses/cyber-security-risk-management

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AR – 25

QUANTUM TECHOLOGIES (Minor)

S. No.	Semester	Course Code	Course	L	T	P	C
1	II – II	25NQT201	Introduction to Quantum Technologies and Applications	4	0	0	4
2	III – I	25NQT302	Foundations of Quantum Technologies	4	0	0	4
3	III – II	25NQT303	Principles of Quantum Algorithms and Information	4	0	0	4
4	IV – I	25NQP404	Mini Project	-	-	-	4
5	IV – II	25NQM405	MOOC Course – I	-	-	-	2
6		25NQM406	MOOC Course – II	-	-	-	
Total Credits							**18**

Introduction to Quantum Technologies and Applications

Subject code: ~~25XXXXXX~~ 25NQT201

L	T	P	C
4	0	0	4

Course Outcomes

CO1: Differentiate classical and quantum information concepts and explain superposition, entanglement, and uncertainty using basic physical interpretations.

CO2: Apply vector spaces, Dirac notation, and matrix representations to describe and manipulate quantum states mathematically.

CO3: Explain the postulates of quantum mechanics and analyse quantum state evolution and measurement in different bases.

CO4: Perform basic single-qubit operations using quantum gates and determine their effects on standard basis states.

CO5: Summarize key applications of quantum technologies such as teleportation, cryptography, sensing, and identify major quantum computing platforms.

Unit 1: Classical vs Quantum Information

Quantum States, Wave functions, Probabilistic interpretation, Wave particle Duality, Heisenberg Uncertainty Principle, Difference between bits and qubits

Young's Double slit Experiment, Superposition and entanglement (conceptual), Real-life analogy: Coin toss vs light polarization, (Stern-Gerlach Experiment) Need for quantum technology (Moore's law, limits of classical computing

Unit 2: Mathematical Tools and Quantum States

Vector space: states as vectors; Dirac notation: $|0\rangle$, $|1\rangle$, $|\psi\rangle$; Complex numbers and probability amplitudes; Inner product, norm, orthogonality (with physical meaning); Simple matrix representation of qubit states

Unit 3: Postulates of Quantum Mechanics

Quantum states in Hilbert space; Unitary evolution of states; Measurement postulate: observable, probability; Projective measurement examples; Basis change: measurement in different bases

Unit 4: Qubits and Quantum Gates (Introduction to quantum computing)

Representation of qubits: Bloch sphere (concept only); Pauli gates: X, Y, Z (with physical analogies); Hadamard gate: creating superposition; Gate matrices and action on basis states; Simple gate operations: $X|0\rangle$, $H|0\rangle$, etc.

Unit 5: Applications of Quantum Technology

Introduction to quantum teleportation (concept only); Quantum cryptography (BB84 protocol); Quantum sensing and quantum metrology; Basics of photon (single and entangled) generation and detection. Overview of quantum computing platforms (IBM Q, Google Sycamore); Career and research paths in Quantum Tech.

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Prescribed books:

1. Quantum Computation and Quantum Information by Michael A. Nielsen & Isaac L. Chuang (Chapters 1 & 2)
2. Quantum Mechanics: The Theoretical Minimum by Leonard Susskind & Art Friedman (Chapter on wave-particle duality)
3. Quantum Mechanics by David J. Griffiths (Sections on linear algebra in QM)

Reference books:

1. Quantum Mechanics by R. Shankar (Detailed postulates and measurement theory)
2. Nielsen & Chuang (Measurement postulates and unitary evolution chapters)
3. Nielsen & Chuang (Chapters on quantum gates and the Bloch sphere)
4. Quantum Computing: A Gentle Introduction by Eleanor Rieffel and Wolfgang Polak
5. Nielsen & Chuang (Chapter on quantum teleportation and cryptography)
6. Quantum Cryptography and Secret-Key Distillation by Nicolas Gisin (Review paper)

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AR – 25

INTERNET OF THINGS (Minor)

S. No.	Semester	Course Code	Course	L	T	P	C
1	II – II	25NIT201	Introduction to IoT	4	0	0	4
2	III – I	25NIT302	Sensors and Actuators in IoT	4	0	0	4
3	III – II	25NIT303	IoT Architecture and Protocols	4	0	0	4
4	IV – I	25NIT404	IoT Applications and Case Studies	4	0	0	4
5	IV – II	25NIM405	MOOC Course – I	-	-	-	2
6		25NIM406	MOOC Course – II	-	-	-	
Total Credits							**18**

AR 25 – B.Tech – ECE

Aditya Institute of Technology and Management (Autonomous), Tekkali

II Year B.Tech (Electronics and Communication Engineering) – 2 nd Sem

INTRODUCTION TO IOT
(Minor Degree- Internet of Things)

Subject Code: 25NIT201	L	T	P	C
	4	0	0	4

COURSE OBJECTIVES

- To learn fundamentals of IoT such as Components, Networking and Communication technologies.
- To discuss various network configurations and topologies.
- To differentiate sensors and actuators used in IoT.
- To study different communication protocols for IoT communication.
- To study the salient features and application scope of each connectivity protocol.

COURSE OUTCOMES

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

CO 1. Explain the evolution of different internet technologies and need for IoT.
CO 2. Identify different networking components in IoT with respect to OSI layer.
CO 3. Analyze the need of sensors and actuators used in IoT.
CO 4. Determine the requirements associated with each of these communication protocols in real-world solutions.
CO 5. Explain the terminologies and technologies associated with IoT connectivity.

UNIT – I

Fundamentals of IoT: Introduction, Evolution of IoT, IoT Functional Blocks, IoT and M2M, IoT - CPS, IoT- WoT, Various enablers of IoT and Complex interdependence technologies, Networking components of IoT.

UNIT –II

Networking Components in IoT: Introduction, Network types (PAN, LAN, WAN and MAN), Network reachability, OSI model, Internet Protocol suite, Data link layer addressing, Network layer addressing, TCP/IP transport layer.

UNIT - III

IoT sensors and actuators: Introduction, Sensors and its characteristics, types of sensing, Actuators, characteristics of actuators, types of actuators, Sensors and Actuators with Microcontrollers (Arduino/ESP/Raspberry Pi)

UNIT - IV

IoT software and Protocols: Introduction, data protocols, MQTT, MQTT-SN, CoAP, XMPP, HTTP, Web Socket, Identification protocols, EPC, µCode.

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UNIT -V

Connectivity Technologies in IoT: Introduction, IEEE 802.15.4, Zigbee, Communication topologies in Zigbee, RFID, Lora, WI-Fi, Bluetooth.Comparison of IoT Communication Technologies (Range, Data Rate, Power, Applications).

TEXT BOOKS

1. Misra, S., Mukherjee, A., & Roy, A. (2021). *Introduction to IoT*. Cambridge: Cambridge University Press. doi:10.1017/9781108913560.
2. Vijay Madisetti, ArshdeepBahga, Adrian McEwen (Author), Hakim Cassimally "Internet of Things A Hands-on-Approach" University Press, 2014.

REFERENCE BOOKS

1. Adrian McEwen, Hakim Cassimally "Designing the Internet of Things", John Wiley & Sons, 2014.
2. Joe Biron and Jonathan Follett "Foundational Elements of an IoT Solution: The Edge, The Cloud, and Application Development", First Edition. Cisco Press, 2017.

WEB LINKS

1. https://onlinecourses.nptel.ac.in/noc21_ee85/course
2. https://onlinecourses.nptel.ac.in/noc21_cs17/preview
3. https://nptel.ac.in/courses/106/105/106105166/

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AR – 25

ROBOTICS AND AUTOMATION (Minor)

S. No.	Semester	Course Code	Course	L	T	P	C
1	II – II	25NRT201	Introduction to Robotics and Mechatronics	4	0	0	4
2	III – I	25NRT302	Fundamentals of Automation for Robotics	4	0	0	4
3	III – II	25NRT303	Robot Programming and Applications	4	0	0	4
4	IV – I	25NRP404	Mini Project	-	-	-	4
5	IV – II	25NRM405	MOOC Course – I	-	-	-	2
6		25NRM406	MOOC Course – II	-	-	-	
Total Credits							**18**

AR25 - B. Tech. -ME

II Year II Semester

INTRODUCTION TO ROBOTICS AND MECHATRONICS

(Minor Course: ROBOTICS AND AUTOMATION)

Subject Code: 25NRT201

L	T	P	C
4	0	0	4

COURSE OBJECTIVES:

- The course is aimed at providing concepts and skills in the industrial automation domain related to mechatronics, robotics, electrical machines and drives.
- In this subject, the fundamental concepts and methodologies are introduced for understanding mechatronic systems and industrial robots; then, they will acquire fundamental knowledge and competences of the subject.
- This course will helps in understanding the evolving Mechatronics systems from their underlying physical principles and properties.
- This course recognizes the synergistic combination of all related branches of engineering and have adequate multi-disciplinary knowledge and conceptual skills

COURSE OUTCOMES:

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

CO1: Understand the history, evolution and anatomy of robot.

CO2: Comprehend the concept of machine and mechanism, architecture and selection of actuation system for various applications.

CO3: Apply the knowledge of sensors for a typical application of robots.

CO4: Design the process of Mechatronics system

CO5: Describe and discuss the basic fundamentals of microprocessors and microcontrollers

UNIT - I

Introduction to Robotics: Brief History, Automation and Types, Robots, Robotics and, Principles, Development of Robotics, Laws of Robotics, Specifications and Classifications, Degree of Freedom, Anatomy and Work Volume, Applications.

UNIT - II

Robot Actuation Systems: Machine and Mechanism, Architecture of Robotics Systems Mechanical - Cams, Gear trains, Ratchet and Pawl, Belt and chain drives, Bearings. Electrical - Electrical systems, Solid State Switches, Solenoids, D.C. motors, A.C. motors, Stepper motors, Pneumatic and, Hydraulic Actuation System - Introduction to Hydraulic and Pneumatic Systems,

P. Srihari

Head of the Department
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Directional Control valves, Flow control valves.

UNIT - III

Sensors: Robotic Sensors, Position Sensors - Optical, Non-Optical, Velocity Sensors, Accelerometers, Proximity Sensors - Contact, Non-Contact, Range Sensing, Touch and Slip Sensors, Force and Torque Sensors

UNIT - IV

Introduction to Mechatronics: Definition and Components, Applications, Mechatronics System Design, Procedure and Possible Design Solutions, Building Blocks of Mechanical, Electrical, Electro-Mechanical, Thermal and Fluid Systems, Open and Closed Loop Systems, Digital and Analogue Control Systems.

UNIT - V

Basic Introduction to Microprocessor: Microcontrollers and PIC Microcontroller, 8051 Programming, Peripheral Interfacing, Microprocessor, Microcontroller in Robotics, Control Modes, PID and Digital Controllers, Velocity Control, Adaptive Control, , Programmable Logic Controllers: Fundamentals of PLCs, Mnemonics and Timers, Relays and Counters, Master and Jump Control, Data Control, Analog I/O Control

Text Books

1. R.K. Mittal & I.J. Nagrath, "Robotics & Control" TMH-2007.
2. Groover. M.P. Industrial Robotics, technology, programming and application Mc-Graw Hill 2012.

Reference Books

1. S Fu, R.C. Gonzalez, C.S.G. Lee, Robotics, McGraw Hill, 1987.
2. S. K. Saha, "Introduction to Robotics", Tata McGraw-Hill Publishing Company Ltd. (2008).
3. Craig. J. J. "Introduction to Robotics- mechanics and control", Addison- Wesley, 1999.
4. Asada, H., and J. J. Slotine. *Robot Analysis and Control.* New York, NY: Wiley, 1986. ISBN: 9780471830290.

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AR – 25

INNOVATION, ENTREPRENEURSHIP AND VENTURE DEVELOPMENT (IEV) (Minor)

S. No.	Semester	Course Code	Course	L	T	P	C
1	II – II	25NVT201	Foundations of Innovation and Creative Thinking	4	0	0	4
2	III – I	25NVT302	Entrepreneurship Fundamentals and Opportunity Recognition	4	0	0	4
3	III – II	25NVT303	Venture Planning and Business Model Development	4	0	0	4
4	IV – I	25NVP404	Mini Project (Venture development and Implementation)	-	-	-	4
5	IV – II	25NVM405	MOOC Course – I	-	-	-	2
6		25NVM406	MOOC Course – II	-	-	-	
Total Credits							**18**

AR-25-B.Tech. **II Year II Semester**

FOUNDATIONS OF INNOVATION AND CREATIVE THINKING

L	T	P	C
4	0	0	4

SUBJECT CODE: 25NVT201

Course Description

This foundational course introduces first-year B.Tech students to the concepts of innovation, creativity, and design thinking. Students will learn to identify problems, generate creative solutions, and understand the innovation ecosystem. The course emphasizes experiential learning through hands-on activities, case studies, and collaborative projects that foster creative confidence and innovative mindset.

Course Objectives

- To develop creative thinking and problem-solving capabilities among engineering students
- To introduce students to design thinking methodology and human-centered innovation
- To familiarize students with the innovation ecosystem and various types of innovations
- To cultivate an entrepreneurial mindset and awareness of opportunity identification
- To develop collaborative skills through team-based innovation projects

Course Outcomes

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

CO1: Apply creative thinking techniques to generate innovative solutions to engineering problems

CO2: Utilize design thinking methodology to develop human-centered solutions

CO3: Analyze and differentiate between various types of innovations and their applications

CO4: Demonstrate collaborative problem-solving skills in multidisciplinary team settings

CO5: Evaluate innovation opportunities and articulate value propositions clearly

Course Outline

UNIT 1: Introduction to Innovation and Creativity

Defining innovation, Innovation vs. invention, Characteristics of innovative thinkers. Creativity fundamentals- Divergent and convergent thinking, Creative thinking techniques (Brainstorming, SCAMPER, Mind Mapping, Random Word Association)

UNIT 2: Design Thinking and Human-Centered Innovation

Introduction to design thinking, The five stages, Empathy building, Problem definition, Ideation techniques, Prototyping principles, Testing and iteration, End-to-end design thinking project

UNIT 3: Innovation Ecosystem and Opportunity Recognition

Understanding the innovation ecosystem, Role of industry and government in innovation, Technology transfer and commercialization basics, Intellectual property awareness, Problem-finding techniques, Opportunity recognition, PESTLE analysis

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UNIT 4: Collaborative Innovation and Team Dynamics

Importance of multidisciplinary collaboration in innovation, Team formation and development: Tuckman's stages, Effective communication in teams, Conflict resolution and consensus building, Leveraging diverse perspectives, Innovation tools for collaboration, Project management basics for innovation projects, Team-based innovation challenge

UNIT 5: Innovation in Practice and Presentation Skills

Rapid prototyping: Materials, techniques, and tools (cardboard, 3D printing basics), Minimum Viable Product (MVP) concept, Storytelling for innovation, Presentation skills (Pitch structure, visual design, delivery techniques), Elevator pitch development and practice, Innovation showcase, Feedback and iteration, Reflection and continuous improvement

Reference Books

1) Brown, T. (2019). Change by Design: How Design Thinking Transforms Organizations and Inspires Innovation. HarperBusiness.
2) Kelley, T., & Kelley, D. (2013). Creative Confidence: Unleashing the Creative Potential Within Us All. Crown Business.
3) Ries, E. (2011). The Lean Startup: How Today's Entrepreneurs Use Continuous Innovation to Create Radically Successful Businesses. Crown Business.
4) Michalko, M. (2006). Thinkertoys: A Handbook of Creative-Thinking Techniques (2nd ed.). Ten Speed Press.
5) Kumar, V. (2012). 101 Design Methods: A Structured Approach for Driving Innovation in Your Organization. Wiley.

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