



JNTUA B.Tech. R20 Regulations

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY ANANTAPUR (Established by Govt. of A.P., ACT No.30 of 2008) ANANTAPUR – 515 002 (A.P) INDIA

B.TECH. - COMPUTER SCIENCE & ENGINEERING Course Structure (R20) – III & IV Year

Semester–V						
S.No.	Course Code	Course Name	L	T	P	Credits
1.	20A05501T	Computer Networks	3	0	0	3
2.	20A05502T	Artificial Intelligence	3	0	0	3
3.	20A05503	Formal Languages and Automata Theory	3	0	0	3
4.	20A05504a 20A04702b 20A05504c	Professional Elective Course – I Software Project Management Digital Image Processing Big Data Technologies	3	0	0	3
5.		Open Elective Course – I	3	0	0	3
6.	20A05501P	Computer Networks Lab	0	0	3	1.5
7.	20A05502P	Artificial Intelligence Lab	0	0	3	1.5
8.	20A05506	Skill oriented course – III Advanced Web Application Development	1	0	2	2
9.	20A05507	Evaluation of Community Service Project				1.5
Total						21.5

Open Elective-I

S.No.	Course Code	Course Name	Offered by the Dept.
1	20A01505	Building Technology	CE
2	20A02505	Electric Vehicles	EEE
3	20A03505	3D Printing Technology	ME
4	20A04507	MATLAB Programming for Engineers	ECE/EEE
5	20A04508	Introduction to Control Systems	ECE/EEE
6	20A27505	Computer Applications in Food Processing	FT
7	20A54501	Optimization Techniques	Mathematics
8	20A56501	Materials Characterization Techniques	Physics
9	20A51501	Chemistry of Energy Materials	Chemistry

Note:

1. A student is permitted to register for Honours or a Minor in IV semester after the results of III Semester are declared and students may be allowed to take maximum two subjects per semester pertaining to their Minor from V Semester onwards.
2. A student shall not be permitted to take courses as Open Electives/Minor/Honours with content substantially equivalent to the courses pursued in the student's primary major.
3. A student is permitted to select a Minor program only if the institution is already offering a Major degree program in that discipline



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Semester-VI						
S.No	Course Code	Course Name Semester-VI	L	T	P	Credits
1.	20A05601T	Compiler Design	3	0	0	3
2.	20A05602T	Machine Learning	3	0	0	3
3.	20A05603T	Internet of Things	3	0	0	3
4.	20A05604a 20A05604b 20A05604c	Professional Elective Course- II Software Testing Advanced Computer Architecture Computer Vision	3	0	0	3
5.		Open Elective Course – II	3	0	0	3
6.	20A05601P	Compiler Design Lab	0	0	3	1.5
7.	20A05602P	Machine Learning Lab	0	0	3	1.5
8.	20A05603P	Internet of Things Lab	0	0	3	1.5
9.	20A52401	Skill oriented course - IV Soft Skills	1	0	2	2
10.	20A99601	Mandatory Non-credit Course Intellectual Property Rights & Patents	2	0	0	0
Total						21.5
Industry Internship (Mandatory) for 6 – 8 weeks duration during summer vacation						

Open Elective-II

S.No	Course Code	Course Name	Offered by the Dept.
1	20A01605	Environmental Economics	CE
2	20A02605	Smart Electric Grid	EEE
3	20A03605	Introduction to Robotics	ME
4	20A04605	Signal Processing	ECE
5	20A04606	Basic VLSI Design	ECE
6	20A27605	Food Refrigeration and Cold Chain Management	FT
7	20A54701	Discrete Time Systems and Applications	Mathematics
8	20A56701	Physics Of Electronic Materials and Devices	Physics
9	20A51701	Chemistry of Polymers and its Applications	Chemistry



JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY ANANTAPUR

B.Tech (CSE)– III-I Sem

L	T	P	C
3	0	0	3

(20A05501T) COMPUTER NETWORKS

Common to CSE,IT,CSD,CSE(AI),CSE(AI&ML),AI&DS,CSE(IOT)

Course Objectives:

The course is designed to

- Understand the basic concepts of Computer Networks.
- Introduce the layered approach for design of computer networks
- Expose the network protocols used in Internet environment
- Explain the format of headers of IP, TCP and UDP
- Familiarize with the applications of Internet
- Elucidate the design issues for a computer network

Course Outcomes:

After completion of the course, students will be able to

- Identify the software and hardware components of a computer network
- Design software for a computer network
- Develop new routing, and congestion control algorithms
- Assess critically the existing routing protocols
- Explain the functionality of each layer of a computer network
- Choose the appropriate transport protocol based on the application requirements

UNIT I Computer Networks and the Internet

Lecture 8Hrs

What Is the Internet? The Network Edge, The Network Core, Delay, Loss, and Throughput in Packet-Switched Networks(Textbook 2), Reference Models, Example Networks, Guided Transmission Media, Wireless Transmission(Textbook 1)

UNIT II The Data Link Layer, Access Networks, and LANs

Lecture 10Hrs

Data Link Layer Design Issues, Error Detection and Correction, Elementary Data Link Protocols, Sliding Window Protocols (Textbook 1) Introduction to the Link Layer, Error-Detection and -Correction Techniques, Multiple Access Links and Protocols, Switched Local Area Networks Link Virtualization: A Network as a Link Layer, Data Center Networking, Retrospective: A Day in the Life of a Web Page Request (Textbook 2)

UNIT III The Network Layer

Lecture 8Hrs

Routing Algorithms, Internetworking, The Network Layer in The Internet (Textbook 1)

UNIT IV The Transport Layer

Lecture 9Hrs

Connectionless Transport: UDP (Textbook 2), The Internet Transport Protocols: TCP, Congestion Control (Textbook 1)

UNIT V Principles of Network Applications

Lecture 8Hrs

Principles of Network Applications, The Web and HTTP, Electronic Mail in the Internet, DNS—The Internet's Directory Service, Peer-to-Peer Applications Video Streaming and Content Distribution Networks (Textbook 2)

Textbooks:

1. Andrew S.Tanenbaum, David j.wetherall, Computer Networks, 5th Edition, PEARSON.
2. James F. Kurose, Keith W. Ross, "Computer Networking: A Top-Down Approach", 6th edition, Pearson, 2019.



Reference Books:

1. Forouzan, Datacommunications and Networking, 5th Edition, McGraw Hill Publication.
2. Youlu Zheng, Shakil Akthar, "Networks for Computer Scientists and Engineers", Oxford Publishers, 2016.

Online Learning Resources:

<https://nptel.ac.in/courses/106105183/25>

<http://www.nptelvideos.in/2012/11/computer-networks.html>

<https://nptel.ac.in/courses/106105183/3>



JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY ANANTAPUR
B.Tech (CSE)– III-I Sem

L T P C
3 0 0 3

(20A05502T) ARTIFICIAL INTELLIGENCE
COMMON To CSE,IT,CSD, CSE (DS), CSE(IOT)

Course Objectives:

This course is designed to:

- Introduce Artificial Intelligence
- Teach about the machine learning environment
- Present the searching Technique for Problem Solving
- Introduce Natural Language Processing and Robotics

Course Outcomes:

After completion of the course, students will be able to

- Apply searching techniques for solving a problem
- Design Intelligent Agents
- Develop Natural Language Interface for Machines
- Design mini robots
- Summarize past, present and future of Artificial Intelligence

UNIT I Introduction

Lecture 9Hrs

Introduction: What is AI, Foundations of AI, History of AI, The State of Art.

Intelligent Agents: Agents and Environments, Good Behaviour: The Concept of Rationality, The Nature of Environments, The Structure of Agents.

UNIT II Solving Problems by searching

Lecture 9 Hrs

Problem Solving Agents, Example problems, Searching for Solutions, Uninformed Search Strategies, Informed search strategies, Heuristic Functions, Beyond Classical Search: Local Search Algorithms and Optimization Problems, Local Search in Continuous Spaces, Searching with Nondeterministic Actions, Searching with partial observations, online search agents and unknown environments.

UNIT III Reinforcement Learning & Natural Language Processing

Lecture 8Hrs

Reinforcement Learning: Introduction, Passive Reinforcement Learning, Active Reinforcement Learning, Generalization in Reinforcement Learning, Policy Search, applications of RL

Natural Language Processing: Language Models, Text Classification, Information Retrieval, Information Extraction.

UNIT IV Natural Language for Communication

Lecture 8 Hrs

Natural Language for Communication: Phrase structure grammars, Syntactic Analysis, Augmented Grammars and semantic Interpretation, Machine Translation, Speech Recognition

Perception: Image Formation, Early Image Processing Operations, Object Recognition by appearance, Reconstructing the 3D World, Object Recognition from Structural information, Using Vision.

UNIT V Robotics

Lecture 10Hrs

Robotics: Introduction, Robot Hardware, Robotic Perception, planning to move, planning uncertain movements, Moving, Robotic software architectures, application domains

Philosophical foundations: Weak AI, Strong AI, Ethics and Risks of AI, Agent Components, Agent Architectures, Are we going in the right direction, What if AI does succeed.

Textbooks:

1. Stuart J.Russell, Peter Norvig, "Artificial Intelligence A Modern Approach", 3rd Edition, Pearson Education, 2019.

Reference Books:

1. Nilsson, Nils J., and Nils Johan Nilsson. Artificial intelligence: a new synthesis. Morgan Kaufmann, 1998.
2. Johnson, Benny G., Fred Phillips, and Linda G. Chase. "An intelligent tutoring system for the accounting cycle: Enhancing textbook homework with artificial intelligence." Journal of Accounting Education 27.1 (2009): 30-39.

Online Learning Resources:

<http://peterindia.net/AILinks.html>

<http://nptel.ac.in/courses/106106139/>

<https://nptel.ac.in/courses/106/105/106105152/>



JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY ANANTAPUR
B.Tech (CSE)– III-I Sem **L T P C**
3 0 0 3
(20A05503) FORMAL LANGUAGES AND AUTOMATA THEORY

Course Objectives:

This course is designed to:

- Introduce languages, grammar, and computational models
- Explain the Context Free Grammars
- Enable the students to use Turing machines
- Demonstrate decidability and un-decidability for NP-Hard problems

Course Outcomes:

After completion of the course, students will be able to

- List types of Turing Machines
- Design Turing Machine
- Formulate decidability and undesirability problems

UNIT I Finite Automata

Why Study Automata Theory? The Central Concepts of Automata Theory, Automation, Finite Automata, Transition Systems, Acceptance of a String by a Finite Automaton, DFA, Design of DFAs, NFA, Design of NFA, Equivalence of DFA and NFA, Conversion of NFA into DFA, Finite Automata with E-Transition, Minimization of Finite Automata, Mealy and Moore Machines, Applications and Limitation of Finite Automata.

UNIT II Regular Expressions

Regular Expressions, Regular Sets, Identity Rules, Equivalence of two Regular Expressions, Manipulations of Regular Expressions, Finite Automata, and Regular Expressions, Inter Conversion, Equivalence between Finite Automata and Regular Expressions, Pumping Lemma, Closers Properties, Applications of Regular Expressions, Finite Automata and Regular Grammars, Regular Expressions and Regular Grammars.

UNIT III Context Free Grammars

Formal Languages, Grammars, Classification of Grammars, Chomsky Hierarchy Theorem, Context-Free Grammar, Leftmost and Rightmost Derivations, Parse Trees, Ambiguous Grammars, Simplification of Context Free Grammars-Elimination of Useless Symbols, E-Productions and Unit Productions, Normal Forms for Context Free Grammars-Chomsky Normal Form and Greibach Normal Form, Pumping Lemma, Closure Properties, Applications of Context Free Grammars.

UNIT IV Pushdown Automata

Pushdown Automata, Definition, Model, Graphical Notation, Instantaneous Description Language Acceptance of pushdown Automata, Design of Pushdown Automata, Deterministic and Non – Deterministic Pushdown Automata, Equivalence of Pushdown Automata and Context Free Grammars Conversion, Two Stack Pushdown Automata, Application of Pushdown Automata.

UNIT V Turing Machine

Turing Machine, Definition, Model, Representation of Turing Machines-Instantaneous Descriptions, Transition Tables and Transition Diagrams, Language of a Turing Machine, Design of Turing Machines, Techniques for Turing Machine Construction, Types of Turing Machines, Church's Thesis, Universal Turing Machine, Restricted Turing Machine.

Decidable and Undecidable Problems: NP, NP-Hard and NP-Complete Problems.



Textbooks:

1. Introduction to Automata Theory, Languages and Computation, J.E.Hopcroft, R.Motwani and J.D.Ullman, 3rd Edition, Pearson, 2008.
2. Theory of Computer Science-Automata, Languages and Computation, K.L.P.Mishra and N.Chandrasekaran, 3rd Edition, PHI, 2007.

Reference Books:

1. Formal Language and Automata Theory, K.V.N.Sunitha and N.Kalyani, Pearson, 2015.
2. Introduction to Automata Theory, Formal Languages and Computation, ShyamalenduKandar, Pearson, 2013.
3. Theory of Computation, V.Kulkarni, Oxford University Press, 2013.
4. Theory of Automata, Languages and Computation, Rajendra Kumar, McGraw Hill, 2014.

Online Learning Resources:

<https://nptel.ac.in/courses/106106049/>

<https://nptel.ac.in/courses/106104028>



JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY ANANTAPUR
B.Tech (CSE)– III-I Sem

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(20A05504a) SOFTWARE PROJECT MANAGEMENT
(Professional Elective Course– I)

Course Objectives:

This course is designed to enable the students to understand the fundamental principles of Software Project management & will also have a good knowledge of the responsibilities of a project manager and how to handle them.

Course Outcomes:

After completion of the course, students will be able to

- Describe the fundamentals of Project Management
- Recognize and use Project Scheduling Techniques
- Familiarize with Project Control Mechanisms
- Understand Team Management
- Recognize the importance of Project Documentation and Evaluation

UNIT I

Lecture 9Hrs

Conventional Software Management: The waterfall model, conventional software Management performance

Evolution of Software Economics: software Economics. Pragmatic Software Cost Estimation

Improving Software Economics: Reducing Software Product Size, Improving Software Processes, Improving Team Effectiveness, Improving Automation, Achieving Required Quality, Peer Inspections.

UNIT II

Lecture 9Hrs

The old way and the new: The principles of conventional software Engineering, principles of modern software management, transitioning to an iterative process.

Life cycle phases: Engineering and production stages, inception, Elaboration, construction, transition phases.

Artifacts of the process: The artifact sets, Management artifacts, Engineering artifacts, programmatic artifacts

UNIT III

Lecture 9Hrs

Work Flows of the process: Software process workflows, Inter Trans workflows.

Checkpoints of the Process: Major Mile Stones, Minor Milestones, Periodic status assessments.

Iterative Process Planning: work breakdown structures, planning guidelines, cost and schedule estimating, Iteration planning process, Pragmatic planning

UNIT IV

Lecture 9Hrs

Process Automation: Automation Building Blocks, The Project Environment.

Project Control and Process instrumentation: The seven core Metrics, Management indicators, quality indicators

Tailoring the Process: Process discriminants. Managing people and organizing teams.

UNIT V

Lecture 9Hrs

Project Organizations and Responsibilities: Line-of-Business Organizations, Project Organizations, evolution of Organizations.

Future Software Project Management: modern Project Profiles, Next generation Software economics, modern process transitions.

Case Study: The Command Center Processing and Display System-Replacement (CCPDS-R)



Textbooks:

1. Software Project Management, Walker Royce, Pearson Education, 2012
2. Bob Hughes, Mike Cotterell and Rajib Mall “Software Project Management”, 6th Edition, McGraw Hill Edition, 2017

Reference Books:

1. PankajJalote, “Software Project Management in practice”, 5th Edition, Pearson Education, 2017.
2. Murali K. Chemuturi, Thomas M. Cagley Jr.” Mastering Software Project Management: Best Practices, Tools and Techniques”, J. Ross Publishing, 2010
3. Sanjay Mohapatra, “Software Project Management”, Cengage Learning, 2011

Online Learning Resources:

<http://nptel.ac.in/courses/106101061/29>



JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY ANANTAPUR
B.Tech (CSE)– III-I Sem

L T P C
3 0 0 3

(20A04702b) DIGITAL IMAGE PROCESSING
(Professional Elective Course– I)

Course Objectives:

This course is designed to enable the students to familiarize themselves with basic concepts of digital image processing and different image transforms and learn various image processing techniques like image enhancement, restoration, segmentation and compression

Course Outcomes:

After completion of the course, students will be able to

- Perform image manipulations and different digital image processing techniques
- Illustrate basic operations like – Enhancement, segmentation, compression, Image transforms and restoration techniques on image.
- Analyze pseudo and full color image processing techniques.
- Apply various morphological operators on images

UNIT I

Lecture 8Hrs

Introduction: Introduction to Image Processing, Fundamental steps in digital image processing, components of an image processing system, image sensing and acquisition, image sampling and quantization, some basic relationships between pixels, an introduction to the mathematical tools used in digital image processing. Image Transforms: Need for image transforms, Discrete Fourier transform (DFT) of one variable, Extension to functions of two variables, some properties of the 2-D Discrete Fourier transform, Importance of Phase, Walsh Transform. Hadamard transform, Haar Transform, Slant transform, Discrete Cosine transform, KL Transform, SVD and Radon Transform, Comparison of different image transforms.

UNIT II

Lecture 9Hrs

Intensity Transformations and Spatial Filtering: Background, Some basic intensity transformation functions, histogram processing, fundamentals of spatial filtering, smoothing spatial filters, sharpening spatial filters, Combining spatial enhancement methods Filtering in the Frequency Domain: Preliminary concepts, The Basics of filtering in the frequency domain, image smoothing using frequency domain filters, Image Sharpening using frequency domain filters, Selective filtering.

UNIT III

Lecture 9Hrs

Image Restoration and Reconstruction: A model of the image degradation / Restoration process, Noise models, restoration in the presence of noise only-Spatial Filtering, Periodic Noise Reduction by frequency domain filtering, Linear, Position –Invariant Degradations, Estimating the degradation function, Inverse filtering, Minimum mean square error (Wiener) filtering, constrained least squares filtering, geometric mean filter, image reconstruction from projections.

UNIT IV

Lecture 8Hrs

Image compression: Fundamentals, Basic compression methods: Huffman coding, Golomb coding, Arithmetic coding, LZW coding, Run-Length coding, Symbol-Based coding, Bit-Plane coding, Block Transform coding, Predictive coding Wavelets and Multiresolution Processing: Image pyramids, subband coding, Multiresolution expansions, wavelet transforms in one dimensions & two dimensions, Wavelet coding.

Lecture 9Hrs

UNIT V

Image segmentation: Fundamentals, point, line, edge detection, thresholding, region –based segmentation. Morphological Image Processing: Preliminaries, Erosion and dilation, opening and closing, basic morphological algorithms for boundary extraction, thinning, gray-scale morphology,



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Segmentation using morphological watersheds.

Color image processing: color fundamentals, color models, pseudo color image processing, basics of full color image processing, color transformations, smoothing and sharpening. Image segmentation based on color, noise in color images, color image compression.

Textbooks:

1. R. C. Gonzalez and R. E. Woods, Digital Image Processing, 3rd edition, Prentice Hall, 2008.
2. Jayaraman, S. Esakkirajan, and T. Veerakumar, "Digital Image Processing", Tata McGraw-Hill Education, 2011.

Reference Books:

1. Anil K.Jain, "Fundamentals of Digital Image Processing", Prentice Hall of India, 9th Edition, Indian Reprint, 2002.
2. B.Chanda, D.Dutta Majumder, "Digital Image Processing and Analysis", PHI, 2009

Online Learning Resources:

- <https://nptel.ac.in/courses/117105079>
<https://nptel.ac.in/courses/117105135>



JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY ANANTAPUR

B.Tech (CSE)– III-I Sem

L T P C
3 0 0 3

(20A05504c) BIG DATA TECHNOLOGIES
Common to CSE, IT, CSE(AI), CSE(AI&ML), AI&DS
(Professional Elective Course– I)

Course Objectives:

To learn the big data characteristics, study challenges and Hadoop framework to handle big data.

Course Outcomes:

After completion of the course, students will be able to

- Understand the elements of Big data
- Use different technologies to tame Big Data
- Process Given data using Map Reduce
- Develop applications using Hive, NoSQL.

UNIT I

Lecture 8Hrs

Getting an Overview of Big Data: Introduction to Big Data, Structuring Big Data, Elements of Big Data, Big Data Analytics. Exploring the use of Big Data in Business Context Use of Big Data in Social Networking, Use of Big Data Preventing Fraudulent Activities, Use of Big Data in Retail Industry

UNIT II

Lecture 9Hrs

Introducing Technologies for Handling Big Data Distributed and Parallel Computing for Big Data, Introducing Hadoop, Cloud Computing and Big Data, In-memory Computing Technology for Big Data.

Understanding Hadoop Ecosystem Hadoop Ecosystem, Hadoop Distributed File System, Map Reduce, Hadoop YARN, Introducing HBase, Combining HBase and HDFS, Hive, Pig and Pig Latin, Sqoop, ZooKeeper, Flume, Oozie.

UNIT III

Lecture 9Hrs

Understanding Map Reduce Fundamentals and H Base The Map Reduce Framework, Techniques to Optimize Map Reduce Jobs, Uses of Map Reduce, Role of H Base in Big Data Processing. Processing Your Data with Map Reduce Recollecting the Concept of Map Reduce Framework, Developing Simple Map Reduce Application, Points to Consider while Designing Map Reduce.

UNIT IV

Lecture 8Hrs

Customizing Map Reduce Execution and Implementing Map Reduce Program Controlling Map Reduce Execution with Input Format, Reading Data with Custom Record Reader, Organizing Output Data with Output Formats, Customizing Data with Record Writer, Customizing the Map Reduce Execution in Terms of YARN, Implementing a Map Reduce Program for Sorting Text Data. Testing and Debugging Map Reduce Application Debugging Hadoop Map Reduce Locally, Performing Unit Testing for Map Reduce Applications.

UNIT V

Lecture 8Hrs

Exploring Hive: Introducing Hive, Hive Service, Built-In Functions in Hive, Hive DDL, Data Manipulation in Hive, Data Retrieval Queries, Using JOINS in Hive. NoSQL Data Management Introduction to NoSQL, Types of NoSQL Data Models, Schema-Less Databases, Materialized Views, Distribution Models, Sharding.

Textbooks:

1. Big Data Black Book, DT Editorial services, Dreamtech Press



Reference Books:

1. Data Science for Business by F. Provost and T. Fawcett, O'Reilly Media.
2. Taming the Big Data Tidal Wave: Finding Opportunities in Huge Data Streams with Advanced
3. Hadoop: The Definitive Guide by Tom White, O'Reilly Media.
4. Big Data and Business Analytics by Jay Liebowitz, Auerbach Publications, CRC Press.



JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY ANANTAPUR
B.Tech (CSE)– III-I Sem

L T P C
0 0 3 1.5

(20A05501P) COMPUTER NETWORKS LAB
Common to CSE,IT,CSD,CSE(IOT)

Course Objectives:

- To understand the different types of networks
- To discuss the software and hardware components of a network
- To enlighten the working of networking commands supported by operating system
- To impart knowledge of Network simulator 2/3
- To familiarize the use of networking functionality supported by JAVA
- To familiarize with computer networking tools.

Course Outcomes (CO):

After completion of the course, students will be able to

- Design scripts for Wired network simulation
- Design scripts of static and mobile wireless networks simulation
- Analyze the data traffic using tools
- Design JAVA programs for client-server communication
- Construct a wired and wireless network using the real hardware

List of Experiments:

1. Study different types of Network cables (Copper and Fiber) and prepare cables (Straight and Cross) to connect Two or more systems. Use crimping tool to connect jacks. Use LAN tester to connect the cables.
 - Install and configure Network Devices: HUB, Switch and Routers. Consider both manageable and non-manageable switches. Do the logical configuration of the system. Set the bandwidth of different ports.
 - Install and Configure Wired and Wireless NIC and transfer files between systems in Wired LAN and Wireless LAN. Consider both adhoc and infrastructure mode of operation.
2. Work with the commands Ping, Tracert, Ipconfig, pathping, telnet, ftp, getmac, ARP, Hostname, Nbtstat, netdiag, and Nslookup
3. Find all the IP addresses on your network. Unicast, Multicast, and Broadcast on your network.
4. Use Packet tracer software to build network topology and configure using Distance vector routing protocol.
5. Use Packet tracer software to build network topology and configure using Link State routing protocol.
6. Using JAVA RMI Write a program to implement Basic Calculator
7. Implement a Chatting application using JAVA TCP and UDP sockets.
8. Hello command is used to know whether the machine at the other end is working or not. Echo command is used to measure the round-trip time to the neighbour. Implement Hello and Echo commands using JAVA.
9. Using Wireshark perform the following operations:
 - Inspect HTTP Traffic
 - .Inspect HTTP Traffic from a Given IP Address,
 - Inspect HTTP Traffic to a Given IP Address,
 - Reject Packets to Given IP Address,
 - Monitor Apache and MySQL Network Traffic.
10. Install Network Simulator 2/3. Create a wired network using dumbbell topology. Attach agents, generate both FTP and CBR traffic, and transmit the traffic. Vary the data rates and evaluate the performance using metric throughput, delay, jitter and packet loss.



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11. Create a static wireless network. Attach agents, generate both FTP and CBR traffic, and transmit the traffic. Vary the data rates and evaluate the performance using metric throughput, delay, jitter and packet loss.
12. Create a mobile wireless network. Attach agents, generate both FTP and CBR traffic, and transmit the traffic. Vary the data rates and evaluate the performance using metric throughput, delay, jitter and packet loss.

References:

1. ShivendraS.Panwar, Shiwen Mao, Jeong-dong Ryoo, and Yihan Li, "TCP/IP Essentials A Lab-Based Approach", Cambridge University Press, 2004.
2. Cisco Networking Academy, "CCNA1 and CCNA2 Companion Guide", Cisco Networking Academy Program, 3rd edition, 2003.
3. Elloitte Rusty Harold, "Java Network Programming", 3rd edition, O'REILLY, 2011.

Online Learning Resources/Virtual Labs:

- <https://www.netacad.com/courses/packet-tracer> - Cisco Packet Tracer.
- Ns Manual, Available at: <https://www.isi.edu/nsnam/ns/ns-documentation.html>, 2011.
- https://www.wireshark.org/docs/wsug_html_chunked/ -Wireshark.
- <https://nptel.ac.in/courses/106105183/25>
- <http://www.nptelvideos.in/2012/11/computer-networks.html>
- <https://nptel.ac.in/courses/106105183/3>
- http://vlabs.iitb.ac.in/vlabs-dev/labs_local/computer-networks/labs/explist.php



JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY ANANTAPUR
B.Tech (CSE)– III-I Sem
(20A05502P) ARTIFICIAL INTELLIGENCE LAB
COMMON To CSE,IT,CSD, CSE (DS)

L	T	P	C
0	0	3	1.5

Course Objectives:

- To teach the methods of implementing algorithms using artificial intelligence techniques
- To illustrate search algorithms

To demonstrate the building of intelligent agents

Course Outcomes:

After completion of the course, students will be able to

- Implement search algorithms
- Solve Artificial intelligence problems
- Design chatbot and virtual assistant

List of Experiments:

1. Write a program to implement DFS and BFS
2. Write a Program to find the solution for traveling salesman Problem
3. Write a program to implement Simulated Annealing Algorithm
4. Write a program to find the solution for the wumpus world problem
5. Write a program to implement 8 puzzle problem
6. Write a program to implement Towers of Hanoi problem
7. Write a program to implement A* Algorithm
8. Write a program to implement Hill Climbing Algorithm
9. Build a Chatbot using AWS Lex, Pandora bots.
10. Build a bot that provides all the information related to your college.
11. Build a virtual assistant for Wikipedia using Wolfram Alpha and Python
12. The following is a function that counts the number of times a string occurs in another string:

Count the number of times string s1 is found in string s2

```
Def count substring(s1,s2):
```

```
count = 0
```

```
for i in range(0,len(s2)-len(s1)+1):
```

```
if s1 == s2[i:i+len(s1)]:
```

```
count += 1
```

```
return count
```

For instance, countsubstring('ab','cabalaba') returns 2.

Write a recursive version of the above function. To get the rest of a string (i.e. everything but the first character).

13. Higher order functions. Write a higher-order function count that counts the number of elements in a list that satisfy a given test. For instance: count (lambda x: x>2, [1, 2, 3, 4, 5]) should return 3, as there are three elements in the list larger than 2. Solve this task without using any existing higher-order function.

14. Brute force solution to the Knapsack problem. Write a function that allows you to generate random problem instances for the knapsack program. This function should generate a list of items containing N items that each have a unique name, a random size in the range 1 5 and a random value in the range 1..... 10.

Next, you should perform performance measurements to see how long the given knapsack solver take to solve different problem sizes. You should perform at least 10 runs with different randomly generated problem instances for the problem sizes 10,12,14,16,18,20 and 22. Use a backpack size of 2:5 x N for each value problem size N. Please note that the method used to generate random numbers can also affect performance, since different distributions of values can make the initial conditions of



the problem slightly more or less demanding.

How much longer time does it take to run this program when we increase the number of items? Does the backpack size affect the answer?

Try running the above tests again with a backpack size of $1 \times N$ and with $4:0 \times N$.

15. Assume that you are organising a party for N people and have been given a list L of people who, for social reasons, should not sit at the same table. Furthermore, assume that you have C tables (that are infinitely large).

Write a function `layout(N,C,L)` that can give a table placement (i.e. a number from $0 : : C - 1$) for each guest such that there will be no social mishaps.

For simplicity we assume that you have a unique number $0 \dots N-1$ for each guest and that the list of restrictions is of the form `[(X, Y) ...]` denoting guests X, Y that are not allowed to sit together. Answer with a dictionary mapping each guest into a table assignment, if there are no possible layouts of the guests you should answer `False`.

References:

1. David Poole, Alan Mackworth, Randy Goebel, "Computational Intelligence: a logical approach", Oxford University Press, 2004.
2. G. Luger, "Artificial Intelligence: Structures and Strategies for complex problem solving", Fourth Edition, Pearson Education, 2002.
3. J. Nilsson, "Artificial Intelligence: A new Synthesis", Elsevier Publishers, 1998.
4. Artificial Neural Networks, B. Yagna Narayana, PHI
5. Artificial Intelligence, 2nd Edition, E.Rich and K.Knight, TMH.
6. Artificial Intelligence and Expert Systems, Patterson, PHI.

Online Learning Resources/Virtual Labs:

<https://www.tensorflow.org/>

<https://pytorch.org/>

<https://github.com/pytorch>

<https://keras.io/>

<https://github.com/keras-team>

<http://deeplearning.net/software/theano/>

<https://github.com/Theano/Theano>

<https://caffe2.ai/>

<https://github.com/caffe2>

<https://deeplearning4j.org/Scikit-learn>:<https://scikit-learn.org/stable/>

<https://github.com/scikit-learn/scikit-learn>

<https://www.deeplearning.ai/>

<https://opencv.org/>

<https://github.com/qjwweee/keras-yolo3>

<https://www.pyimagesearch.com/2018/11/12/yolo-object-detection-with-opencv/>

<https://developer.nvidia.com/cuda-math-library>

http://vlabs.iitb.ac.in/vlabs-dev/labs/machine_learning/labs/index.php



JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY ANANTAPUR
B.Tech (CSE)– III-I Sem
(20A05506) ADVANCED WEB APPLICATION DEVELOPMENT
Skill Oriented Course - III

L T P C
1 0 2 2

Course Objectives:

- Learn how to create dynamic websites using PHP and establish database connectivity.
- Explore SMS API and session management
- Understand the common Web Application Vulnerabilities and provide Security.
- Acquire the knowledge of external libraries to generate various types of documents and files.
- Understand the difference between traditional hosting services and Cloud Hosting services

Course Outcomes:

After completion of the course, students will be able to

- Create dynamic websites using PHP and MySQL
- Handle Authentication using Sessions, JWT.
- Secure Web applications from common attacks like Injection, XSS.
- Integrate Libraries to dynamically generate documents, spreadsheets, pdfs, etc.
- Host Websites in traditional web hosting platforms and also Cloud based infrastructure

Module 1:

Introduction: Web Server, Database Server, Private IP Address, Port Address, Server-side Programming, Web Server solution stack.

Task: Installation of XAMPP/WAMP. Access a test page using a device (Laptop/Desktop/Mobile) within LAN or hotspot using its private IP address.

Module 2:

PHPMyAdmin: Create, Browse, Drop, Copy, Rename and Alter databases, tables, views, fields and indexes, Import data from CSV and SQL, Export (back-up) data.

Task: Design a Student Profile Data Management System for a college. Create a Database and its associated tables.

Module 3:

Php basics: Basic Syntax, primitive types, Variables, Constants, Expressions, Operators, Control structures, functions.

Task: Develop a PHP application and run it with a command-line interpreter

Module 4:

Handling HTML Forms: Predefined Variables, Reading data from web form controls like input, textarea, select etc., Handling File Uploads.

Task: Develop an Add Student Profile Page which accepts all student details including photo and display them in order.

Module 5:

Predefined Functions and Files: Arrays, Associative Arrays, Multidimensional Arrays, Array functions, String functions, Date and Time functions, File Handling: Open, Close, Create, Read, Write, Append.

Task: Implement an effective Logging System using files in PHP.

Module 6:

Classes and Objects: Creating classes and objects, Visibility, Constructor and Destructor, Inheritance, static keyword, interfaces, class Abstraction, namespaces

Task: Design and implement Class diagram representation of Student Management System for a college using PHP.



Module 7:

Database Connectivity with MySql: Establish a database Connection using mysqli, Prepare SQL Statement, Bind parameters, Execute the statement, bind the result.

Task: Develop Add Student Profile Page to store data into the database and develop a webpage to retrieve the student details based on the Roll Number or any unique ID.

Module 8:

HTTP is a Stateless Protocol: Handling Cookies and Sessions, Implementation of JSON Web Tokens (JWT), SMS API.

Task: Design and develop a User Authentication System (Login-Logout functionality) using cookies, sessions, JWT, and SMS API. Also, identify which is suitable for your application

Module 9:

Exception Handling and Security: Handle Database connectivity exceptions, SQL Injection Vulnerability, Cross-site scripting, Session hijacking, and Session fixation

Task: Secure all your PHP applications from common vulnerabilities like Injection, XSS, Session hijacking and fixation, and other exceptions

Module 10:

PHP Libraries: Read data from Excel Files, Generate dynamic Excel Files, PDF files, and Word Documents.

Task: Design an Administrator Portal through which administrators can be able to upload student data into the database, Download the student data, Generate certificates, etc.

Module 11:

Hosting service provider: Public IP Address, Nameservers, Domain Name, Understand cPanel Modules: File Manager, Databases, Email Accounts, One-Click Installers, DNS, Other Configuration & Monitoring Controls.

Task: Host a PHP-MySQL based application on the internet using the Web Hosting Service Provider of your choice (000webhost, Hostinger, Heroku, Godaddy, etc.)

Module 12:

Cloud Hosting: Advantages of Cloud Hosting, Creating Instances or droplets, Managing Roles, Scaling the Application, Securing the instances, Monitoring Tools, etc.

Task: Host a PHP-MySQL based application on the internet using the Cloud Hosting Provider of your choice (Amazon Web Services, Google Cloud Platform, DigitalOcean, etc.)

References:

1. MacIntyre, Peter, and Tatroe, Kevin. Programming PHP: Creating Dynamic Web Pages. United States, O'Reilly Media, 2020.
2. Valade, Janet. PHP and MySQL Web Development All-in-One Desk Reference For Dummies. Germany, Wiley, 2011.
3. Gulabani, Sunil. Amazon Web Services Bootcamp: Develop a Scalable, Reliable, and Highly Available Cloud Environment with AWS. United Kingdom, Packt Publishing, 2018.

Online Learning Resources/Virtual Labs:

<https://www.apachefriends.org/>

<https://www.wampserver.com/en/>

<https://www.php.net/>

<https://in.godaddy.com/>

<https://www.hostinger.in/>

<https://aws.amazon.com/>

<https://cloud.google.com/>



JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY ANANTAPUR
B.Tech (CSE)– III-II Sem
L T P C
3 0 0 3

(20A05601T) COMPILER DESIGN

Course Objectives:

- Teach the concepts related to assemblers, loaders, linkers and editors
- Introduce the basic principles of the compiler construction
- Explain the Concept of Context Free Grammars, Parsing and various Parsing Techniques.
- Expose the process of intermediate code generation.
- Instruct the process of Code Generation and various Code optimization techniques

Course Outcomes:

After completion of the course, students will be able to

- Differentiate the various phases of a compiler
- Design code generator
- Apply code optimization techniques
- Identify the tokens and verify the code

UNIT I Introduction

Lecture 8Hrs

Introduction: The structure of a compiler, the science of building a compiler, programming language basics

Lexical Analysis: The Role of the Lexical Analyzer, Input Buffering, Recognition of Tokens, The Lexical-Analyzer Generator Lex, Finite Automata, From Regular Expressions to Automata, Design of a Lexical-Analyzer Generator, Optimization of DFA-Based Pattern Matchers.

UNIT II Syntax Analysis

Lecture 9Hrs

Introduction, Context-Free Grammars, Writing a Grammar, Top-Down Parsing, Bottom-Up Parsing, Introduction to LR Parsing: Simple LR, More Powerful LR Parsers, Using Ambiguous Grammars and Parser Generators.

UNIT III Syntax-Directed Translation

Lecture 9Hrs

Syntax-Directed Translation: Syntax-Directed Definitions, Evaluation Orders for SDD's, Applications of Syntax-Directed Translation, Syntax-Directed Translation Schemes, Implementing L-Attributed SDD's.

Intermediate-Code Generation: Variants of Syntax Trees, Three-Address Code, Types and Declarations, Type Checking, Control Flow, Switch-Statements, Intermediate Code for Procedures.

UNIT IV Code Generation

Lecture 8Hrs

Run-Time Environments: Stack Allocation of Space, Access to Nonlocal Data on the Stack, Heap Management, Introduction to Garbage Collection, Introduction to Trace-Based Collection.

Code Generation: Issues in the Design of a Code Generator, The Target Language, Addresses in the Target Code, Basic Blocks and Flow Graphs, Optimization of Basic Blocks, A Simple Code Generator, Peephole Optimization, Register Allocation and Assignment, Dynamic Programming Code-Generation.

UNIT V Machine-Independent Optimization

Lecture 8Hrs

Machine-Independent Optimization: The Principal Sources of Optimization, Introduction to Data-Flow Analysis, Foundations of Data-Flow Analysis, Constant Propagation, Partial-Redundancy Elimination, Loops in Flow Graphs

Textbooks:

1. Alfred V. Aho, Monica S. Lam, Ravi Sethi, Jeffrey D. Ullman, "Compilers Principles, Techniques and Tools", 2nd Edition, Pearson.



Reference Books:

1. Yunlin Su, Song Y. Yan, “Principles of Compilers”, Springer, 2012.
2. Andrew W. Appel, “Modern Compiler Implementation in JAVA”, 2nd edition, Cambridge University Press, 2004.
3. Lex & Yacc – John R. Levine, Tony Mason, Doug Brown, O’reilly
4. Compiler Construction, Loudon, Thomson.

Online Learning Resources:

1. <https://nptel.ac.in/courses/106108052/>
2. <http://openclassroom.stanford.edu/MainFolder/CoursePage.php?course=Compilers>



JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY ANANTAPUR
B.Tech (CSE)– III-II Sem
(20A05602T) MACHINE LEARNING
Common to CSE, IT,CSD,CSE(AI),CSE(AI&ML),CSE(DS),AI&DS,CSE(IOT)

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Course Objectives:

The course is introduced for students to

- Understand basic concepts of Machine Learning
- Study different learning algorithms
- Illustrate evaluation of learning algorithms

Course Outcomes (CO):

After completion of the course, students will be able to

- Identify machine learning techniques suitable for a given problem
- Solve the problems using various machine learning techniques
- Design application using machine learning techniques

UNIT I Introduction to Machine Learning & Preparing to Model Lecture 9Hrs

Introduction: What is Human Learning? Types of Human Learning, what is Machine Learning? Types of Machine Learning, Problems Not to Be Solved Using Machine Learning, Applications of Machine Learning, State-of-The-Art Languages/Tools in Machine Learning, Issues in Machine Learning

Preparing to Model: Introduction, Machine Learning Activities, Basic Types of Data in Machine Learning, Exploring Structure of Data, Data Quality and Remediation, Data Pre-Processing

UNIT II Modelling and Evaluation & Basics of Feature Engineering Lecture 9Hrs

Introduction, selecting a Model, training a Model (for Supervised Learning), Model Representation and Interpretability, Evaluating Performance of a Model, Improving Performance of a Model
Basics of Feature Engineering: Introduction, Feature Transformation, Feature Subset Selection

UNIT III Bayesian Concept Learning & Supervised Learning: Classification Lecture 10Hrs

Introduction, Why Bayesian Methods are Important? Bayes' Theorem, Bayes' Theorem and Concept Learning, Bayesian Belief Network

Supervised Learning: Classification: Introduction, Example of Supervised Learning, Classification Model, Classification Learning Steps, Common Classification Algorithms- k -Nearest Neighbour(k NN), Decision tree, Random forest model, Support vector machines

UNIT IV Supervised Learning: Regression Lecture 10Hrs

Introduction, Example of Regression, Common Regression Algorithms-Simple linear regression, Multiple linear regression, Assumptions in Regression Analysis, Main Problems in Regression Analysis, Improving Accuracy of the Linear Regression Model, Polynomial Regression Model, Logistic Regression, Maximum Likelihood Estimation.

UNIT V Unsupervised Learning Lecture 9Hrs

Introduction, Unsupervised vs Supervised Learning, Application of Unsupervised Learning, Clustering – Clustering as a machine learning task, Different types of clustering techniques, Partitioning methods,

K -Medoids: a representative object-based technique, Hierarchical clustering, Density-based methods-DBSCAN

Finding Pattern using Association Rule- Definition of common terms, Association rule, The apriori algorithm for association rule learning, Build the apriori principles



Textbooks:

1. Machine Learning, SaikatDutt, Subramanian Chandramouli, Amit Kumar Das, Pearson, 2019.

Reference Books:

1. EthernAlpaydin, "Introduction to Machine Learning", MIT Press, 2004.
2. Stephen Marsland, "Machine Learning -An Algorithmic Perspective", Second Edition, Chapman and Hall/CRC Machine Learning and Pattern Recognition Series,2014.
1. Andreas C. Müller and Sarah Guido "Introduction to Machine Learning with Python: A Guide for Data Scientists", Oreilly.

Online Learning Resources:

- Andrew Ng, "Machine Learning Yearning"
- <https://www.deeplearning.ai/machine-learning-yearning/>
- Shai Shalev-Shwartz , Shai Ben-David, "Understanding Machine Learning: From Theory to Algorithms" , Cambridge University Press
<https://www.cse.huji.ac.il/~shais/UnderstandingMachineLearning/index.html>



JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY ANANTAPUR
B.Tech (CSE)– III-II Sem

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3 0 0 3

(20A05603T) INTERNET OF THINGS
Common to CSE, IT, CSD, CSE(AI), CSE(DS), AI&DS

Course Objectives:

- Understand the basics of Internet of Things and protocols.
- Discuss the requirement of IoT technology
- Introduce some of the application areas where IoT can be applied.
- Understand the vision of IoT from a global perspective, understand its applications, determine its market perspective using gateways, devices and data management

Course Outcomes:

After completion of the course, students will be able to

- Understand general concepts of Internet of Things.
- Apply design concept to IoT solutions
- Analyze various M2M and IoT architectures
- Evaluate design issues in IoT applications
- Create IoT solutions using sensors, actuators and Devices

UNIT I Introduction to IoT

Lecture 8Hrs

Definition and Characteristics of IoT, physical design of IoT, IoT protocols, IoT communication models, IoT Communication APIs, Communication protocols, Embedded Systems, IoT Levels and Templates

UNIT II Prototyping IoT Objects using Microprocessor/Microcontroller

Lecture 9Hrs

Working principles of sensors and actuators, setting up the board – Programming for IoT, Reading from Sensors, Communication: communication through Bluetooth, Wi-Fi.

UNIT III IoT Architecture and Protocols

Lecture 8Hrs

Architecture Reference Model- Introduction, Reference Model and architecture, IoT reference Model, Protocols- 6LowPAN, RPL, CoAP, MQTT, IoT frameworks- Thing Speak.

UNIT IV Device Discovery and Cloud Services for IoT

Lecture 8Hrs

Device discovery capabilities- Registering a device, Deregister a device, Introduction to Cloud Storage models and communication APIs Web-Server, Web server for IoT.

UNIT V UAV IoT

Lecture 10Hrs

Introduction to Unmanned Aerial Vehicles/Drones, Drone Types, Applications: Defense, Civil, Environmental Monitoring; UAV elements and sensors- Arms, motors, Electronic Speed Controller(ESC), GPS, IMU, Ultra sonic sensors; UAV Software –Arudpilot, Mission Planner, Internet of Drones(IoD)- Case study FlytBase.

Textbooks:

1. Vijay Madiseti and ArshdeepBahga, “ Internet of Things (A Hands-on-Approach)”, 1st Edition, VPT, 2014.
2. Handbook of unmanned aerial vehicles, K Valavanis; George J Vachtsevanos, New York, Springer, Boston, Massachusetts : Credo Reference, 2014. 2016.

Reference Books:

1. Jan Holler, VlasiosTsiatsis, Catherine Mulligan, Stefan Avesand, Stamatis Karnouskos, David Boyle, “ From Machine-to-Machine to the Internet of Things: Introduction to a New Age of Intelligence”, 1st Edition, Academic Press, 2014.
2. ArshdeepBahga, Vijay Madiseti - Internet of Things: A Hands-On Approach, Universities



Press, 2014.

3. The Internet of Things, Enabling technologies and use cases – Pethuru Raj, Anupama C. Raman, CRC Press.
4. Francis daCosta, “Rethinking the Internet of Things: A Scalable Approach to Connecting Everything”, 1st Edition, Apress Publications, 2013
5. Cuno Pfister, Getting Started with the Internet of Things, O’Reilly Media, 2011, ISBN: 978-1-4493-9357-1
6. DGCA RPAS Guidance Manual, Revision 3 – 2020
7. Building Your Own Drones: A Beginners' Guide to Drones, UAVs, and ROVs, John Baichtal

Online Learning Resources:

1. <https://www.arduino.cc/>
2. <https://www.raspberrypi.org/>
3. <https://nptel.ac.in/courses/106105166/5>
4. <https://nptel.ac.in/courses/108108098/4>



JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY ANANTAPUR
B.Tech (CSE)– III-II Sem
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(20A05604a) SOFTWARE TESTING
(Professional Elective Course-II)

Course Objectives:

- Introduce the fundamentals of various testing methodologies.
- Describe the principles and procedures for designing test cases.
- Teach debugging methods.

Course Outcomes :

After completion of the course, students will be able to

- Understand the basic testing procedures.
- Develop reliable software
- Design test cases for testing different programming constructs
- Test the applications by applying different testing methods and automation tools

UNIT I Introduction

Lecture 8Hrs

Introduction: Purpose of Testing, Dichotomies, Model for Testing, Consequences of Bugs, Taxonomy of Bugs.

Flow graphs and Path testing: Basics Concepts of Path Testing, Predicates, Path Predicates and Achievable Paths, Path Sensitizing, Path Instrumentation, Application of Path Testing.

UNIT II Flow Testing

Lecture 9Hrs

Transaction Flow Testing: Transaction Flows, Transaction Flow Testing Techniques.

Dataflow testing: Basics of Dataflow Testing, Strategies in Dataflow Testing, Application of Dataflow Testing.

UNIT III Domain Testing

Lecture 9Hrs

Domain Testing: Domains and Paths, Nice & Ugly Domains, Domain testing, Domains and Interfaces Testing, Domain and Interface Testing, Domains and Testability.

UNIT IV Logic Based Testing

Lecture 8Hrs

Paths, Path products and Regular expressions: Path Products & Path Expression, Reduction Procedure, Applications, Regular Expressions & Flow Anomaly Detection. **Logic Based Testing:** Overview, Decision Tables, Path Expressions, KV Charts, Specifications.

UNIT V Graph Matrices and Application

Lecture 8Hrs

State, State Graphs and Transition Testing: State Graphs, Good & Bad State Graphs, State Testing, Testability Tips.

Graph Matrices and Application: Motivational Overview, Matrix of Graph, Relations, Power of a Matrix, Node Reduction Algorithm, Building Tools.

Textbooks:

1. Boris Beizer, “Software testing techniques”, Dreamtech, second edition, 2002.

Reference Books:

1. Brian Marick, “The craft of software testing”, Pearson Education.
2. Yogesh Singh, “Software Testing”, Camebridge
3. P.C. Jorgensen, “Software Testing” 3rd edition, Aurbach Publications (Dist.by SPD).
4. N.Chauhan, “Software Testing”, Oxford University Press.
5. P.Ammann&J.Offutt, “Introduction to Software Testing” , Cambridge Univ. Press.
6. Perry, “Effective methods of Software Testing”, John Wiley, 2nd Edition, 1999.



Online Learning Resources:

<http://www.nptelvideos.in/2012/11/software-engineering.html>

https://onlinecourses.nptel.ac.in/noc16_cs16/preview

<https://nptel.ac.in/courses/117105135>



JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY ANANTAPUR
B.Tech (CSE)– III-II Sem
(20A05604b) ADVANCED COMPUTER ARCHITECTURE
(Professional Elective Course-II)

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Course Objectives:

- Understand the Concept of Parallel Processing and its applications
- Implement the Hardware for Arithmetic Operations
- Analyse the performance of different scalar Computers
- Develop the Pipelining Concept for a given set of Instructions
- Distinguish the performance of pipelining and non-pipelining environment in a processor

Course Outcomes:

After completion of the course, students will be able to

- Illustrate the types of computers, and new trends and developments in computer architecture
- Outline pipelining, instruction set architectures, memory addressing
- Apply ILP using dynamic scheduling, multiple issue, and speculation
- Illustrate the various techniques to enhance a processors ability to exploit Instruction-level parallelism (ILP), and its challenges
- Apply multithreading by using ILP and supporting thread-level parallelism (TLP)

UNIT I

Lecture 8Hrs

Computer Abstractions and Technology: Introduction, Eight Great Ideas in Computer Architecture, Below Your Program, Under the Covers, Technologies for Building Processors and Memory, Performance, The Power Wall, The Sea Change: The Switch from Uni-processors to Multiprocessors, Benchmarking the Intel Core i7, Fallacies and Pitfalls.

UNIT II

Lecture 9Hrs

Instructions: Language of the Computer: Operations of the Computer Hardware, Operands of the Computer Hardware, Signed and Unsigned Numbers, Representing Instructions in the Computer, Logical Operations, Instructions for Making Decisions, Supporting Procedures in Computer Hardware, Communicating with People, MIPS Addressing for 32-Bit Immediates and Addresses, Parallelism and Instructions: Synchronization, Translating and Starting a Program, A C Sort Example to Put It All Together, Arrays versus Pointers, ARMv7 (32-bit) Instructions, x86 Instructions, ARMv8 (64-bit) Instructions.

UNIT III

Lecture 9Hrs

Arithmetic for Computers: Introduction, Addition and Subtraction, Multiplication, Division, Floating Point, Parallelism and Computer Arithmetic: Subword Parallelism, Streaming SIMD Extensions and Advanced Vector Extensions in x86, Subword Parallelism and Matrix Multiply.

UNIT IV

Lecture 8Hrs

The Processor: Introduction, Logic Design Conventions, Building a Datapath, A Simple Implementation Scheme, An Overview of Pipelining, Pipelined Datapath and Control, Data Hazards: Forwarding versus Stalling, Control Hazards, Exceptions, Parallelism via Instructions, The ARM Cortex-A8 and Intel Core i7 Pipelines.

UNIT V

Lecture 8Hrs

Large and Fast: Exploiting Memory Hierarchy: Introduction, Memory Technologies, The Basics of Caches, Measuring and Improving Cache Performance, Dependable Memory Hierarchy, Virtual Machines, Virtual Memory, A Common Framework for Memory Hierarchy, Using a Finite-State Machine to Control a Simple Cache, Parallelism and Memory Hierarchies: Cache Coherence,



Parallelism and Memory Hierarchy: Redundant Arrays of Inexpensive Disks, Advanced Material: Implementing Cache Controllers, The ARM Cortex-A8 and Intel Core i7 Memory Hierarchies.

Textbooks:

- 1) Computer Organization and Design: The hardware and Software Interface, David A Patterson, John L Hennessy, 5th edition, MK.
- 2) Computer Architecture and Parallel Processing – Kai Hwang, Faye A.Brigs, Mc Graw Hill.

Reference Books:

- 1) Modern Processor Design: Fundamentals of Super Scalar Processors, John P. Shen and Miikko H. Lipasti, Mc Graw Hill.
- 2) Advanced Computer Architecture – A Design Space Approach – DezsoSima, Terence Fountain, Peter Kacsuk , Pearson.

Online Learning Resources:

<https://nptel.ac.in/courses/106/105/106105163/>



JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY ANANTAPUR
B.Tech (CSE)– III-II Sem

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(20A05604c) COMPUTER VISION

Common to CSE, IT, CSD, CSE(AI), CSE(AI&ML) AI&DS
(Professional Elective Course– II)

Course Objectives:

The objective of this course is to understand the basic issues in computer vision and major approaches to address the methods to learn the Linear Filters, segmentation by clustering, Edge detection, Texture.

Course Outcomes:

After completing the course, you will be able to:

- Identify basic concepts, terminology, theories, models and methods in the field of computer vision,
- Describe known principles of human visual system,
- Describe basic methods of computer vision related to multi-scale representation, edge detection and detection of other primitives, stereo, motion and object recognition,
- Suggest a design of a computer vision system for a specific problem

UNIT I LINEAR FILTERS Lecture 8Hrs

Introduction to Computer Vision, Linear Filters and Convolution, Shift Invariant Linear Systems, Spatial Frequency and Fourier Transforms, Sampling and Aliasing Filters as Templates, Technique: Normalized Correlation and Finding Patterns, Technique: Scale and Image Pyramids.

UNIT II EDGE DETECTION Lecture 9Hrs

Noise- Additive Stationary Gaussian Noise, Why Finite Differences Respond to Noise, Estimating Derivatives - Derivative of Gaussian Filters, Why Smoothing Helps, Choosing a Smoothing Filter, Why Smooth with a Gaussian? Detecting Edges-Using the Laplacian to Detect Edges, Gradient-Based Edge Detectors, Technique: Orientation Representations and Corners.

UNIT III TEXTURE Lecture 9Hrs

Representing Texture –Extracting Image Structure with Filter Banks, Representing Texture using the Statistics of Filter Outputs, Analysis (and Synthesis) Using Oriented Pyramids –The Laplacian Pyramid, Filters in the Spatial Frequency Domain, Oriented Pyramids, Application: Synthesizing Textures for Rendering, Homogeneity, Synthesis by Sampling Local Models, Shape from Texture, Shape from Texture for Planes

UNIT IV SEGMENTATION BY CLUSTERING Lecture 8Hrs

What is Segmentation, Human Vision: Grouping and Gestalt, Applications: Shot Boundary Detection and Background Subtraction. Image Segmentation by Clustering Pixels, Segmentation by Graph-Theoretic Clustering. The Hough Transform, Fitting Lines, Fitting Curves

UNIT V RECOGNITION BY RELATIONS BETWEEN TEMPLATES Lecture 8Hrs

Finding Objects by Voting on Relations between Templates, Relational Reasoning Using Probabilistic Models and Search, Using Classifiers to Prune Search, Hidden Markov Models, Application: HMM and Sign Language Understanding, Finding People with HMM.

Textbooks:

David A. Forsyth, Jean Ponce, Computer Vision – A modern Approach, PHI, 2003.

Reference Books:

1. Geometric Computing with Clifford Algebras: Theoretical Foundations and Applications in Computer Vision and Robotics, Springer; 1 edition, 2001 by Sommer.
2. Digital Image Processing and Computer Vision, 1/e, by Sonka.
3. Computer Vision and Applications: Concise Edition (With CD) by Jack Academy Press, 2000.

Online Learning Resources: <https://nptel.ac.in/courses/106105216> <https://nptel.ac.in/courses/108103174>



JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY ANANTAPUR
B.Tech (CSE)– III-II Sem

L T P C
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(20A05601P) COMPILER DESIGN LAB

Course Objectives:

- To introduce LEX and YACC tools
- To learn to develop algorithms to generate code for a target machine
- To implement LL and LR parsers

Course Outcomes:

After completion of the course, students will be able to

- Design, develop, and implement a compiler for any language
- Use LEX and YACC tools for developing a scanner and a parser
- Design and implement LL and LR parsers
- Design algorithms to perform code optimization in order to improve the performance of a program in terms of space and time complexity

List of Experiments:

- 1.Design and implement a lexical analyzer for given language using C and the lexical analyzer should ignore redundant spaces, tabs and new lines.
- 2.Implementation of Lexical Analyzer using Lex Tool
3. Generate YACC specification for a few syntactic categories.
 - a. Program to recognize a valid arithmetic expression that uses operator +, −, * and /.
 - b. Program to recognize a valid variable which starts with a letter followed by any number of letters or digits.
 - c. Implementation of Calculator using LEX and YACC
 - d. Convert the BNF rules into YACC form and write code to generate abstract syntax tree
4. Write program to find ϵ – closure of all states of any given NFA with ϵ transition.
5. Write program to convert NFA with ϵ transition to NFA without ϵ transition.
6. Write program to convert NFA to DFA
7. Write program to minimize any given DFA.
8. Develop an operator precedence parser for a given language.
9. Write program to find Simulate First and Follow of any given grammar.
10. Construct a recursive descent parser for an expression.
11. Construct a Shift Reduce Parser for a given language.
12. Write a program to perform loop unrolling.
13. Write a program to perform constant propagation.
14. Implement Intermediate code generation for simple expressions.

References:

1. Compilers: Principles, Techniques and Tools, Second Edition, Alfred V. Aho, Monica S. Lam, Ravi Sethi, Jeffrey D. Ullman, Pearson.
2. Compiler Construction-Principles and Practice, Kenneth C Loudon, Cengage Learning.
3. Modern compiler implementation in C, Andrew W Appel, Revised edition, Cambridge University Press.
4. The Theory and Practice of Compiler writing, J. P. Tremblay and P. G. Sorenson, TMH
5. Writing compilers and interpreters, R. Mak, 3rd edition, Wiley student edition.

Online Learning Resources/Virtual Labs:

<http://cse.iitkgp.ac.in/~bivasm/notes/LexAndYaccTutorial.pdf>



JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY ANANTAPUR
B.Tech (CSE)– III-II Sem

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(20A05602P) MACHINE LEARNING LAB
Common to CSE, CSD,CSE(AI),CSE(AI&ML),CSE(DS),AI&DS

Course Objectives:

- Make use of Data sets in implementing the machine learning algorithms
- Implement the machine learning concepts and algorithms in any suitable language of choice.

Course Outcomes (CO):

After completion of the course, students will be able to

- Understand the Mathematical and statistical perspectives of machine learning algorithms through python programming
- Appreciate the importance of visualization in the data analytics solution.
- Derive insights using Machine learning algorithms

List of Experiments:

Note:

- a. The programs can be implemented in either JAVA or Python.
 - b. For Problems 1 to 6 and 10, programs are to be developed without using the built-in classes or APIs of Java/Python.
 - c. Data sets can be taken from standard repositories (<https://archive.ics.uci.edu/ml/datasets.html>) or constructed by the students.
1. Implement and demonstrate the FIND-S algorithm for finding the most specific hypothesis based on a given set of training data samples. Read the training data from a .CSV file.
 2. For a given set of training data examples stored in a .CSV file, implement and demonstrate the Candidate-Elimination algorithm to output a description of the set of all hypotheses consistent with the training examples.
 3. Write a program to demonstrate the working of the decision tree based ID3 algorithm. Use an appropriate data set for building the decision tree and apply this knowledge to classify a new sample.
 4. Build an Artificial Neural Network by implementing the Back-propagation algorithm and test the same using appropriate data sets.
 5. Write a program to implement the naïve Bayesian classifier for a sample training data set stored as a .CSV file. Compute the accuracy of the classifier, considering few test data sets.
 6. Assuming a set of documents that need to be classified, use the naïve Bayesian Classifier model to perform this task. Built-in Java classes/API can be used to write the program. Calculate the accuracy, precision, and recall for your data set.
 7. Write a program to construct a Bayesian network considering medical data. Use this model to demonstrate the diagnosis of heart patients using standard Heart Disease Data Set. You can use Java/Python ML library classes/API.
 8. Apply EM algorithm to cluster a set of data stored in a .CSV file. Use the same data set for clustering using k-Means algorithm. Compare the results of these two algorithms and comment on the quality of clustering. You can add Java/Python ML library classes/API in the program.
 9. Write a program to implement k-Nearest Neighbour algorithm to classify the iris data set. Print both correct and wrong predictions. Java/Python ML library classes can be used for this problem.
 10. Implement the non-parametric Locally Weighted Regression algorithm in order to fit data points. Select appropriate data set for your experiment and draw graphs.

Projects

1. Predicting the Sale price of a house using Linear regression



JNTUA B.Tech. R20 Regulations

2. Spam classification using Naïve Bayes algorithm
3. Predict car sale prices using Artificial Neural Networks
4. Predict Stock market trends using LSTM
5. Detecting faces from images

References:

1. Python Machine Learning Workbook for beginners, AI Publishing, 2020.

Online Learning Resources/Virtual Labs:

- 1) [Machine Learning A-Z \(Python & R in Data Science Course\) | Udemy](#)
- 2) [Machine Learning | Coursera](#)



JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY ANANTAPUR
B.Tech (CSE)– III-II Sem

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(20A05603P) INTERNET OF THINGS LAB

Course Objectives:

- To introduce components such as WiFi, Bluetooth, Temperature, Moisture sensors
- To know the Micro controller such as Arduino
- To know the System on Chip (SOC) / Single Board Computer such as Raspberry Pi
- To understand HTTP IoT protocols and perform Experiments for data transmission
- To understand UAV/Drones and Internet of Drones Experiments

Course Outcomes:

After completion of the course, students will be able to

- Know the various IoT sensors and understand the functionality
- Design and analyze IoT experiments and transfer the data to IoT Clouds
- Design the IoT systems for real time applications
- Understand Drones and Perform Internet of Drones Experiments

List of Experiments:

Experiments using ESP32

1. Serial Monitor, LED, Servo Motor - Controlling

- **Experiment1:**
Controlling actuators through Serial Monitor. Creating different led patterns and controlling them using push button switches. Controlling servo motor with the help of joystick.

2. Distance Measurement of an object

- **Experiment 2:**
Calculate the distance to an object with the help of an ultrasonic sensor and display it on an LCD.

3. LDR Sensor, Alarm and temperature, humidity measurement

Experiment 3:

- Controlling relay state based on ambient light levels using LDR sensor.
- Basic Burglar alarm security system with the help of PIR sensor and buzzer.
- Displaying humidity and temperature values on LCD

4. Experiments using Raspberry Pi

Experiment 4:

- Controlling relay state based on input from IR sensors
- Interfacing stepper motor with R-Pi
- Advanced burglar alarm security system with the help of PIR sensor, buzzer and keypad. (Alarm gets disabled if correct keypad password is entered)
- 5. Automated LED light control based on input from PIR (to detect if people are present) and LDR(ambient light level)

5. IOT Framework

Experiment 5:

Upload humidity & temperature data to ThingSpeak, periodically logging ambient light level to ThingSpeak

Experiment 6:

Controlling LEDs, relay & buzzer using Blynk app

6. HTTP Based

Experiment 7:

- Introduction to HTTP. Hosting a basic server from the ESP32 to control various digital based actuators (led, buzzer, relay) from a simple web page.



Experiment 8:

- Displaying various sensor readings on a simple web page hosted on the ESP32.

7. MQTT Based

Experiment 9:

Controlling LEDs/Motors from an Android/Web app, Controlling AC Appliances from an android/web app with the help of relay.

Experiment 10:

Displaying humidity and temperature data on a web-based application

8. UAV/Drone:

Experiment 11:

- Demonstration of UAV elements, Flight Controller
- Mission Planner flight planning design

Experiment 12:

- Python program to read GPS coordinates from Flight Controller

Reference:

1. Adrian McEwen, Hakim Cassimally - Designing the Internet of Things, Wiley Publications, 2012.
2. Alexander Osterwalder, and Yves Pigneur – Business Model Generation – Wiley, 2011
3. ArshdeepBahga, Vijay Madisetti - Internet of Things: A Hands-On Approach, Universities Press, 2014.
4. The Internet of Things, Enabling technologies and use cases – Pethuru Raj, Anupama C. Raman, CRC Press.

Online Learning Resources/Virtual Labs:

<https://www.arduino.cc/>

<https://www.raspberrypi.org/>



JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY ANANTAPUR
B.Tech (CSE)– III-II Sem

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(20A52401) SOFT SKILLS

Course Objectives:

- To encourage all round development of the students by focusing on soft skills
- To make the students aware of critical thinking and problem-solving skills
- To develop leadership skills and organizational skills through group activities
- To function effectively with heterogeneous teams

Course Outcomes (CO):

By the end of the program students should be able to

- Memorize various elements of effective communicative skills
- Interpret people at the emotional level through emotional intelligence
- apply critical thinking skills in problem solving
- analyse the needs of an organization for team building
- Judge the situation and take necessary decisions as a leader
- Develop social and work-life skills as well as personal and emotional well-being

UNIT – I

Soft Skills & Communication Skills

10 Hrs

Introduction, meaning, significance of soft skills – definition, significance, types of communication skills - Intrapersonal & Inter-personal skills - Verbal and Non-verbal Communication

Activities:

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

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

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

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

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

UNIT – II

Critical Thinking

10 Hrs

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

Activities:

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

UNIT – III

Problem Solving & Decision Making

10 Hrs

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

Activities:

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

Case Study & Group Discussion



UNIT – IV Emotional Intelligence & Stress Management

10 Hrs

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

Activities:

Providing situations for the participants to express emotions such as happiness, enthusiasm, gratitude, sympathy, and confidence, compassion in the form of written or oral presentations. Providing opportunities for the participants to narrate certain crisis and stress –ridden situations caused by failure, anger, jealousy, resentment and frustration in the form of written and oral presentation, Organizing Debates

UNIT – V

Leadership Skills

10 Hrs

Team-Building – Decision-Making – Accountability – Planning – Public Speaking – Motivation – Risk-Taking - Team Building - Time Management

Activities:

Forming group with a consensus among the participants- choosing a leader- encouraging the group members to express views on leadership- democratic attitude- sense of sacrifice – sense of adjustment – vision – accommodating nature- eliciting views on successes and failures of leadership using the past knowledge and experience of the participants, Public Speaking, Activities on Time Management, Motivation, Decision Making, Group discussion etc.

NOTE:-

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

Textbooks:

1. Personality Development and Soft Skills (English, Paperback, Mitra BarunK.)Publisher: Oxford University Press; Pap/Cdr edition (July 22, 2012)
2. Personality Development and Soft Skills: Preparing for Tomorrow, Dr Shikha Kapoor Publisher : I K International Publishing House; 0 edition (February 28, 2018)

Reference Books:

1. Soft skills: personality development for life success by Prashant Sharma, BPB publications 2018.
2. Soft Skills By Alex K. Published by S.Chand
3. Soft Skills: An Integrated Approach to Maximise Personality Gajendra Singh Chauhan, Sangeetha Sharma Published by Wiley.
4. Communication Skills and Soft Skills (Hardcover, A. Sharma) Publisher: Yking books
5. SOFT SKILLS for a BIG IMPACT (English, Paperback, RenuShorey) Publisher: Notion Press
6. Life Skills Paperback English Dr. Rajiv Kumar Jain, Dr. Usha Jain Publisher: Vayu Education of India

Online Learning Resources:

1. https://youtu.be/DUlsNJtg2L8?list=PLLy_2iUCG87CQhELCyvXh0E_y-bOO1_q
2. https://youtu.be/xBaLgJZ0t6A?list=PLzf4HHlsQFwJZel_j2PUy0pwjVUgi7KlJ
3. <https://youtu.be/-Y-R9hDI7IU>
4. <https://youtu.be/gkLsn4ddmTs>
5. <https://youtu.be/2bf9K2rRWwo>
6. <https://youtu.be/FchfE3c2jzc>



JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY ANANTAPUR
B.Tech (CSE)– III-II Sem
(20A99601) INTELLECTUAL PROPERTY RIGHTS AND PATENTS
(Mandatory Non-Credit Course)

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Course Objectives:

- This course introduces the student to the basics of Intellectual Property Rights, Copy Right Laws, Cyber Laws, Trade Marks and Issues related to Patents. The overall idea of the course is to help and encourage the student for startups and innovations

Course Outcomes:

- Understand IPR law & Cyber law
- Discuss registration process, maintenance and litigations associated with trademarks
- Illustrate the copy right law

Enumerate the trade secret law.

UNIT I

Introduction to Intellectual Property Law – Evolutionary past – Intellectual Property Law Basics – Types of Intellectual Property – Innovations and Inventions of Trade related Intellectual Property Rights – Agencies Responsible for Intellectual Property Registration – Infringement – Regulatory – Overuse or Misuse of Intellectual Property Rights – Compliance and Liability Issues.

UNIT II

Introduction to Copyrights – Principles of Copyright – Subject Matters of Copyright – Rights Afforded by Copyright Law – Copyright Ownership – Transfer and Duration – Right to Prepare Derivative Works – Rights of Distribution – Rights of performers – Copyright Formalities and Registration – Limitations – Infringement of Copyright – International Copyright Law-Semiconductor Chip Protection Act.

UNIT III

Introduction to Patent Law – Rights and Limitations – Rights under Patent Law – Patent Requirements – Ownership and Transfer – Patent Application Process and Granting of Patent – Patent Infringement and Litigation – International Patent Law – Double Patenting – Patent Searching – Patent Cooperation Treaty – New developments in Patent Law- Invention Developers and Promoters.

UNIT IV

Introduction to Trade Mark – Trade Mark Registration Process – Post registration procedures – Trade Mark maintenance – Transfer of rights – Inter parties Proceedings – Infringement – Dilution of Ownership of Trade Mark – Likelihood of confusion – Trade Mark claims – Trade Marks Litigation – International Trade Mark Law.

UNIT V

Introduction to Trade Secrets – Maintaining Trade Secret – Physical Security – Employee Access Limitation – Employee Confidentiality Agreement – Trade Secret Law – Unfair Competition – Trade Secret Litigation – Breach of Contract – Applying State Law. Introduction to Cyber Law – Information Technology Act – Cyber Crime and E-commerce – Data Security – Confidentiality – Privacy – International aspects of Computer and Online Crime.

Textbooks:

1. Deborah E.Bouchoux: “Intellectual Property”. Cengage learning, New Delhi
2. Kompal Bansal & Parishit Bansal “Fundamentals of IPR for Engineers”, BS Publications (Press)
3. Cyber Law. Texts & Cases, South-Western’s Special Topics Collections

References:

1. Prabhuddha Ganguli: ‘ Intellectual Property Rights’ Tata Mc-Graw – Hill, New Delhi
2. Richard Stim: “Intellectual Property”, Cengage Learning, New Delhi.
3. R. Radha Krishnan, S. Balasubramanian: “Intellectual Property Rights”, Excel Books. New Delhi.
4. M. Ashok Kumar and Mohd. Iqbal Ali: “Intellectual Property Right” Serials Pub.



OPEN ELECTIVES



JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY ANANTAPUR			
B.Tech III-I Sem	L	T	P C
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(20A01505) BUILDING TECHNOLOGY
(Open Elective-I)

Course Objectives:

- To know different types of buildings, principles and planning of the buildings.
- To identify the termite control measure in buildings, and importance of grouping circulation, lighting and ventilation aspects in buildings.
- To know the different modes of vertical transportation in buildings.
- To know the utilization of prefabricated structural elements in buildings.
- To know the importance of acoustics in planning and designing of buildings.

Course Outcomes (CO):

- Understand the principles in planning and design the buildings
- To get different types of buildings, principles and planning of the buildings
- To know the different methods of termite proofing in buildings.
- Know the different methods of vertical transportation in buildings.
- Know the implementation of prefabricated units in buildings and effect of earthquake on buildings.
- Know the importance of acoustics in planning and designing of buildings.

UNIT I

Overview of the course, basic definitions, buildings-types-components-economy and design-principles of planning of buildings and their importance. Definitions and importance of grouping and circulation-lighting and ventilation-consideration of the above aspects during planning of building.

UNIT II

Termite proofing: Inspection-control measures and precautions-lighting protection of buildings-general principles of design of openings-various types of fire protection measures to be considered while planning a building.

UNIT III

Vertical transportation in a building: Types of vertical transportation-stairs-different forms of stairs-planning of stairs-other modes of vertical transportation –lifts-ramps-escalators.

UNIT IV

Prefabrication systems in residential buildings-walls-openings-cupboards-shelves etc., planning and modules and sizes of components in prefabrication. Planning and designing of residential buildings against the earthquake forces, principles, seismic forces and their effect on buildings.

UNIT V

Acoustics –effect of noise –properties of noise and its measurements, principles of acoustics of building. Sound insulation-importance and measures.

Textbooks:

1. Building construction by Varghese, PHI Learning Private Limited 2nd Edition 2015
2. Building construction by Punmia.B.C, Jain.A.K and Jain.A.K Laxmi Publications 1st edition 2016

Reference Books:

1. National Building Code of India, Bureau of Indian Standards
2. Building construction-Technical teachers training institute, Madras, Tata McGraw Hill.
3. Building construction by S.P.Arora and S.P.BrndraDhanpat Rai and Sons Publications, New Delh 2014 edition
<https://nptel.ac.in/courses/105102206>
<https://nptel.ac.in/courses/105103206>



JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY ANANTAPUR
B.Tech III-I Sem **L T P C**
3 0 0 3

(20A02505) ELECTRIC VEHICLES
(Open Elective-I)

Course Objectives:

- To get exposed to new technologies of battery electric vehicles, fuel cell electric vehicles
- To get exposed to EV system configuration and parameters
- To know about electro mobility and environmental issues of EVs
- To understand about basic EV propulsion and dynamics
- To understand about fuel cell technologies for EV and HVEs
- To know about basic battery charging and control strategies used in electric vehicles

Course Outcomes:

- Understand and differentiate between conventional and latest trends in Electric Vehicles
- Analyze various EV resources, EV dynamics and Battery charging
- Apply basic concepts of EV to design complete EV system
- Design EV system with various fundamental concepts

UNIT I INTRODUCTION TO EV SYSTEMS AND PARAMETERS

Past, Present and Future EV, EV Concept, EV Technology, State-of-the Art EVs, EV configuration, EV system, Fixed and Variable gearing, single and multiple motor drive, in-wheel drives, EV parameters: Weight, size, force and energy, performance parameters.

UNIT II EV AND ENERGY SOURCES

Electro mobility and the environment, history of Electric power trains, carbon emissions from fuels, green houses and pollutants, comparison of conventional, battery, hybrid and fuel cell electric systems

UNIT III EV PROPULSION AND DYNAMICS

Choice of electric propulsion system, block diagram, concept of EV Motors, single and multi motor configurations, fixed and variable geared transmission, In-wheel motor configuration, classification, Electric motors used in current vehicle applications, Recent EV Motors, Vehicle load factors, vehicle acceleration.

UNIT IV FUEL CELLS

Introduction of fuel cells, basic operation, model, voltage, power and efficiency, power plant system – characteristics, sizing, Example of fuel cell electric vehicle.

Introduction to HEV, brake specific fuel consumption, comparison of series, series-parallel hybrid systems, examples

UNIT V BATTERY CHARGING AND CONTROL

Battery charging: Basic requirements, charger architecture, charger functions, wireless charging, power factor correction.

Control: Introduction, modelling of electromechanical system, feedback controller design approach, PI controllers designing, torque-loop, speed control loop compensation, acceleration of battery electric vehicle

Textbooks:

1. C.C Chan, K.T Chau: Modern Electric Vehicle Technology, Oxford University Press Inc., New York 2001.
2. James Larminie, John Lowry, Electric Vehicle Technology Explained, Wiley, 2003.

Reference Books:

1. Electric and Hybrid Vehicles Design Fundamentals, Iqbal Husain, CRC Press 2005.
2. Ali Emadi, Advanced Electric Drive Vehicles, CRC Press, 2015.

Online Learning Resources:

1. https://onlinecourses.nptel.ac.in/noc22_ee53/preview



JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY ANANTAPUR
B.Tech III-I Sem **L T P C**
3 0 0 3

(20A03505a) 3D PRINTING TECHNOLOGY
(Open Elective-I)

Course Objectives:

- Familiarize techniques for processing of CAD models for rapid prototyping.
- Explain fundamentals of rapid prototyping techniques.
- Demonstrate appropriate tooling for rapid prototyping process.
- Focus Rapid prototyping techniques for reverse engineering.
- Train Various Pre – Processing, Processing and Post Processing errors in RP Processes.

Course Outcomes:

- Use techniques for processing of CAD models for rapid prototyping.
- Understand and apply fundamentals of rapid prototyping techniques.
- Use appropriate tooling for rapid prototyping process.
- Use rapid prototyping techniques for reverse engineering.
- Identify Various Pre – Processing, Processing and Post Processing errors in RP processes.

UNIT I Introduction to 3D Printing

Introduction to Prototyping, Traditional Prototyping Vs. Rapid Prototyping (RP), Need for time compression in product development, Usage of RP parts, Generic RP process, Distinction between RP and CNC, other related technologies, Classification of RP.

UNIT II Solid and Liquid Based RP Systems

Working Principle, Materials, Advantages, Limitations and Applications of Fusion Deposition Modelling (FDM), Laminated Object Manufacturing (LOM), Stereo lithography (SLA), Direct Light Projection System (DLP) and Solid Ground Curing (SGC).

UNIT III Powder Based & Other RP Systems

Powder Based RP Systems: Working Principle, Materials, Advantages, Limitations and Applications of Selective Laser Sintering (SLS), Direct Metal Laser Sintering (DMLS), Laser Engineered Net Shaping (LENS) and Electron Beam Melting (EBM).

Other RP Systems: Working Principle, Materials, Advantages, Limitations and Applications of Three Dimensional Printing (3DP), Ballistic Particle Manufacturing (BPM) and Shape Deposition Manufacturing (SDM).

UNIT IV Rapid Tooling & Reverse Engineering

Rapid Tooling: Conventional Tooling Vs. Rapid Tooling, Classification of Rapid Tooling, Direct and Indirect Tooling Methods, Soft and Hard Tooling methods.

Reverse Engineering (RE): Meaning, Use, RE – The Generic Process, Phases of RE Scanning, Contact Scanners and Noncontact Scanners, Point Processing, Application Geometric Model, Development.

UNIT V Errors in 3D Printing and Applications:

Pre-processing, processing and post-processing errors, Part building errors in SLA, SLS, etc.

Software: Need for software, MIMICS, Magics, SurgiGuide, 3-matic, 3D-Doctor, Simplant, Velocity2, VoXim, Solid View, 3DView, etc., software, Preparation of CAD models, Problems with STL files, STL file manipulation, RP data formats: SLC, CLI, RPI, LEAF, IGES, HP/GL, CT, STEP.

Applications: Design, Engineering Analysis and planning applications, Rapid Tooling, Reverse Engineering, Medical Applications of RP.

Textbooks:

1. Chee Kai Chua and Kah Fai Leong, “3D Printing and Additive Manufacturing Principles and Applications” 5/e, World Scientific Publications, 2017.



2. Ian Gibson, David W Rosen, Brent Stucker, “Additive Manufacturing Technologies: 3D Printing, Rapid Prototyping, and Direct Digital Manufacturing”, Springer, 2/e, 2010.

Reference Books:

1. Frank W.Liou, “Rapid Prototyping & Engineering Applications”, CRC Press, Taylor & Francis Group, 2011.
2. Rafiq Noorani, “Rapid Prototyping: Principles and Applications in Manufacturing”, John Wiley&Sons, 2006.

Online Learning Resources:

- NPTEL Course on Rapid Manufacturing.
- <https://nptel.ac.in/courses/112/104/112104265/>
- <https://www.hubs.com/knowledge-base/introduction-fdm-3d-printing/>
- <https://slideplayer.com/slide/6927137/>
- <https://www.mdpi.com/2073-4360/12/6/1334>
- <https://www.centropiaggio.unipi.it/sites/default/files/course/material/2013-11-29%20-%20FDM.pdf>
- <https://lecturenotes.in/subject/197>
- https://www.cet.edu.in/noticefiles/258_Lecture%20Notes%20on%20RP-ilovepdf-compressed.pdf
- https://www.vssut.ac.in/lecture_notes/lecture1517967201.pdf
- <https://www.youtube.com/watch?v=NkC8TNts4B4>



JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY ANANTAPUR
B.Tech III-I Sem **L T P C**
3 0 0 3

20A27505) COMPUTER APPLICATIONS IN FOOD TECHNOLOGY
(Open Elective-1)

Course Objectives:

- To know different software and applications in food technology.
- To understand the Chemical kinetics in food processing, Microbial distraction in thermal processing of food.
- To acquire knowledge on computer aided manufacturing and control of food machinery, inventory control, process control.

Course Outcomes:

- Students will gain knowledge on software in food technology, data analysis, Chemical kinetics, microbial distortion in thermal process
- Use of linear regression in analyzing sensory data, application of computer in some common food industries like, milk plant, bakery units & fruits vegetable plants.

UNIT I

Introduction to various software and their applications in food technology. Application of MS Excel to solve the problems of Food Technology, SPSS and JMP for data analysis, Pro-Engineering for design, Lab VIEW and SCADA for process control .

UNIT II

Chemical kinetics in food processing: Determining rate constant of zero order reaction First order rate constant and half-life of reactions. Determining energy of activation of vitamin degradation during food storage Rates of Enzymes catalyzed reaction. Microbial distraction in thermal processing of food. Determining decimal reduction time from microbial survival data, Thermal resistance factor, Z-values in thermal processing of food. Sampling to ensure that a lot is not contaminated with more than a given percentage Statistical quality control. Probability of occurrence in normal distribution. Using binomial distribution to determine probability of occurrence. Probability of defective items in a sample obtained from large lot

UNIT III

Sensory evaluation of food Statistical descriptors of a population estimated from sensory data obtained from a sample Analysis of variance. One factor, completely randomized design For two factor design without replication. Use of linear regression in analyzing sensory data. Mechanical transport of liquid food. Measuring viscosity of liquid food using a capillary tube viscometer . Solving simultaneous equations in designing multiple effect evaporator while using matrix algebra available in excel.

UNIT IV

Familiarization with the application of computer in some common food industries like, milk plant, bakery units & fruits vegetable plants, stating from the receiving of raw material up to the storage & dispatch of finished product.

UNIT V

Basic Introduction to computer aided manufacturing. Application of computers, instrumentation and control of food machinery, inventory control, process control etc.

Recommended books:

1. Computer Applications in Food Technology: Use of Spreadsheets in Graphical, Statistical and Process Analysis by R. Paul Singh, AP.
2. Manuals of MS Office.



JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY ANANTAPUR
B.Tech III-I Sem
(20A54501) OPTIMIZATION TECHNIQUES
(Open Elective- I)

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Course Objectives:

This course enables the students to classify and formulate real-life problem for modeling as optimization problem, solving and applying for decision making.

Course Outcomes: Student will be able to

- formulate a linear programming problem and solve it by various methods.
- give an optimal solution in assignment jobs, give transportation of items from sources to destinations.
- identify strategies in a game for optimal profit.
- implement project planning.

UNIT I

Introduction to operational research-Linear programming problems (LPP)-Graphical method-Simplex method-Big M Method-Dual simplex method.

UNIT II

Transportation problems- assignment problems-Game theory.

UNIT III

CPM and PERT –Network diagram-Events and activities-Project Planning-Reducing critical events and activities-Critical path calculations.

UNIT IV

Sequencing Problems-Replacement problems-Capital equipment- Discounting costs- Group replacement.

UNIT V

Inventory models-various costs- Deterministic inventory models-Economic lot size-Stochastic inventory models- Single period inventory models with shortage cost.

Textbooks:

1. Operations Research , S.D. Sharma.
2. Operations Research, An Introduction, Hamdy A. Taha, Pearson publishers.
3. Operations Research, Nita H Shah, Ravi M Gor, Hardik Soni, PHI publishers

Reference Books:

1. Problems on Operations Research, Er. Prem kumargupta, Dr.D.S. Hira, Chand publishers
2. Operations Research, CB Gupta, PK Dwivedi, Sunil kumaryadav

Online Learning Resources:

https://nptel.ac.in/content/storage2/courses/105108127/pdf/Module_1/M1L2slides.pdf
<https://slideplayer.com/slide/7790901/>
<https://www.ime.unicamp.br/~andreani/MS515/capitulo12.pdf>



JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY ANANTAPUR
B.Tech III-I Sem **L T P C**
3 0 0 3
(20A56501) MATERIALS CHARACTERIZATION TECHNIQUES
(Open Elective- I)

Course Objectives:

- To provide an exposure to different characterization techniques.
- To enlighten the basic principles and analysis of different spectroscopic techniques.
- To explain the basic principle of Scanning electron microscope along with its limitations and applications.
- To identify the Resolving power and Magnification of Transmission electron microscope and its applications.
- To educate the uses of advanced electric and magnetic instruments for characterization.

Course Outcomes: At the end of the course the student will be able

- To explain the structural analysis by X-ray diffraction.
- To understand the morphology of different materials using SEM and TEM.
- To recognize basic principles of various spectroscopic techniques.
- To study the electric and magnetic properties of the materials.
- To make out which technique can be used to analyse a material

UNIT I

Structure analysis by Powder X-Ray Diffraction: Introduction, Bragg's law of diffraction, Intensity of Diffracted beams, Factors affecting Diffraction, Intensities, Structure of polycrystalline Aggregates, Determination of crystal structure, Crystallite size by Scherrer and Williamson-Hall (W-H) Methods, Small angle X-ray scattering (SAXS) (in brief).

UNIT II

Microscopy technique -1 –Scanning Electron Microscopy (SEM)

Introduction, Principle, Construction and working principle of Scanning Electron Microscopy, Specimen preparation, Different types of modes used (Secondary Electron and Backscatter Electron), Advantages, limitations and applications of SEM.

UNIT III

Microscopy Technique -2 - Transmission Electron Microscopy (TEM): Construction and Working principle, Resolving power and Magnification, Bright and dark fields, Diffraction and image formation, Specimen preparation, Selected Area Diffraction, Applications of Transmission Electron Microscopy, Difference between SEM and TEM, Advantage and Limitations of Transmission Electron Microscopy.

UNIT IV

Spectroscopy techniques – Principle, Experimental arrangement, Analysis and advantages of the spectroscopic techniques – (i) UV-Visible spectroscopy (ii) Raman Spectroscopy, (iii) Fourier Transform infrared (FTIR) spectroscopy, (iv) X-ray photoelectron spectroscopy (XPS).

UNIT V

Electrical & Magnetic Characterization techniques: Electrical Properties analysis techniques (DC conductivity, AC conductivity) Activation Energy, Effect of Magnetic field on the electrical properties (Hall Effect). Magnetization measurement by induction method, Vibrating sample Magnetometer (VSM) and SQUID.

Textbooks:

1. Material Characterization: Introduction to Microscopic and Spectroscopic Methods –Yang Leng – John Wiley & Sons (Asia) Pvt. Ltd. 2008
2. Handbook of Materials Characterization -by Sharma S. K. - Springer

References:

1. Fundamentals of Molecular Spectroscopy – IV Ed. – Colin Neville Banwell and Elaine M. McCash, Tata McGraw-Hill, 2008.
2. Elements of X-ray diffraction – Bernard Dennis Cullity & Stuart R Stocks, Prentice Hall, 2001
3. Materials Characterization: Introduction to Microscopic and Spectroscopic Methods-Yang Leng- John Wiley & Sons
4. Characterization of Materials 2nd Edition, 3 Volumes-Kaufmann E N -John Wiley (Bp)



JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY ANANTAPUR
B.Tech III-I Sem **L T P C**
3 0 0 3
(20A51501) CHEMISTRY OF ENERGY MATERIALS
(Open Elective- I)

Course Objectives:

- To make the student understand basic electrochemical principles such as standard electrode potentials, emf and applications of electrochemical principles in the design of batteries.
- To understand the basic concepts of processing and limitations of fossil fuels and Fuel cells & their applications.
- To impart knowledge to the students about fundamental concepts of hydrogen storage in different materials and liquification method
- Necessasity of harnessing alternate energy resources such as solar energy and its basic concepts.
- To understand and apply the basics of calculations related to material and energy flow in the processes.

Course Outcomes:

- Ability to perform simultaneous material and energy balances.
- Student learn about various electrochemical and energy systems
- Knowledge of solid, liquid and gaseous fuels
- To know the energy demand of world, nation and available resources to fulfill the demand
- To know about the conventional energy resources and their effective utilization
- To acquire the knowledge of modern energy conversion technologies
- To be able to understand and perform the various characterization techniques of fuels
- To be able to identify available nonconventional (renewable) energy resources and techniques to utilize them effectively

UNIT I: Electrochemical Systems: Galvanic cell, standard electrode potential, application of EMF, electrical double layer, dipole moments, polarization, Batteries-Lead-acid and Lithium ion batteries.

UNIT II: Fuel Cells: Fuel cell working principle, Classification of fuel cells, Polymer electrolyte membrane (PEM) fuel cells, Solid-oxide fuel cells (SOFC), Fuel cell efficiency, Basic design of fuel cell,.

UNIT III: Hydrogen Storage: Hydrogen Storage, Chemical and Physical methods of hydrogen storage, Hydrogen Storage in metal hydrides, metal organic frame works (MOF), Carbon structures, metal oxide porous structures, hydrogel storage by high pressure methods. Liquification method.

UNIT IV:Solar Energy: Solar energy introduction and prospects, photo voltaic (PV) technology, concentrated solar power (CSP), Solar Fuels, Solar cells.

UNIT V: Photo and Photo electrochemical Conversions: Photochemical cells and applications of photochemical reactions, specificity of photo electrochemical cell, advantage of photoelectron catalytic conversions.

References:

1. Physical chemistry by Ira N. Levine
2. Essentials of Physical Chemistry, Bahl and Bahl and Tuli.
3. Inorganic Chemistry, Silver and Atkins
4. Fuel Cell Hand Book 7th Edition, by US Department of Energy (EG&G technical services and corporation)
5. Hand book of solar energy and applications by Arvind Tiwari and Shyam.
6. Solar energy fundamental, technology and systems by Klaus Jagar et.al.
7. Hydrogen storage by Levine Klebonoff



JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY ANANTAPUR
B.Tech III-II Sem **L T P C**
3 0 0 3

(20A02605) SMART ELECTRIC GRID
(Open Elective Course-II)

Course Objectives:

- Understand recent trends in grids, smart grid architecture and technologies
- Analyze smart substations
- Apply the concepts to design smart transmission systems
- Apply the concepts to design smart distribution systems

Course Outcomes:

- Understand trends in Smart grids, needs and roles of Smart substations
- Design and Analyze Smart Transmission systems
- Design and Analyze Smart Distribution systems
- Analyze SCADA and DSCADA systems in practical working environment

UNIT I INTRODUCTION TO SMART GRID

Working definitions of Smart Grid and Associated Concepts – Smart Grid Functions – Traditional Power Grid and Smart Grid – New Technologies for Smart Grid – Advantages – Indian Smart Grid – Key Challenges for Smart Grid

UNIT II SMART GRID TECHNOLOGIES

Characteristics of Smart grid, Micro grids, Definitions, Drives, benefits, types of Micro grid, building blocks, Renewable energy resources, needs in smart grid, integration impact, integration standards, Load frequency control, reactive power control, case studies and test beds

UNIT III SMART SUBSTATIONS

Protection, Monitoring and control devices, sensors, SCADA, Master stations, Remote terminal unit, interoperability and IEC 61850, Process level, Bay level, Station level, Benefits, role of substations in smart grid, Volt/VAR control equipment inside substation

UNIT IV SMART TRANSMISSION SYSTEMS

Energy Management systems, History, current technology, EMS for the smart grid, Synchro Phasor Measurement Units (PMUs), Wide Area Monitoring Systems (WAMS), protection & Control (WAMPC), needs in smart grid, Role of WAMPC smart grid, Drivers and benefits, Role of transmission systems in smart grid

UNIT V SMART DISTRIBUTION SYSTEMS

DMS, DSCADA, trends in DSCADA and control, current and advanced DMSs, Voltage fluctuations, effect of voltage on customer load, Drivers, objectives and benefits, voltage-VAR control, VAR control equipment on distribution feeders, implementation and optimization, FDIR - Fault Detection Isolation and Service restoration (FDIR), faults, objectives and benefits, equipment, implementation

Textbooks:

1. Stuart Borlase, Smart Grids - Infrastructure, Technology and Solutions, CRC Press, 1e, 2013
2. Gil Masters, Renewable and Efficient Electric Power System, Wiley–IEEE Press, 2e, 2013.

Reference Books:

1. A.G. Phadke and J.S. Thorp, Synchronized Phasor Measurements and their Applications, Springer Edition, 2e, 2017.
2. T. Ackermann, Wind Power in Power Systems, Hoboken, NJ, USA, John Wiley, 2e, 2012.

Online Learning Resources:

1. https://onlinecourses.nptel.ac.in/noc22_ee82/preview



JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY ANANTAPUR
B.Tech III-II Sem
L T P C
3 0 0 3

(20A04606) BASIC VLSI DESIGN

Course Objectives:

- Understand the fundamental aspects of circuits in silicon
- Relate to VLSI design processes and design rules

Course Outcomes:

- Identify the CMOS layout levels, and the design layers used in the process sequence.
- Describe the general steps required for processing of CMOS integrated circuits.
- Design static CMOS combinational and sequential logic at the transistor level.
- Demonstrate different logic styles such as complementary CMOS logic, pass-transistor Logic, dynamic logic, etc.
- Interpret the need for testability and testing methods in VLSI.

UNIT I

Moore's law, speed power performance, nMOS fabrication, CMOS fabrication: n-well, pwell processes, BiCMOS, Comparison of bipolar and CMOS. Basic Electrical Properties of MOS And BiCMOS Circuits: Drain to source current versus voltage characteristics, threshold voltage, transconductance.

UNIT II

Basic Electrical Properties of MOS And BiCMOS Circuits: nMOS inverter, Determination of pull up to pull down ratio: nMOS inverter driven through one or more pass transistors, alternative forms of pull up, CMOS inverter, BiCMOS inverters, latch up. Basic Circuit Concepts: Sheet resistance, area capacitance calculation, Delay unit, inverter delay, estimation of CMOS inverter delay, super buffers, BiCMOS drivers.

UNIT III

MOS and BiCMOS Circuit Design Processes: MOS layers, stick diagrams, nMOS design style, CMOS design style Design rules and layout & Scaling of MOS Circuits: λ - based design rules, scaling factors for device parameters

UNIT IV

Subsystem Design and Layout-1: Switch logic pass transistor, Gate logic inverter, NAND gates, NOR gates, pseudo nMOS, Dynamic CMOS Examples of structured design: Parity generator, Bus arbitration, multiplexers, logic function block, code converter.

UNIT V

Subsystem Design and Layout-2: Clocked sequential circuits, dynamic shift registers, bus lines, General considerations, 4-bit arithmetic processes, 4-bit shifter, Regularity Definition & Computation Practical aspects and testability: Some thoughts of performance, optimization and CAD tools for design and simulation.

Textbooks:

1. "Basic VLSI Design", Douglas A Pucknell, Kamran Eshraghian, 3 rd Edition, Prentice Hall of India publication, 2005.

References:

1. "CMOS Digital Integrated Circuits, Analysis And Design", Sung – Mo (Steve) Kang, Yusuf Leblebici, Tata McGraw Hill, 3 rd Edition, 2003.
2. "VLSI Technology", S.M. Sze, 2nd edition, Tata McGraw Hill, 2003



JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY ANANTAPUR
B.Tech III-II Sem **L T P C**
3 0 0 3
(20A27605) FOOD REFRIGERATION AND COLD CHAIN MANAGEMENT
OPEN ELECTIVE II

Course Objectives:

- To know the equipment available to store perishable items for a long time
- To understand to increase the storage life of food items

Course Outcomes

By the end of the course, the students will

- Understand various principles and theories involved in refrigeration systems
- Understand the different equipment useful to store the food items for a long period.
- Understand how to increase the storage life of food items

UNIT I

Principles of refrigeration: Definition, background with second law of thermodynamics, unit of refrigerating capacity, coefficient of performance; Production of low temperatures: Expansion of a liquid with flashing, reversible/ irreversible adiabatic expansion of a gas/ real gas, thermoelectric cooling, adiabatic demagnetization; Air refrigerators working on reverse Carnot cycle: Carnot cycle, reversed Carnot cycle, selection of operating temperatures;

UNIT II

Air refrigerators working on Bell Coleman cycle: Reversed Brayton or Joule or Bell Coleman cycle, analysis of gas cycle, polytropic and multistage compression; Vapour refrigeration: Vapor as a refrigerant in reversed Carnot cycle with p-V and T-s diagrams, limitations of reversed Carnot cycle; Vapour compression system: Modifications in reverse Carnot cycle with vapour as a refrigerant (dry vs wet compression, throttling vs isentropic expansion), representation of vapor compression cycle on pressure- enthalpy diagram, super heating, sub cooling;

UNIT III

Liquid-vapour regenerative heat exchanger for vapour compression system, effect of suction vapour super heat and liquid sub cooling, actual vapour compression cycle; Vapour-absorption refrigeration system: Process, calculations, maximum coefficient of performance of a heat operated refrigerating machine, Common refrigerants and their properties: classification, nomenclature, desirable properties of refrigerants- physical, chemical, safety, thermodynamic and economical; Azeotropes; Components of vapour compression refrigeration system, evaporator, compressor, condenser and expansion valve;

UNIT IV

Ice manufacture, principles and systems of ice production, Treatment of water for making ice, brines, freezing tanks, ice cans, air agitation, quality of ice; Cold storage: Cold store, design of cold storage for different categories of food resources, size and shape, construction and material, insulation, vapour barriers, floors, frost-heave, interior finish and fitting, evaporators, automated cold stores, security of operations; Refrigerated transport: Handling and distribution, cold chain, refrigerated product handling, order picking, refrigerated vans, refrigerated display;

UNIT V

Air-conditioning: Meaning, factors affecting comfort air-conditioning, classification, sensible heat factor, industrial air-conditioning, problems on sensible heat factor; Winter/summer/year round air-conditioning, unitary air-conditioning systems, central air-conditioning, physiological principles in air-conditioning, air distribution and duct design methods; design of complete air-conditioning systems; humidifiers and dehumidifiers; Cooling load calculations: Load sources, product cooling, conducted heat, convected heat, internal heat sources, heat of respiration, peak load; etc.



JNTUA B.Tech. R20 Regulations

Textbooks:

1. Arora, C. P. "Refrigeration and Air Conditioning". Tata MC Graw Hill Publishing Co.Ltd., New Delhi. 1993.

References:

1. Adithan, M. and Laroia, S. C. "Practical Refrigeration and Air Conditioning". Wiley Eastern Ltd., New Delhi 1991



JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY ANANTAPUR
B.Tech III-II Sem **L T P C**
3 0 0 3
(20A54701) WAVELET TRANSFORMS AND ITS APPLICATIONS
(Open Elective-II)

Course Objectives:

This course provides the students to understand Wavelet transforms and its applications.

Course Outcomes:

- Understand wavelets and wavelet expansion systems.
- Illustrate the multi resolution analysis and scaling functions.
- Form fine scale to coarse scale analysis.
- Find the lattices and lifting.
- Perform numerical complexity of discrete wavelet transforms.
- Find the frames and tight frames using fourier series.

UNIT I Wavelets

Wavelets and Wavelet Expansion Systems - Wavelet Expansion- Wavelet Transform- Wavelet System- More Specific Characteristics of Wavelet Systems -Haar Scaling Functions and Wavelets - effectiveness of Wavelet Analysis -The Discrete Wavelet Transform the Discrete-Time and Continuous Wavelet Transforms.

UNIT II A Multiresolution Formulation of Wavelet Systems

Signal Spaces -The Scaling Function -Multiresolution Analysis - The Wavelet Functions - The Discrete Wavelet Transform- A Parseval's Theorem - Display of the Discrete Wavelet Transform and the Wavelet Expansion.

UNIT III Filter Banks and the Discrete Wavelet Transform

Analysis - From Fine Scale to Coarse Scale- Filtering and Down-Sampling or Decimating -Synthesis - From Coarse Scale to Fine Scale -Filtering and Up-Sampling or Stretching - Input Coefficients - Lattices and Lifting - -Different Points of View.

UNIT IV Time-Frequency and Complexity

Multiresolution versus Time-Frequency Analysis- Periodic versus Nonperiodic Discrete Wavelet Transforms -The Discrete Wavelet Transform versus the Discrete-Time Wavelet Transform- Numerical Complexity of the Discrete Wavelet Transform.

UNIT V Bases and Matrix Examples

Bases, Orthogonal Bases, and Biorthogonal Bases -Matrix Examples - Fourier Series Example - Sine Expansion Example - Frames and Tight Frames - Matrix Examples -Sine Expansion as a Tight Frame Example.

Textbooks:

1. C. Sidney Burrus, Ramesh A. Gopinath, "Introduction to Wavelets and Wavelets Transforms", Prentice Hall, (1997).
2. James S. Walker, "A Primer on Wavelets and their Scientific Applications", CRC Press, (1999).

Reference Books:

1. Raghuveer Rao, "Wavelet Transforms", Pearson Education, Asia.

Online Learning Resources:

<https://www.slideshare.net/RajEndiran1/introduction-to-wavelet-transform-51504915>



JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY ANANTAPUR
B.Tech III-II Sem **L T P C**
3 0 0 3
(20A56701) PHYSICS OF ELECTRONIC MATERIALS AND DEVICES
(Open Elective-II)

Course Objectives:

- To impart the fundamental knowledge on various materials, their properties and applications.
- To provide insight into various semiconducting materials, and their properties.
- To enlighten the characteristic behavior of various semiconductor devices.
- To provide the basics of dielectric and piezoelectric materials and their properties.
- To explain different categories of magnetic materials, mechanism and their advanced applications.

Course Outcome: At the end of the course the student will be able

- To understand the fundamentals of various materials.
- To exploit the physics of semiconducting materials
- To familiarize with the working principles of semiconductor-based devices.
- To understand the behaviour of dielectric and piezoelectric materials.
- To identify the magnetic materials and their advanced applications.

UNIT I Fundamentals of Materials Science

Introduction, Phase rule, Phase Diagram, Elementary idea of Nucleation and Growth, Methods of crystal growth. Basic idea of point, line and planar defects. Concept of thin films, preparation of thin films, Deposition of thin film using sputtering methods (RT and glow discharge).

UNIT II Semiconductors

Introduction, charge carriers in semiconductors, effective mass, Diffusion and drift, Diffusion and recombination, Diffusion length. The Fermi level & Fermi-Dirac distribution, Electron and Hole in quantum well, Change of electron-hole concentration- Qualitative analysis, Temperature dependency of carrier concentration, Conductivity and mobility, Effects of temperature and doping on mobility, High field effects.

UNIT III Physics of Semiconductor devices

Introduction, Band structure, PN junctions and their typical characteristics under equilibrium and under bias, Construction and working principles of: Light emitting diodes, Heterojunctions, Transistors, FET and MOSFETs.

UNIT IV Dielectric Materials and their applications:

Introduction, Dielectric properties, Electronic polarizability and susceptibility, Dielectric constant and frequency dependence of polarization, Dielectric strength and dielectric loss, Piezoelectric properties.

UNIT V Magnetic Materials and their applications

Introduction, Magnetism & various contributions to para and dia magnetism, Ferro and Ferri magnetism and ferrites, Concepts of Spin waves and Magnons, Anti-ferromagnetism, Domains and domain walls, Coercive force, Hysteresis, Nano-magnetism, Super-paramagnetism – Properties and applications.

Textbooks

1. Principles of Electronic Materials and Devices- S.O. Kasap, McGraw-Hill Education (India) Pvt. Ltd., 3rd edition, 2007.
2. Electronic Components and Materials- Grover and Jamwal, Dhanpat Rai and Co.

Reference Books:

1. Solid State Electronic Devices -B.G. Streetman and S. Banerjee, PHI Learning, 6th edition
2. Electronic Materials Science- Eugene A. Irene, , Wiley, 2005
3. An Introduction to Electronic Materials for Engineers-Wei Gao, Zhengwei Li, Nigel Sammes, World Scientific Publishing Co. Pvt. Ltd., , 2nd Edition,2011
4. A First Course In Material Science- by Raghvan, McGraw Hill Pub.
5. The Science and Engineering of materials- Donald R.Askeland, Chapman& Hall Pub.

NPTEL courses links

<https://nptel.ac.in/courses/113/106/113106062/>
https://onlinecourses.nptel.ac.in/noc20_mm02/preview,
<https://nptel.ac.in/noc/courses/noc17/SEM1/noc17-mm07>



JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY ANANTAPUR
B.Tech III-II Sem

L	T	P	C
3	0	0	3

(20A51701) CHEMISTRY OF POLYMERS AND ITS APPLICATIONS

Course Objectives:

- To understand the basic principles of polymers
- To synthesize the different polymeric materials and their characterization by various instrumental methods.
- To impart knowledge to the students about fundamental concepts of Hydro gels of polymer networks, surface phenomenon by micelles
- To enumerate the applications of polymers in engineering

Course Outcome

- At the end of the course, the student will be able to:
- Understand the state of art synthesis of Polymeric materials
- Understand the hydro gels preparation, properties and applications in drug delivery system.
- Characterize polymers materials using IR, NMR, XRD.
- Analyze surface phenomenon fo micelles and characterise using photoelectron spectroscopy, ESCA and Auger spectroscopy

UNIT I : Polymers-Basics and Characterization

Basic concepts: monomers, repeat units, degree of polymerization, linear, branched and network polymers, classification of polymers, Polymerization: condensation, addition, radical chain, ionic and coordination and copolymerization. Average molecular weight concepts: number, weight and viscosity average molecular weights, polydispersity and molecular weight distribution Measurement of molecular weight: end group, viscosity, light scattering, osmotic and ultracentrifugation methods, analysis and testing of polymers.

Unit II : Synthetic Polymers

Addition and condensation polymerization processes – Bulk, Solution, Suspension and Emulsion polymerization.

Preparation and significance, classification of polymers based on physical properties, Thermoplastics, Thermosetting plastics, Fibers and elastomers, General Applications.

Preparation of Polymers based on different types of monomers, Olefin polymers, Diene polymers, nylons, Urea - formaldehyde, phenol - formaldehyde and melamine Epoxy and Ion exchange resins.

Characterization of polymers by IR, NMR, XRD.

UNIT III : Natural Polymers & Modified cellulotics

Natural Polymers: Chemical & Physical structure, properties, source, important chemical modifications, applications of polymers such as cellulose, lignin, starch, rosin, shellac, latexes, vegetable oils and gums, proteins.

Modified cellulotics: Cellulose esters and ethers such as Ethyl cellulose, CMC, HPMC, cellulose acetals, Liquid crystalline polymers; specialty plastics- PES, PAES, PEEK, PEAK.

Learning Outcomes:

UNIT IV: Hydrogels of Polymer networks and Drug delivery

Definitions of Hydrogel, polymer networks, Types of polymer networks, Methods involved in hydrogel preparation, Classification, Properties of hydrogels, Applications of hydrogels in drug delivery.

Introduction to drug systems including, drug development, regulation, absorption and disposition, routes of administration and dosage forms. Advanced drug delivery systems and controlled release.

UNIT V : Surface phenomena



Surface tension, adsorption on solids, electrical phenomena at interfaces including electrokinetics, micelles, reverse micelles, solubilization. Application of photoelectron spectroscopy, ESCA and Auger spectroscopy to the study of surfaces.

References :

1. A Text book of Polymer science, Billmayer
2. Organic polymer Chemistry, K.J.Saunders, Chapman and Hall
3. Advanced Organic Chemistry, B.Miller, Prentice Hall
4. Polymer Chemistry – G.S.Mishra
5. Polymer Chemistry – Gowarikar
6. Physical Chemistry –Galston
7. Drug Delivery- Ashim K. Misra



HONOURS



JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY ANANTAPUR
B.Tech (CSE)

L	T	P	C
3	1	0	4

(20A05H01) PRIVACY PRESERVING AND DATA PUBLISHING

Pre-requisite **Probability, Design and Analysis of Algorithms**

Course Objectives:

Introduce attack models, provide methods and tools for publishing useful information while preserving data privacy.

Course Outcomes:

After completion of the course, students will be able to

- Apply anonymization methods for sensitive data protection.
- Apply state-of art techniques for data privacy protection.
- Design privacy preserving algorithms for real-world applications.
- Identify security and privacy issues in OLAP systems.
- Apply information metrics for Maximizing the preservation of information in the anonymization process.

UNIT I

12 Hrs

Data Collection and Data Publishing, Introduction to Privacy-Preserving Data Publishing, Attack Models and Privacy Models: Record Linkage Model, Attribute Linkage Model, Probabilistic Model, Modeling Adversary's Background Knowledge

UNIT II

12 Hrs

Anonymization Operations, Generalization and Suppression, Anonymization and Permutation, Random Perturbation, Information Metrics, General Purpose Metrics, Special Purpose Metrics, Trade-Off Metrics, Anonymization Algorithms: Algorithms for the Record Linkage Model, Algorithms for the Attribute Linkage Model, Algorithms for the Table Linkage Model, Algorithms for the Probabilistic Attack Model, Attacks on Anonymous Data,

UNIT III

12 Hrs

Anonymization for Classification Analysis: Introduction, Anonymization Problems for Red Cross BTS, High-Dimensional Top-Down Specialization (HDTDS), Workload-Aware Mondrian, Bottom-Up Generalization, Genetic Algorithm, Evaluation Methodology, Anonymization for Cluster Analysis: Introduction, Anonymization Framework for Cluster Analysis, Dimensionality Reduction-Based Transformation

12 Hrs

UNIT IV

Multiple Views Publishing: Introduction, Checking Violations of k -Anonymity on Multiple Views, Checking Violations with Marginals, Anonymizing Sequential Releases with New Attributes: Introduction, Monotonicity of Privacy, Anonymization Algorithm for Sequential Releases, Anonymizing Incrementally Updated Data Records: Introduction, Continuous Data Publishing, Dynamic Data Republishing

UNIT V

12 Hrs

Collaborative Anonymization for Vertically Partitioned Data: Introduction, Privacy-Preserving Data Mashup, Cryptographic Approach, Collaborative Anonymization for Horizontally Partitioned Data: Introduction, Privacy Model, Overview of the Solution, Anonymizing Transaction Data: Introduction, Cohesion Approach, Band Matrix Method, km -Anonymization, Transactional k -Anonymity, Anonymizing Query Logs

Textbooks:



1. Benjamin C.M. Fung, Ke Wang, Ada Wai-Chee Fu and Philip S. Yu, Introduction to Privacy-Preserving Data Publishing: Concepts and Techniques, 1st Edition, Chapman & Hall/CRC, 2010.
2. Charu C. Aggarwal, Privacy-Preserving Data Mining: Models and Algorithms, 1st Edition, Springer, 2008.

Reference Books:

1. Chen, B. C., Kifer, D., LeFevre, K., & Machanavajjhala, A. (2009). Privacy-preserving data publishing. Foundations and Trends® in Databases, 2(1–2), 1-167.

Online Learning Resources:

<https://archive.nptel.ac.in/courses/106/106/106106235/>

<https://archive.nptel.ac.in/courses/106/106/106106146/>



JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY ANANTAPUR
B.Tech (CSE)

L	T	P	C
4	0	0	4

(20A05H02) NoSQL DATABASES

Pre-requisite DBMS

Course Objectives:

- Discuss the history unstructured data
- To know non-relational databases and their importance in Data science.
- Understand the differences between Relational and NoSQL databases
- To explore the several types of NoSQL databases and understand the role in Big Data.

Course Outcomes:

After completion of the course, students will be able to

- Explain and compare different types of NoSQL database.
- Compare and contrast RDBMS with different NoSQL databases.
- Define, compare and use the four types of NoSQL databases (Document-oriented, Key-Value pairs, Column-oriented and Graph
- Demonstrate the architecture, define objects, load data, query data and performance tune Column-oriented, Key-Value pair, Document and Graph databases.
- Evaluate NoSQL database development tools and programming languages

UNIT I Overview and history of NoSQL Databases

Lecture 12Hrs

Definition of the four types of NoSQL databases. The value of Relational Databases, Getting at Persistent Data, Concurrency, Integration, Impedance Mismatch, Application and Integration Databases, Attack of the Clusters, The emergence of NoSQL, Key Points.

UNIT II RDBMS Vs NoSQL

Lecture 12Hrs

Comparison of relational databases to new NoSQL stores, MongoDB, Cassandra, HBASE, Neo4j use and deployment, Application, RDBMS approach, Challenges NoSQL approach, Key-Value and Document Data Models, Column-Family Stores, Aggregated-Oriented Databases, Replication and Sharding, MapReduce on databases, Distribution Models, Single Server, Sharding, Master-Slave Replication, Peer-to-Peer Replication, Combining Sharding and Replication.

UNIT III Document Databases

Lecture 12Hrs

No-SQL Key-Value Databases using MongoDB, Document Databases, Document oriented Database Features, Consistency, Transactions, Availability, Query Features, Scaling, Suitable Use Cases, Event Logging, Content Management Systems, Blogging Platforms, Web Analysis or Real Time Analytics.

UNIT IV Column Oriented Databases

Lecture 12Hrs

Column-oriented NoSQL databases using Apache HBASE, Column-oriented NoSQL databases using Apache Cassandra, Architecture of HBASE, Column-Family Data Store Features, Consistency, Transactions, Availability, Query Features, Scaling, Suitable Use Cases, Event Logging, Content Management Systems, Blogging Platforms, Counters, Expiring Usage.

UNIT V Key Value Databases

Lecture 12Hrs

NoSQL Key-Value databases using Riak, Key-Value Databases, Key-Value Store, Key-Value Store Features, Consistency, Transactions, Query Features, Consistency, Transactions, Query Features, Structure of Data, Scaling, Suitable Use Cases, Storing Session Information, User Profiles, Preferences, Shopping Cart Data, Relationships among Data, Multi operation Transactions, Query by Data, Operations by Sets, Firebase- Cloud hosted NoSQL Database, Graph NoSQL databases using Neo4j, NoSQL database development tools and programming languages, Graph Databases features, consistency, Transactions, Availability, Query Features, Scaling, Suitable Use Cases.



Textbooks:

1. Sadalage, P. & Fowler, NoSQL Distilled: A Brief Guide to the Emerging World of Polyglot Persistence, Wiley Publications, 1st Edition 2019.

Reference Books:

1. Redmond, E. & Wilson, J. (2012). Seven Databases in Seven Weeks: A Guide to Modern Databases and the NoSQL Movement (1st Ed.). Raleigh, NC: The Pragmatic Programmers, LLC. ISBN-13: 978-1934356920 ISBN-10: 1934356921
2. Guy Harrison, Next Generation Database: NoSQL and big data, Apress.

Online Learning Resources:

1. <https://www.ibm.com/cloud/learn/nosql-databases>
2. <https://www.coursera.org/lecture/nosql-databases/introduction-to-nosql-VdRNp>
3. <https://www.geeksforgeeks.org/introduction-to-nosql/>
4. <https://www.javatpoint.com/nosql-databa>



JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY ANANTAPUR				
B.Tech (CSE)	L	T	P	C
	4	0	0	4

(20A05H03) SOFTWARE DEFINED DATA CENTER

Course Objectives:

- Introduce conventional Data Centers followed by Modern Data Centers
- To discuss various software elements of modern data centers
- Explain Virtualization concepts for Data Centers
- Discuss Compute, Storage and Network virtualization

Course Outcomes:

After completion of the course, students will be able to

- Understanding of difference between Conventional Data Center Vs Modern Data Centers
- Differentiate Cloud computing and Software Defined Data Centers
- Differentiate Virtualization with conventional techniques
- Explore the techniques of Software Defined Compute, Storage and Networking components
- Able Manage Software Defined Data Centers and Develop the techniques for future Data Centers.

UNIT I Introduction

Lecture 12Hrs

Data Center evolution, A history of Modern Data Center, Focus on cost reduction, Focus on Customer service in the business, Flattening of the IT organization, IT as an operational Expense, Monolithic Storage Array rise and fall, Move From Disk to Flash, Emergence of Convergence, The Role of Cloud computing.

UNIT II Emerging Data Center Trends

Lecture 12Hrs

Emergence of SDCC, Commoditization of Hardware, Software Defined – Compute, Storage, Networking and Security, Software Defined Storage (SDS), Hyperconvergence, Hyper Converged Infrastructure(HCI) and SDS relationship, Flash in Hyperconvergence, Modern IT business Requirements.

UNIT III Data Center Agility

Lecture 12Hrs

Principles and Strategies, Transform Data Center, Align Data Center and Business Needs, Server virtualization, VDI, Eliminate and Implement Monolithic to Hyperconvergence, Full Stack Management.

UNIT IV Hyper converged Infrastructure

Lecture 12Hrs

Software Defined Storage, SDS comparison to Traditional Storage, SDS requirements, SDS in Hyperconverged, Hyperconvergence Design Model, Virtual Storage appliances, Appliance vs. Software/Reference Architecture,

UNIT V Future Data Centers

Lecture 12Hrs

Data growth, Storage capacity, flash storage deployment, Deployment Experiences SDS and HCI, IT transformations- Automation, Orchestration, DevOps, Open Standards and Interoperability, Performance Benchmarking Standards, Future Trends, Containers Instead of virtual machines, Open Source tools, Beyond Today's Flash, Pooling of Resources.

Textbooks:

1. Building a Modern Data Center, Principles and Strategies of Design, Scott D.Lowe, James Green, David Davis. Actual Tech Media, 2016.

Reference Books:

1. Data Center Handbook: Plan, Design, Build, and Operations of a Smart Data Center, Second Edition, Hwaiyu Geng P.E., 2021 John Wiley & Sons.



JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY ANANTAPUR				
B.Tech (CSE)	L	T	P	C
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(20A05H04) ROBOTICS AND INTELLIGENT SYSTEMS				

Course Objectives:

- Understand the basic concepts of robotics.
- Discuss the requirement of robotic technology
- Introduce robotics kinematics, dynamic analysis and programming.
- Understand the concepts of intelligent system and apply them to robotics

Course Outcomes:

After completion of the course, students will be able to

- Understand general concepts of Robotics and intelligent systems.
- Understand robotics control systems
- Analyze and understand the various programming languages of robotics
- Understand Industrial robots and its applications
- Create IoT solutions using sensors, actuators and Devices

UNIT I

Lecture 8Hrs

Introduction to Robotics :Background, Historical development, Robot Arm Kinematics and Dynamics, Manipulator Trajectory planning and Motion Control, Robot Sensing

UNIT II

Lecture 9Hrs

Robot Arm Kinematics and Dynamics: Introduction to Kinematics, Direct and Inverse Kinematics Problem and solution, Dynamics introduction, Lagrange-Euler Formulation, Newton Euler Formulation, Generalized D'Alembert Equations of motion. Trajectory planning,

UNIT III

Lecture 9Hrs

Sensing and Vision: Introduction to Sensing, Proximity Sensing, Touch Sensors, Force and Torque Sensing, Image acquisition, Illumination techniques, Imaging Geometry, Recognition and Interpretation.

UNIT IV

Lecture 8Hrs

Robot Programming Languages: Introduction to Robot Programming Languages, Characteristics of Robot Level Languages, three levels of robot programming, requirements of a robot programming language, Task Level Languages, problems peculiar to robot languages, Introduction to Robot Operating System (ROS)

UNIT V

Lecture 8Hrs

Robot Intelligence: Introduction, State Space Search, Problem Reduction, Use of Predicate Logic, Means-Ends Analysis, Problem solving, Robot Learning, Robot Task Planning, Basic Problems in Task Planning, Expert systems and knowledge engineering.

Textbooks:

1. K.S. Fu, R.C. Gonzalez, C.S.G. Lee, Robotics : Control, Sensing, Vision and Intelligence
2. Aaron Martinez, Enrique Fernandez, Learning ROS for Robotics Programming: A practical, instructive, and comprehensive guide to introduce yourself to ROS, the top-notch, leading robotics framework, PACKT publishing, Open Source.

Reference Books:

John J. Craig, Introduction to Robotics: Mechanics and Control, Addison Wesley publication, Third Edition.

Online Learning Resources

<https://nptel.ac.in/courses/107106090>

<https://nptel.ac.in/courses/112108298>