



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



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 **L T P C**
3 0 0 3
(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,



JNTUA B.Tech. R20 Regulations

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.



JNTUA B.Tech. R20 Regulations

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 **L T P C**
1 0 2 2
(20A05506) ADVANCED WEB APPLICATION DEVELOPMENT
Skill Oriented Course - III

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/>



OPEN ELECTIVES



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

(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)

L	T	P	C
3	0	0	3

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