**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 (DATA SCIENCE)**

**Course Structure (R20) – III & IV Year**

|  |
| --- |
| **Semester–V** |
| **S.No.** | **Course Code** | **Course Name** | **L** | **T** | **P** | **Credits** |
| **1.** | 20A32501T | Data Management Techniques | 3 | 0 | 0 | 3 |
| **2.** | 20A05502T | Artificial Intelligence | 3 | 0 | 0 | 3 |
| **3.** | 20A32502 | Foundations of Data Analytics | 3 | 0 | 0 | 3 |
| **4.** | 20A12701a20A12501a20A05302T | **Professional Elective Course – I**Advanced Databases Data Warehousing and Data MiningObject Oriented Programming through Java  | 3 | 0 | 0 | 3 |
| **5.** |  | **Open Elective Course – I** | 3 | 0 | 0 | 3 |
| **6.** | 20A32501P | Data Management Techniques Lab | 0 | 0 | 3 | 1.5 |
| **7.** | 20A05502P | Artificial Intelligence Lab | 0 | 0 | 3 | 1.5 |
|  8. | 20A32503 | **Skill oriented course – III**Digital and Social Media Marketing | 1 | 0 | 2 | 2 |
| **9.** | 20A32504 | 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 | 20A04505 | Digital Electronics | ECE |
| 5 | 20A27505 | Computer Applications in Food Processing | FT |
| 6 | 20A54501 | Optimization Techniques  | Mathematics |
| 7 | 20A56501 | Materials Characterization Techniques | Physics |
| 8 | 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** **Semester-VI** |
| **S.No** | **Course Code** | **Course Name** | **L** | **T** | **P** | **Credits** |
| **1.** | 20A05602T | Machine Learning | 3 | 0 | 0 | 3 |
| **2.** | 20A05701a | Cloud Computing | 3 | 0 | 0 | 3 |
| **3.** | 20A32601T | Data Visualization | 3 | 0 | 0 | 3 |
| **4.** | 20A32602a20A05603T20A12602a | **Professional Elective Course– II**Predictive AnalyticsInternet of ThingsComputer Graphics | 3 | 0 | 0 | 3 |
| **5.** |  | **Open Elective Course – II** | 3 | 0 | 0 | 3 |
| **6.** | 20A05602P | Machine Learning Lab | 0 | 0 | 3 | 1.5 |
| **7.** | 20A32601P | Data Visualization lab | 0 | 0 | 3 | 1.5 |
| **8.** | 20A12604 | Cloud Computing 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 vacationHonors/Minor courses (The hours distribution can be 3-0-2 or 3-1-0 also) 4 0 0 4 |

**Open Elective-II**

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| **S.No** | **Course Code** | **Course Name** | **Offered by the Dept.** |
| 1 | 20A01704 | Environmental Economics | CE |
| 2 | 20A02605 | Smart Electric Grid | EEE |
| 3 | 20A03605 | Non-Conventional sources of energy | ME |
| 4 | 20A04605 | Signal Processing | ECE |
| 5 | 20A27605 | Food Refrigeration and Cold Chain Management | FT |
| 6 | 20A54701 | Wavelet Transforms & its applications  | Mathematics |
| 7 | 20A56701 | Physics Of Electronic Materials and Devices | Physics |
| 8 | 20A51701 | Chemistry of Polymers and its Applications | Chemistry |

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| **Semester-VII** |
| **S.No.** | **Course** **Code** | **Course Name** | **L** | T | **P** | **Credits** |
| **1.** | 20A05705a20A32701a20A32702b | **Professional Elective Course– III**Cyber SecurityUser Interface Design Process Mining | 3 | 0 | 0 | 3 |
| **2.** | 20A32702a20A05702c20A32702b | **Professional Elective Course– IV**Bio InformaticsNatural Language ProcessingSocial Network Analysis | 3 | 0 | 0 | 3 |
| **3.** | 20A05703b20A05703c20A05702b | **Professional Elective Course– V**Block Chain Technology and ApplicationsDeep LearningCryptography and Network Security | 3 | 0 | 0 | 3 |
| **4.** | 20A52701a20A52701b20A52701c |  **Humanities Elective – II**1. Entrepreneurship and Incubation
2. Management Science
3. Enterprise Resource Planning
 | 3 | 0 | 0 | 3 |
| **5.** |  | **Open Elective Course – III** |  3 | 0 | 0 | 3 |
| **6.** |  | **Open Elective Course – IV** | 3 | 0 | 0 |  3 |
| **7.** | 20A32703 | **Skill oriented course – V**NoSQL using MongoDB | 1 | 0 | 2 |  2 |
|  | 20A32704 | Evaluation of Industry Internship |  |  |  | 3 |
|  **Total** | **23** |

**Open Elective-III**

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| **S.No.** | **Course Code** | **Course Name** | **Offered by the Dept.** |
| 1 | 20A01705 | Cost Effective Housing Techniques | CE |
| 2 | 20A02704 |  IOT Applications in Electrical Engineering | EEE |
| 3 | 20A03704 | Introduction to Hybrid and Electric Vehicles | ME |
| 4 | 20A04704 |  Electronic Sensors | ECE |
| 5 | 20A27704 | Human Nutrition  | FT |
| 6 | 20A54702 | Numerical Methods for Engineers  | Mathematics |
| 7 | 20A56702 | Sensors And Actuators for Engineering ApplicationsApplications | Physics |
| 8 | 20A51702 | Chemistry of Nanomaterials and Applications | Chemistry |

**Open Elective-IV**

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| **S.No.** | **Course Code** | **Course Name** | **Offered by the Dept.** |
| 1 | 20A01706 | Health, Safety & Environmental management | CE |
| 2 | 20A02705 | Renewable Energy Systems | EEE |
| 3 | 20A03705 | Introduction to Composite Materials | ME |
| 4 | 20A04705 | Microcontrollers and Applications | ECE |
| 5 | 20A27705 | Waste and Effluent Management | FT |
| 6 | 20A54703 | Number theory & its Applications | Mathematics |
| 7 | 20A56703 | Smart Materials and Devices | Physics |
| 8 | 20A51703 | Green Chemistry and Catalysis for Sustainable Environment | Chemistry |

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| **Semester-VIII** |
| **S.No.** | **Course Code** | **Course Name** | **Category** | **L** | T | **P** | **Credits** |
| **1.** | 20A32801 | Full Internship & Project work | PR |  |  |  | 12 |
| **Total** | **12** |

**COURSES OFFERED FOR HONOURS DEGREE IN CSE (DATA SCIENCE)**

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| --- | --- | --- | --- | --- |
| **S.No.** | **Code** | **Course Name** | **Contact Hours per week** |  **Credits** |
| **L** | **T** |
| 1 | 20A32H01 | Data Science for Business | 3 | 1 |  4 |
| 2 | 20A32H02 | Software Project Management using Agile | 3 | 1 |  4 |
| 3 | 20A30H03 | Ethics and Privacy in AI | 3 | 1 |  4 |
| 4 | 20A30H04 | Medical Image Data Processing | 3 | 1 |  4 |
|  | 20A32H03 | MOOC – I |  |  |  2 |
|  | 20A32H04 | MOOC - II |  |  |  2 |

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| MOOC Course for 2 credits | Big Data Analytics using Spark | 10 weeks(To be considered only for 8 weeks) | https://www.edx.org/course/big-data-analytics-using-spark?source=aw&awc=6798\_1657520739\_578015a7e5fc85aba86de3f77adff378&utm\_source=aw&utm\_medium=affiliate\_partner&utm\_content=text-link&utm\_term=422873\_Edflex |
| MOOC Courses for a Total of 2 credits | Deep Learning with TensorFlow | 5 weeks | https://www.edx.org/course/deep-learning-with-tensorflow?source=aw&awc=6798\_1657521273\_57ca8f6c944caac9a0aabd49519739f6&utm\_source=aw&utm\_medium=affiliate\_partner&utm\_content=text-link&utm\_term=422873\_Edflex |
| Data Representation and Visualization in Tableau | 4 weeks | https://www.edx.org/course/data-representation-and-visualization-in-tableau |
| MOOC Course for 2 credits | Data Science: Productivity Tools | 8 weeks | <https://www.edx.org/course/data-science-productivity-tools?source=aw&awc=6798_1657522115_2a535463f4ca875a60c8c8eb4e8553b2&utm_source=aw&utm_medium=affiliate_partner&utm_content=text-link&utm_term=422873_Edflex> |
| MOOC Course for 2 credits | Six Sigma: Analyze, Improve, Control | 8 weeks | https://www.edx.org/course/six-sigma-analyze-improve-control?source=aw&awc=6798\_1657522256\_dd3daa384fdef3044ce20596cba19261&utm\_source=aw&utm\_medium=affiliate\_partner&utm\_content=text-link&utm\_term=422873\_Edflex |
| MOOC Course for 2 credits | Scalable Data Science | 8 weeks | https://onlinecourses.nptel.ac.in/noc22\_cs105/preview |
| MOOC Course for 2 credits | Applied Accelerated Artificial Intelligence | 12 weeks (To be considered for 8 weeks) | https://onlinecourses.nptel.ac.in/noc22\_cs83/preview |

**LIST OF MINORS OFFERED TO CSE (DATA SCIENCE)**

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| **S.No.** | **Minor Title** | **Department offering the Minor** |
| 1. | Construction Technology | Civil Engineering |
| 2. | Environmental Geotechnology | Civil Engineering |
| 3. | Energy Systems | EEE |
| 4. | 3D Printing | ME |
| 5. | Industrial Engineering | ME |
| 6. | Food Science | Food Technology |

**JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY ANANTAPUR**

**B.TechCSE(DS)– III-I Sem L T P C**

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|  | **(20A32501T) DATA MANAGEMENT TECHNIQUES** |  |  |  |  |
|  |  |  |  |  |
| **Pre-requisite**  | **DBMS** |  |  |
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| **Course Objectives:** |
| * The objective of the course is to present an introduction to data management techniques with an emphasis on how to organize, maintain and retrieve - efficiently, and effectively.
 |
| **Course Outcomes:** |
| * Describe the fundamental elements of data management
* Implement the tools and techniques of Data handling System.
* Learn the Data modeling, design and operations
* Apply the security and integrity tools in management system
* Improving the Data usability and Findability using metadata
 |
| **UNIT I** | **Data Management, Data Handling Ethics** | Lecture 8Hrs |
| **Data Management:** Introduction, Essential Concepts, Data Management Frameworks**Data Handling Ethics:** Introduction, Business Drivers, Essential Concepts: Ethical Principles for Data, Principles Behind Data Privacy Law, Online Data in an Ethical Context, Risks of Unethical Data Handling Practices, Establishing an Ethical Data Culture, Data Ethics and Governance |
| **UNIT II** | **Data Governance, Data Architecture** | Lecture 10Hrs |
| **Data Governance:** Introduction, Activities, Tools and Techniques, Implementation Guidelines: Organization and Culture, Adjustment and Communication, Metrics**Data Architecture: -**Introduction: Business Drivers, Data Architecture Outcomes and Practices, Essential Concepts. Activities, Tools: Data Modelling Tools, Asset Management Software, Graphical Design Applications., Techniques: LifecycleProjections, Diagramming Clarity, Implementation Guidelines, Data Architecture Governance  |
| **UNIT IIIData Modelling and Design, Data Storage and Operations** | Lecture 8Hrs |
| **Data Modelling and Design:** Introduction, Activities, BestPractices, Data Model Governance **Data Storage and Operations:** Introduction, Activities, Tools,Techniques, Implementation Guidelines, Data Storage and Operations Governance |
| **UNIT IVData Security, Data Integration and Interoperability** | Lecture 9Hrs |
| **Data Security:** Introduction, Activities, Tools, Techniques, Implementation Guidelines, Data Security Governance, Works Cited / Recommended **Data Integration and Interoperability:** Introduction, Data Integration Activities, Tools, Techniques: Implementation Guidelines, DII Governance |
| **UNIT VMetadata Management, Big Data and Data Science, Data Management Maturity Assessment** | Lecture 8Hrs |
| **Metadata Management:** Introduction, Activities, Tools, Techniques, Implementation Guidelines, Metadata Governance, Works Cited / Recommended.**Big Data and Data Science:** Introduction, Activities, Tools, Implementation Guidelines, Big Data and Data Science Governance**Data Management Maturity Assessment: -** Introduction, Activities Tools, Techniques, Guidelines for a DMMA, Maturity Management Governance |
| **Textbooks:** |
| 1. “DAMA-DMBOK: Data Management body of Knowledge”, 2nd Edition, Technics Publications, 2017
 |
| **Reference Books:** |
| Data Mining: Concepts and Techniques (The Morgan Kaufman series in Data Management Systems),2011Text Data Management and Analysis: A Practical Introduction to Information Retrieval and Text Mining (ACM Books) Paperback – 30 June 2016by ChengXiangZhai (Author), Sean Massung (Author). |
| **Online Learning Resources:** |
| 1)[Google Data Analytics Professional Certificate | Coursera](https://www.coursera.org/professional-certificates/google-data-analytics?utm_source=bg&utm_medium=sem&utm_campaign=15-GoogleDataAnalytics-IN&utm_content=15-GoogleDataAnalytics-IN&campaignid=415452288&adgroupid=1219358872662123&device=c&keyword=data%20mining%20data&matchtype=b&network=o&devicemodel=&adpostion=&creativeid=&hide_mobile_promo&msclkid=eb179a7521e7172a76f6f8e0e1d400f3&utm_term=data%20mining%20data) |

**JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY ANANTAPUR**

**B.TechCSE(DS)– III-I Sem L T P C**

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| **(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 Continues 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.htmlhttp://nptel.ac.in/courses/106106139/ https://nptel.ac.in/courses/106/105/106105152/ |

**JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY ANANTAPUR**

**B.TechCSE(DS)– III-I Sem L T P C**

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| **(20A32502) FOUNDATIONS OF DATA ANALYTICS** |
| **Course Objectives:** |
| * Discuss various jobs related to Data Science
* Understand MapReduce
* Study Bigdata patterns
 |
| **Course Outcomes:** |
| * Analyze data, test claims, and draw valid conclusions using appropriate statistical methodology
* Use various tools related to Big data
* Obtain training to secure a job
 |
| **UNIT I** | **Introduction**  | Lecture 8Hrs |
| What is Analytics, What is Big Data, Characteristics of Big data, Domain specific examples of big data, Analytics flow for big data, Big data stack, Mapping analytics flow to big data stack, case studies: Genome and Weather data analysis, Analytics patterns |
| **UNIT II** | **Setting up Big data stack and Big data Patterns** | Lecture 8Hrs |
| Hortonworks data platform, Cloudera CDH stack, Amazon Elastic MapReduce, Azure HDInsight, Analytics architecture components and Design styles |
| **UNIT III** | **MapReduce, NoSQL** | Lecture 10Hrs |
| MapReduce patterns, Key-Value Databases, Document Databases, Column Family Databases, Graph databases. |
| **UNIT IV Serving databases and Web Frameworks, Big Data Jobs** | Lecture10 Hrs |
| Relational databases, Non-Relational Databases, Python web application framework – Django, Case study: Django application for viewing weather data, The big picture of Bigdata jobs |
| **UNIT V** **Simulation, Monte Carlo integration & Variance reduction** | Lecture 8 Hrs |
| Seeing yourself in a big data job, looking into big data platform, Big data jobs for business analytics, big data jobs for data scientists, big data jobs for software developers. |
| **Textbooks:** |
| 1. ArshdeepBahga, Vijay Madisetti, Big Data Science and Analytics: A Hands of Approach, Self Published: www.hands-on-books-series.com.
2. Jason Williamson, Big Data job for Dummies, Willey, 2015
 |
| **Reference Books:** |
| * + - 1. Exploratory Data Analysis with R – Roger D. Peng, Lean pub publications, 2015
			2. The Art of Data Science- A Guide for anyone Who Works with Data – Roger D. Peng and Elizabeth Matsui, Lean pub Publications, 2014
 |
| **Online Learning Resources:** |
| 1. <https://www.mastersindatascience.org/learning/what-is-data-analytics/>
2. <https://www.techtarget.com/searchdatamanagement/definition/data-analytics>
3. <https://www.lotame.com/what-is-data-analytics/>
4. https://www.oracle.com/business-analytics/data-analytics/
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**JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY ANANTAPUR**

**B.TechCSE(DS)– III-I Sem L T P C**

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| **(20A12701a) ADVANCED DATABASES****(Professional Elective Course– I)** |  |
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| **Course Objectives:** |
| •    To study the needs of different databases.•    To understand about different data models that can be used for these databases.•    To make the students get familiarized with transaction management of the database |
| **Course Outcomes:** |
| * Design, develop and implement a mid-scale relational database for an application domain using a commercial-grade RDBMS.
* Identify and resolve physical database design and implementation issues.
* Use the persistence framework of a chosen language to perform Object Relational Mapping.
* To provide an introductory concept about the way in which data can be stored in geographical information systems etc., to develop in-depth knowledge about web and intelligent database
 |
| **UNIT I** | **Distributed Databases**                                   | Lecture 8Hrs |
| Distributed DBMS Concepts and Design – Introduction –Functions and Architecture of DDBMS – Distributed Relational Database Design – Transparency in DDBMS – Distributed Transaction Management – Concurrency control – Deadlock Management – Database recovery – The X/Open Distributed Transaction Processing Model – Replication servers – Distributed Query Optimization - Distribution and Replication in Oracle.    |
| **UNIT II** | **Object Oriented Databases**                      | Lecture 8Hrs |
| Object Oriented Databases – Introduction – Weakness of RDBMS – Object Oriented Concepts Storing Objects in Relational Databases – Next Generation Database Systems – Object Oriented Data models – OODBMS Perspectives – Persistence – Issues in OODBMS – Object Oriented Database Management System Manifesto – Advantages and Disadvantages of OODBMS – Object Oriented Database Design – OODBMS Standards and Systems – Object Management Group – Object Database Standard ODMG – Object Relational DBMS –Postgres - Comparison of ORDBMS and OODBMS.   |
| **UNIT III** | **Web Databases** | Lecture 9Hrs |
| Web Technology and DBMS – Introduction – The Web – The Web as a Database Application Platform – Scripting languages – Common Gateway Interface – HTTP Cookies – Extending the Web Server – Java – Microsoft’s Web Solution Platform – Oracle Internet Platform – Semi structured Data and XML – XML Related Technologies – XML Query Languages |
| **UNIT IV** | **Data Warehousing Concepts** | Lecture 9Hrs |
| **Data Warehousing Concept:** Introduction to Data Warehousing, Data Warehouse Architecture, Data Warehousing Tools and Technologies, Data Mart, Data Warehousing and Temporal Databases, Data Warehousing Using Oracle **Data Warehousing Design: Designing** a Data Warehouse Database, Data Warehouse Development Methodologies, Kimball’s Business Dimensional Lifecycle, Dimensionality Modeling, The Dimensional Modeling Stage of Kimball’s, Data Warehouse Development Issues, Data Warehousing Design Using Oracle |
| **UNIT V** | **OLAP&Data Mining** | Lecture 9Hrs |
| **OLAP:** Online Analytical Processing, OLAP Applications, Multidimensional Data Model, OLAP Tools, OLAP Extensions to the SQL Standard, Oracle OLAP**Data Mining:** Data Mining Techniques, The Data Mining Process, Data Mining Tools, Data Mining and Data Warehousing, Data Mining (ODM) |
| **Textbooks:** |
| 1.   Thomas M. Connolly, Carolyn E. Begg, “Database Systems - A Practical Approach to Design, Implementation, and Management”, Third Edition, Pearson Education,2003. |
| **Reference Books:** |
| 1.RamezElmasri&ShamkantB.Navathe, “Fundamentals of Database Systems”, Fourth Edition, Pearson Education, 2004.2. M.TamerOzsu , Patrick Ualduriel, “Principles of Distributed Database Systems”, Second Edition, PearsonEducation, 2003.3. C.S.R. Prabhu, “Object Oriented Database Systems”, PHI, 2003.4. Peter Rob and Corlos Coronel, “Database Systems – Design, Implementation and Management”, Thompson Learning, Course Technology, 5th Edition, 2003. |
| **Online Learning Resources:** |
| 1. Advanced Database Queries | edX
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**JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY ANANTAPUR**

**B.TechCSE (DS)– III-I Sem L T P C**

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|  | **(20A12701a) DATA WAREHOUSINGAND MINING****Common to IT, CSE(DS)** |  |  |  |  |
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| **Course Objectives:** |
| The course is designed* To familiarize with mathematical foundations of data mining tools.
* To introduce classical models and algorithms in data warehouses and data mining.
* To investigate the kinds of patterns that can be discovered by association rule mining, classification and clustering.
* To explore data mining techniques in various applications like social, scientific and environmental context.
 |
| **Course Outcomes:**After completion of the course, students will be able to* Design a Data warehouse system and perform business analysis with OLAP tools
* Apply suitable pre-processing and visualization techniques for data analysis
* Apply frequent pattern and association rule mining techniques for data analysis
* Design appropriate classification and clustering techniques for data analysis
* Infer knowledge from raw data
 |
| **UNIT I Warehousing and Online Analytical Processing** | Lecture 8Hrs |
| Basic Concepts – Data Warehousing Components – Building a Data Warehouse – Database Architectures for Parallel Processing – Parallel DBMS Vendors – Multidimensional Data Model – Data Warehouse Schemas for Decision Support, Concept Hierarchies -Characteristics of OLAP Systems – Typical OLAP Operations, OLAP and OLTP. |
| **UNIT II Data Mining and Data Preprocessing** | Lecture 10Hrs |
| Introduction to Data Mining Systems – Knowledge Discovery Process – Data Mining Techniques – Issues – applications- Data Objects and attribute types, Statistical description of data, Data Pre-processing – Cleaning, Integration, Reduction, Transformation and discretization, Data Visualization, Data similarity and dissimilarity measures. |
| **UNIT III Associations and Classification** | Lecture 8Hrs |
| Mining Frequent Patterns, Associations and Correlations – Mining Methods- Pattern Evaluation Method – Pattern Mining in Multilevel, Multi-Dimensional Space – Constraint Based Frequent Pattern Mining, Classification using Frequent Patterns. |
| **UNIT IV Cluster Analysis** | Lecture 9Hrs |
| Decision Tree Induction – Bayesian Classification – Rule Based Classification – Classification by Back Propagation – Support Vector Machines –– Lazy Learners – Model Evaluation and Selection-Techniques to improve Classification Accuracy. Clustering Techniques – Cluster Analysis-Partitioning Methods – Hierarchical Methods – Density Based Methods – Grid Based Methods – Evaluation of clustering – Clustering high dimensional data- Clustering with constraints, Outlier analysis-outlier detection methods. |
| **UNIT V Weka Tool** | Lecture 8Hrs |
| Datasets – Introduction, Iris plants database, Breast cancer database, Auto imports database – Introduction to WEKA, The Explorer – Getting started, Exploring the explorer, Learning algorithms, Clustering algorithms, Association–rule learners. |
| **Textbooks:** |
| 1. Jiawei Han, Micheline Kamber and Jian Pei, Data Mining: Concepts and Techniques, Elsevier, Third Edition, 2013.
2. Introduction to Data Mining – Pang-Ning Tan, Michael Steinbach and Vipin Kumar, Pearson education.
 |
| **Reference Books:** |
| 1. Alex Berson and Stephen J.Smith, ―Data Warehousing, Data Mining & OLAP‖, Tata McGraw – Hill Edition, 35th Reprint 2016.
2. K.P. Soman, Shyam Diwakar and V. Ajay, ―Insight into Data Mining Theory and Practice, Eastern Economy Edition, Prentice Hall of India, 2006.
3. Ian H.Witten and Eibe Frank, ―Data Mining: Practical Machine Learning Tools and Techniques, Elsevier, Second Edition.
 |
| **Online Learning Resources:** |
| 1. <https://www.coursera.org/courses?query=data%20warehouse>
2. https://www.edx.org/learn/data-warehouse
 |

**JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY ANANTAPUR**

**B.TechCSE (DS)– III-I Sem L T P C**

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**(20A05302T) OBJECT ORIENTED PROGRAMMING THROUGH JAVA**

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

**Pre-requisite Fundamental Programming**

**Course Objectives:**

* To understand object oriented concepts and problem solving techniques
* To obtain knowledge about the principles of inheritance and polymorphism
* To implement the concept of packages, interfaces, exception handling and concurrency mechanism.
* To design the GUIs using applets and swing controls.
* To understand the Java Database Connectivity Architecture

**Course Outcomes (CO):**

After completion of the course, students will be able to

* Solve real-world problems using OOP techniques.
* Apply code reusability through inheritance, packages and interfaces
* Solve problems using java collection framework and I/O classes.
* Develop applications by using parallel streams for better performance.
* Develop applets for web applications.
* Build GUIs and handle events generated by user interactions.
* Use the JDBC API to access the database

**UNIT - I Introduction 8Hrs**

Introduction: Introduction to Object Oriented Programming, The History and Evolution of Java, Introduction to Classes, Objects, Methods, Constructors, this keyword, Garbage Collection, Data Types, Variables, Type Conversion and Casting, Arrays, Operators, Control Statements, Method Overloading, Constructor Overloading, Parameter Passing, Recursion, String Class and String handling methods.

**UNIT - II Inheritance, Packages, Interfaces 9Hrs**

Inheritance: Basics, Using Super, Creating Multilevel hierarchy, Method overriding, Dynamic Method Dispatch, Using Abstract classes, Using final with inheritance, Object class,

Packages: Basics, finding packages and CLASSPATH, Access Protection, Importing packages.

Interfaces: Definition, Implementing Interfaces, Extending Interfaces, Nested Interfaces, Applying Interfaces, Variables in Interfaces.

**UNIT - III Exception handling, Stream based I/O (java.io) 9Hrs**

Exception handling - Fundamentals, Exception types, Uncaught exceptions, using try and catch, multiple catch clauses, nested try statements, throw, throws and finally, built-in exceptions, creating own exception subclasses.

Stream based I/O (java.io) – The Stream classes-Byte streams and Character streams, Reading console Input and Writing Console Output, File class, Reading and Writing Files, Random access file operations, The Console class, Serialization, Enumerations, Autoboxing, Generics.

**UNIT - IV Multithreading, The Collections Framework (java.util) 8Hrs**

Multithreading: The Java thread model, Creating threads, Thread priorities, Synchronizing threads, Interthread communication.

The Collections Framework (java.util): Collections overview, Collection Interfaces, The Collectionclasses- Array List, Linked List, Hash Set, Tree Set, Priority Queue, Array Deque. Hashtable, Properties, Stack, Vector, String Tokenizer, Bit Set, Date, Calendar, Random, Formatter, Scanner.

**UNIT – V Applet, GUI Programming with Swings, Accessing Databases with JDBC 8Hrs**

Applet: Basics, Architecture, Applet Skeleton, requesting repainting, using the status window, passing parameters to applets

GUI Programming with Swings – The origin and design philosophy of swing, components and containers, layout managers, event handling, using a push button, jtextfield, jlabel and image icon, the swing buttons, jtext field, jscrollpane, jlist, jcombobox, trees, jtable, An overview of jmenubar, jmenu and jmenuitem, creating a main menu, showmessagedialog, showconfirmdialog, showinputdialog, showoptiondialog, jdialog, create a modeless dialog.

Accessing Databases with JDBC:

Types of Drivers, JDBC Architecture, JDBC classes and Interfaces, Basic steps in developing JDBC applications, Creating a new database and table with JDBC.

**Textbooks:**

1. Java The complete reference, 9th edition, Herbert Schildt, McGraw Hill Education (India) Pvt. Ltd.
2. Java How to Program, 10th Edition, Paul Dietel, Harvey Dietel, Pearson Education.

**Reference Books:**

1. Understanding Object-Oriented Programming with Java, updated edition, T. Budd, Pearson Education.
2. Core Java Volume – 1 Fundamentals, Cay S. Horstmann, Pearson Education.
3. Java Programming for core and advanced learners, Sagayaraj, Dennis, Karthik andGajalakshmi, University Press
4. Introduction to Java programming, Y. Daniel Liang, Pearson Education.
5. Object Oriented Programming through Java, P. Radha Krishna, University Press.
6. Programming in Java, S. Malhotra, S. Chaudhary, 2nd edition, Oxford Univ. Press.
7. Java Programming and Object-oriented Application Development, R.A. Johnson,Cengage Learning.

**Online Learning Resources:**

https://www.w3schools.com/java/java\_oop.asp

http://peterindia.net/JavaFiles.html

**JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY ANANTAPUR**

**B.TechCSE (DS)– III-I Sem L T P C**

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| **(20A32501P) DATA MANAGEMENT TECHNIQUES LAB** |
| **Course Objectives:** |
| * To understand data definition and data manipulation commands.
* To understand functions, procedures and procedural extensions of data bases
* To get familiar with the use of a front-end tool
* To understand design and implementation of typical database applications
 |
| **Course Outcomes:** |
| **Upon completion of the course, the students will be able to:*** Use typical data definitions and manipulation commands.
* Design applications to test Nested and Join Queries
* Implement simple applications that use Views
* Implement applications that require a Front-end Tool
* Critically analyze the use of Tables, Views, Functions and Procedures
 |
| **List of Experiments:** |
| 1.Perform the following database administrator tasks* Install the database software of your choice
* Plan the database of your organization
* Create and open the database
* Backup the database
* Enroll system users
* Implement the Database design
* Backup the fully functional database
* Tune database performance
* Download and install patches
* Rollout to additional hosts
* Starting up and shutting down a database
* Altering database availability
* Configure database memory manually and automatically
* Monitor errors and alerts
* Monitor performance
* Collect statistics on tables
* Alter the tables
* Creating, altering, dropping indexes
* Create, alter, using and dropping views
1. Experiment with the following
* Common number functions
* Common string functions
* Common data and time functions
* Conversion functions
1. Perform inner join, left join, right join, full join
2. Perform the following
* Data import and export with Oracle, SQL Server, MYSQL
* Create a stored procedure with parameters in Oracle, SQL Server, MYSQL
1. Create a database for the State Government considering different departments and functions of the state government
* Design the database
* Represent using ER model
* Apply Normalization up to BCNF
* Implement the database using DBMS of your choice
* Design user interfaces for performing different operations. You can do it with the feature of the DBMS or use language like Python and JAVA
* Perform the operations
* Generate appropriate reports using the data and aggregate functions
 |
| **References:** |
| 1. Oracle Database Administrators guide, 11g release, 2010
2. Preston Zhang, Practical Guide to Oracle SQK, T-SQL, and MYSQL, CRC Press
3. [Use Data Management Tools & Guides - Research Data Management Basics – InfoGuides at George Mason University (gmu.edu)](https://infoguides.gmu.edu/data-management/handbooks)
4. RafatSarosh, MecheleGruhn, SQL Server Interview Questions
5. Peter Rob, Carlos Coronel, Database systems design, implementation and management, Thomson Course technology
 |
| **Online Learning Resources/Virtual Labs:** |
| 1. [Lab Data Management & Analysis Software | Thermo Fisher Scientific - IN](https://www.thermofisher.com/in/en/home/life-science/lab-data-management-analysis-software.html)
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**B.TechCSE(DS)– III-I Sem L T P C**

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| **(20A05502P) ARTIFICIAL INTELLIGENCE LAB****Common To CSE,IT,CSD, CSE (DS)**  |
| **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 Algorithm9. 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 Python12. 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 x N and with 4:0 x 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 ......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/pytorchhttps://keras.io/https://github.com/keras-teamhttp://deeplearning.net/software/theano/https://github.com/Theano/Theanohttps://caffe2.ai/https://github.com/caffe2https://deeplearning4j.org/Scikit-learn:https://scikit-learn.org/stable/https://github.com/scikit-learn/scikit-learnhttps://www.deeplearning.ai/https://opencv.org/https://github.com/qqwweee/keras-yolo3https://www.pyimagesearch.com/2018/11/12/yolo-object-detection-with-opencv/https://developer.nvidia.com/cuda-math-libraryhttp://vlabs.iitb.ac.in/vlabs-dev/labs/machine\_learning/labs/index.php |

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**JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY ANANTAPUR**

**B.TechCSE(DS)– III-I Sem L T P C**

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| **(20A32503) DIGITAL AND SOCIAL MEDIA MARKETING****(Skill Oriented Course)** |
| **Pre-requisite Internet Knowledge, Acquittance with some social media Facebook, Twitter** |
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| **Course Objectives:** |
| * This course takes an in-depth look at the relationship between media and human behavior, and examines how organizations capitalize on social media, and these consumer-to-consumer interactions, to support their marketing efforts.
 |
| **Course Outcomes:** |
| After completion of the course, students will be able to* Understand what social media is, the various channels through which it operates, and its role in marketing strategy
* Use principles of consumer and social psychology to develop social media content and campaigns that engage consumers
* Draw on knowledge about word-of-mouth marketing to develop effective approaches for propagating ideas, messages, products, and behaviors across social networks
* Measure the impact of a social media campaign in terms of a specific marketing objective
 |
| **UNIT I** | **Introduction, Search Engine optimization** | Lecture 9Hrs |
| **Marketing Goes Digital:** Introduction, Digital isn’t the only option, Non-Marketing digital marketers, Personalization, Viral Marketing, Paid, earned and owned, Content marketing, Influencers, Affiliate marketing, Attribution, Public relations and reputation management, Integrated marketing communications, Gaming, Legal Considerations, Strategic digital marketing, Digital marketing Objectives**Search Engine optimization:** Introduction, How search engines work, Keyword selection, On-site optimization, Off-site optimization, Strategic search engine optimization, Third-party search engine ranking**Activity 1:(Search Engine Optimization)**Perform the following activities in relation to On Page -Search Engine Optimization.1. Submit your site to Google Search Console: Take a screenshot of successful message.
2. Create XML Map. Submit to Google Search Console: Take a screenshot of successful message.
3. Install Yoast SEO Plug-in. Perform SEO Analysis.  Take screenshot of the report
4. Perform Readability Analysis of the post that you created in Activity 1 Website Review: Part:1.  Question 1 using Yoast SEO. Take a screenshot of the report
5. Use keyword Planner tool. Select 10 Important Keyword for your website. Takescreen shot of this list.
 |
| **UNIT II** | **Website Development** | Lecture 8Hrs |
| **Website Development:** Introduction, Web presence ownership, management and development, Usability, The basics, Content development, The B2B website, The global web presence**Activity 2: Buy Domain Name and WebHosting**You need to buy a domain name and webhosting to build your own websites which is very important  to have hands-on experience with SEO and other digital marketing techniques.  |
| **UNIT III** | **E-commerce** | Lecture9 Hrs |
| **E-commerce:** Introduction, Multi-channel retailing, Fulfilment, Comparison shopping engines, e-marketplaces and third-party shopping websites, The e-commerce website**Advertising online:** Introduction, Programmatic advertising, Objectives and management, Online ad formats, Search advertising, Network advertising, Landing pages**Activity-3: (Website Review)**1. Crete a Website of your own
2. Add a new post to your website, a topic should be related to your Website.
3. Add a contact us form in the website (Use Contact Form 7 Plug-in).
4. Create Home page of your Website using Elementor Plug-in.
5. Add Slider to any page of your website
6. Create top Menu of your website
 |
| **UNIT IV** | **Email marketing** | Lecture8 Hrs |
| **Email marketing:** Introduction, Email as a medium for direct marketing, Email as a medium for marketing messages, Email newsletters**Activity 4: Email Marketing**All these questions are with respect to MailChimp1. Create a new Audience. Add 10 Dummy Subscribers to the audience list using any of the following methods
	1. Manual
	2. Copy Paste from the file
	3. CSV or tab-delimited text file
2. Make sure your list includes, First Name, Last name, Phone (Dummy), Tag, Address and Gender. Please also mention which method you have used. Take a screenshot of the list. Upload to your website. Send the URL of Page.
3. Create a signup form using “Form Builder Option”. Objective should be collecting the emails for your Digital Marketing Training Institute. Share the URL of Signup form
4. Create an embedded form. Embed this form in any page of your website. Share the link of the page. Objective should be collecting the emails only.
5. Suppose you are offering Training on Digital Marketing. Create a 1 Column - Full Width Template by using at least five Blocks in the template. Share the URL of that template
6. Select “Art Newsletter” and customize it a newsletter from digital marketing training institute. You may include the text/ message as per your wish.

**Activity 5: Email Marketing** All these questions are with respect to Mail Chimp1. Take the audience list. Create   Two segments based on gender. Take the screenshot of each segment and Upload to your website. Send the URL of Page.
2. Create a group based on interest in your audience. It should be visible in Signup form.   Take the screenshot and Upload to your website. Send the URL of Page.
3. Create a dummy campaign using mail chimp to promote Digital marketing services. Share the URLs of the Campaign. Use may use any template as per your wish.
4. Create a dummy ‘plain text campaign’ on any subject. Take a screenshot of Desktop and Mobile preview.  Upload to your website. Send the URL of Page.
5. Create a pop-up form for your website. Share the URL of your website.
 |
| **UNIT V** | **Marketing on Social media** | Lecture 9Hrs |
| **Marketing on social media:** Introduction, Blogging, Consumer reviews and ratings, Social networking, Social sharing, Social media service and support, Strategic marketing on social media, Measure and monitor**Activity 6: Social Media Marketing** Assume a product. You want to advertise it. Prepare the advertisement and do the marketing on Face book.**Activity 7: Twitter and LinkedIn**Experiment with Twitter and LinkedIn**Activity 8: YouTube**All the students put together create a YouTube Chanel. Upload videos. Optimize it. **Activity 9: Logo, Banner, Video**Prepare logo, banner, and Video for assumed product/organization**Activity 10: WhatsApp**Prepare a publicity video and market it on WhatsApp |
| **Textbooks:** |
| 1.Alan Charlesworth, “Digital Marketing: A Practical Approach”, 3rd Edition,2018 |
| **Reference Books:** |
| 1. Digital and Social Media Marketing: Emerging Applications and Theoretical Development,Nripendra P. Rana 2019
2. Digital Marketing Paperback – 6 August 2020by Seema Gupta
 |
| **Online Learning Resources:** |
| 1. Advanced Certificate in Digital Marketing and Communication | MICA, upGrad
 |

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**B.TechCSE(DS)– III-II Sem L T P C**

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| **(20A05602T) MACHINE LEARNING****Common to CSE, IT,CSD,CSE(AI),CSE(AI&ML),CSE(DS),AI&DS,CSE(IOT)** |
| **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](#_bookmark26), 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](#_bookmark63): 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 ModelBasics 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](#_bookmark309), Bayesian Belief NetworkSupervised Learning: Classification: Introduction**,** Example of Supervised Learning**,** Classification Model**,** Classification Learning Steps**,** Common Classification Algorithms-[*k*-Nearest Neighbour(*k*NN)](#_bookmark357), 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**](#_bookmark458)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-DBSCANFinding Pattern using Association Rule- Definition of common terms, Association rule, Theapriori algorithm for association rule learning, Build the aprioriprinciple rules |
| **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.
3. 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/](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>
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**B.TechCSE(DS)– III-II Sem L T P C**

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| **(20A05701a) CLOUD COMPUTING****Common to CSE,IT, CSD, CSE(AI), CSE(AI&ML), CSE(DS), AI&DS** |
| **Course Objectives:** |
| * To explain the evolving computer model called cloud computing.
* To introduce the various levels of services that can be achieved by cloud.
* To describe the security aspects in cloud.
 |
| **Course Outcomes (CO):** |
| After completion of the course, students will be able to* Ability to create cloud computing environment
* Ability to design applications for Cloud environment
* Design &amp; develop backup strategies for cloud data based on features.
* Use and Examine different cloud computing services.
* Apply different cloud programming model as per need.
 |
| UNIT - I | **Basics of Cloud computing** | Lecture 8Hrs |
| **Introduction to cloud computing:** Introduction, Characteristics of cloud computing, Cloud Models, Cloud Services Examples, Cloud Based services and applications**Cloud concepts and Technologies:** Virtualization, Load balancing, Scalability and Elasticity, Deployment, Replication, Monitoring, Software defined, Network function virtualization, Map Reduce, Identity and Access Management, services level Agreements, Billing.**Cloud Services and Platforms:** Compute Services, Storage Services, Database Services, Application services, Content delivery services, Analytics Services, Deployment and Management Services, Identity and Access Management services, Open Source Private Cloud software. |
| UNIT - II | **Hadoop and Python** | Lecture 9Hrs |
| **Hadoop MapReduce:** Apache Hadoop, Hadoop Map Reduce Job Execution, Hadoop Schedulers, Hadoop Cluster setup.**Cloud Application Design**: Reference Architecture for Cloud Applications, Cloud Application Design Methodologies, Data Storage Approaches.**Python Basics:** Introduction, Installing Python, Python data Types &amp; Data Structures, Control flow, Function, Modules, Packages, File handling, Date/Time Operations, Classes. |
| UNIT - III | **Python for Cloud computing** | Lecture 8Hrs |
| **Python for Cloud:** Python for Amazon web services, Python for Google Cloud Platform, Python for windows Azure, Python for MapReduce, Python packages of Interest, Python web Application Frame work, Designing a RESTful web API.**Cloud Application Development in Python**: Design Approaches, Image Processing APP, Document Storage App, MapReduce App, Social Media Analytics App. |
| UNIT - IV | **Big data, multimedia and Tuning** | Lecture 8Hrs |
| **Big Data Analytics:** Introduction, Clustering Big Data, Classification of Big data Recommendation of Systems.**Multimedia Cloud:** Introduction, Case Study: Live video Streaming App, Streaming Protocols, case Study: Video Transcoding App.**Cloud Application Benchmarking and Tuning:** Introduction, Workload Characteristics, Application Performance Metrics, Design Considerations for a Benchmarking Methodology, Benchmarking Tools, Deployment Prototyping, Load Testing & Bottleneck Detection case Study, Hadoop benchmarking case Study. |
| UNIT - V | **Applications and Issues in Cloud** | Lecture 9 Hrs |
| **Cloud Security:** Introduction, CSA Cloud Security Architecture, Authentication, Authorization, Identity Access Management, Data Security, Key Management, Auditing.**Cloud for Industry, Healthcare &Education:** Cloud Computing for Healthcare, Cloud computing for Energy Systems, Cloud Computing for Transportation Systems, Cloud Computing for Manufacturing Industry, Cloud computing for Education.**Migrating into a Cloud:** Introduction, Broad Approaches to migrating into the cloud, the seven–step model of migration into a cloud.**Organizational readiness and Change Management in The Cloud Age:** Introduction, Basic concepts of Organizational Readiness, Drivers for changes: A frame work to comprehend the competitive environment, common change management models, change management maturity models, Organizational readiness self – assessment.**Legal Issues in Cloud Computing**: Introduction, Data Privacy and security Issues, cloud contracting models, Jurisdictional issues raised by virtualization and data location, commercial and business considerations, Special Topics. |
| **Textbooks:** |
| 1. Cloud computing A hands-on Approach‖ By ArshdeepBahga, Vijay Madisetti, Universities Press, 20162. Cloud Computing Principles and Paradigms: By Raj Kumar Buyya, James Broberg, Andrzej Goscinski, Wiley, 2016 |
| **Reference Books:** |
| 1. Mastering Cloud Computing by Rajkumar Buyya, Christian Vecchiola, SThamaraiSelvi, TMH
2. Cloud computing A Hands-On Approach by ArshdeepBahga and Vijay Madisetti.
3. Cloud Computing: A Practical Approach, Anthony T. Velte, Toby J. Velte, Robert Elsenpeter, Tata McGraw Hill, rp2011.
4. Enterprise Cloud Computing, Gautam Shroff, Cambridge University Press, 2010.
5. Cloud Application Architectures: Building Applications and Infrastructure in the Cloud, George Reese, O ‘Reilly, SPD, rp2011.
6. Essentials of Cloud Computing by K. Chandrasekaran. CRC Press.
 |
| **Online Learning Resources:** |
| [Cloud computing - Course (nptel.ac.in)](https://onlinecourses.nptel.ac.in/noc21_cs14/preview) |

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**B.TechCSE(DS)– III-II Sem L T P C**

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| **(20A32601T) DATA VISUALIZATION** |
| **Course Objectives:** |
| * Discuss the importance of Data Visualization
* Demonstrate story telling
* Explain the environment of Tableau
 |
| **Course Outcomes:** |
| After completion of the course, students will be able to* Effectively present the data
* Draw insights from the data
* Use Tableau
 |
| **UNIT I** |  | Lecture 9 Hrs |
| Introduction, the importance of Context, Choosing and effective visual |
| **UNIT II** |  | Lecture 9 Hrs |
| Clutter is your enemy, Focus your audience’s attention, Lessons in Storytelling |
| **UNIT III** |  | Lecture 10 Hrs |
| Communicating data: A step in the process, a model of communication, Three types of communication problems, six principles of communicating data.Introduction to Tableau: Using Tableau, Tableau products, Connecting to data.How much and How many: Communicating how much, communicating how manyRatios and Rates: Ratios, Rates |
| **UNIT IV** |  | Lecture 10 Hrs |
| Proportions and Percentages: Part to whole, current to historical, actual to target.Mean and MedianVariation and Uncertainty: Respecting variation, Variation over time-Control charts, Understanding uncertainty |
| **UNIT V** |  | Lecture 8 Hrs |
| Multiple Quantities: Scatterplots, Stacked Bars, Regression and Trend Lines, The Quadrant ChartChanges over time: The origin of time charts, the line chart, the dual axis line chart, the connected scatterplot, the date filed type and seasonality, the timeline, the slopegraphMaps and Location: One special map, circle maps, filled maps, dual encoded maps. |
| **Textbooks:** |
| 1. Cole NussbaumerKnaflic, Storytelling with data, Wiley
2. Ben Jones, Communicating Data with Tableau, O’Reilly
 |
| **Reference Books:** |
| 1. A Julie Steele and Noah Iliinsky, Designing Data Visualizations: Representing Informational Relationships, O’Reilly.
2. Andy Kirk, Data Visualization: A Successful Design Process, PAKT.
3. Scott Murray, Interactive Data Visualization for Web, O’Reilly.
 |
| **Online Learning Resources:** |
| 1. [Data Analysis and Visualization Foundations | Coursera](https://www.coursera.org/specializations/data-analysis-visualization-foundations)
2. [Data Visualization | Coursera](https://www.coursera.org/learn/datavisualization)
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**JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY ANANTAPUR**

**B.TechCSE(DS)– III-II Sem L T P C**

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| **(20A32602a) PREDICTIVE ANALYTICS****(Professional Elective Course-II)** |  |
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| **Course Objectives:** |
| * Discuss the concept Predictive Analytics
* Illustrate the uses and applications of Predictive Analytics
* Demonstrate building of Predictive Analytics models
 |
| **Course Outcomes:** |
| * Visualize and explore data to better understand relationships among variables
* Understand how ensemble models improve predictions
* Organize the predictive modelling task and data flow
* Apply predictive models to generate predictions for new data
* Choose and implement appropriate performance measures for predictive models
 |
| **UNIT I** |  | Lecture 10 Hrs |
| **Overview of Predictive Analytics:** What Is Analytics? What Is Predictive Analytics? Business Intelligence Predictive Analytics vs. Business Intelligence, Predictive Analytics vs. Statistics, Predictive Analytics vs. Data Mining, Who Uses Predictive Analytics? , Challenges in Using Predictive Analytics, What Educational Background Is Needed to Become a Predictive Modeler?**Setting Up the Problem:** Predictive Analytics Processing Steps: CRISP-DM, Business Understanding, Defining Data for Predictive Modelling, Defining the Target Variable, Defining Measures of Success for Predictive Models, Doing Predictive Modelling Out of Order, Case study- Recovering Lapsed Donors, Fraud Detection |
| **UNIT II** |  | Lecture 8 Hrs |
| **Data Understanding:** What the Data Looks Like, Single Variable Summaries, Data Visualization in One Dimension, Histograms, Multiple Variable Summaries, Data Visualization, Two or Higher Dimensions, The Value of Statistical Significance, Pulling It All Together into a Data Audit.**Data Preparation:** Variable Cleaning, Feature Creation. |
| **UNIT III** |  | Lecture 9 Hrs |
| **Itemsets and Association Rules:** Terminology, Parameter Settings, How the Data Is Organized, Measures of Interesting Rules, Deploying Association Rules, Problems with Association Rules, Building Classification Rules from Association Rules.**Descriptive Modelling:** Data Preparation Issues with Descriptive Modelling, Principal Component Analysis, Clustering Algorithms.**Interpreting Descriptive Models:** Standard Cluster Model Interpretation. |
| **UNIT IV** |  | Lecture 9 Hrs |
| **Predictive Modelling:** Decision Trees, Logistic Regression, Neural Networks, K-Nearest Neighbour, Naïve Bayes, Regression Models, Linear Regression, Other Regression Algorithms.**Assessing Predictive Models:** Batch Approach to Model Assessment, Assessing Regression Models. |
| **UNIT V** |  | Lecture 10 Hrs |
| **Model Ensembles:** Motivation for Ensembles, Bagging, Boosting, Improvements to Bagging and Boosting, Model Ensembles and Occam’s Razor, Interpreting Model Ensembles.**Text Mining:** Motivation for Text Mining, A Predictive Modelling Approach to Text Mining, structured vs. Unstructured Data, Why Text Mining Is Hard, Data Preparation Steps, Text Mining Features, Modelling with Text Mining Features, Regular Expressions.**Model Deployment:** General Deployment Considerations.**Case Studies:** Survey Analysis Case Study, Help Desk Case Study. |
| **Textbooks:** |
| 1. Dean Abbott, Applied Predictive Analytics, Published by Jhon Wiley &Sons, Inc,2014.
 |
| **Reference Books:** |
| 1. Eric Siegel, Predictive Analytics, Published by Jhon Wiley & Sons, inc,2013.
2. Data Analytics using Python Kindle Editionby Bharti Motwani, 2020.
 |
| **Online Learning Resources:** |
| 1. [Predictive Analytics: Introduction to Business Forecasting | Udemy](https://www.udemy.com/course/predictive-analytics-introduction-to-business-forecasting/)
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**JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY ANANTAPUR**

**B.TechCSE(DS)– III-II Sem L T P C**

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| **(20A05603T) INTERNET OF THINGS****Common to CSE, IT, CSD, CSE(AI), CSE(DS),AI&DS****PROFESSIONAL ELECTIVE COURSE - II** |
| **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 toUnmanned 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 Madisetti and ArshdeepBahga, “ Internet of Things ( A Hands-on-Approach)”, 1st Edition, VPT, 2014.
2. Handbook of unmanned aerial vehicles,  [K Valavanis](https://www.worldcat.org/search?q=au%3AValavanis%2C+K.&qt=hot_author); [George J Vachtsevanos](https://www.worldcat.org/search?q=au%3AVachtsevanos%2C+George+J.%2C&qt=hot_author), 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 Madisetti - 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
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**JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY ANANTAPUR**

**B.TechCSE (DS)– III-II Sem L T P C**

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|  | **(20A12602a) COMPUTER GRAPHICS****(Professional Elective-II)** |  |  |  |  |
| **Course Objectives:** |
| * To familiarize with the use of the components of a graphics system.
* To learn how to draw the line, circle etc., from preliminary element (pixel).
* To learn the basic principles of 3-dimensional computer graphics.
* To provide an understanding of how to scan convert the basic geometrical primitives and how to transform the shapes to fit them as per the picture definition.
* To provide an understanding of mapping from a world coordinate to device coordinates, clipping, and projections.
* To be able to apply computer graphics concepts in the development of computer games, information visualization, and in business applications.
 |
| **Course Outcomes:** |
| After completion of the course, students will be able to* Explain the basic concepts used in computer graphics.
* Inspect various algorithms to scan, convert the basic geometrical primitives, transformations, Area filling, clipping.
* Assess the importance of viewing and projections.
* Define the fundamentals of animation, virtual reality and its related technologies.
* Analyze the typical graphics pipeline.
 |
| **UNIT IOverview of computer graphics system** | Lecture 8Hrs |
| Overview of Computer Graphics System – Video display devices – Raster Scan and randomscan system – Input devices – Hard copy devices. |
| **UNIT IIOutput primitives and attributes** | Lecture 9Hrs |
| Drawing line, circle and ellipse generating algorithms – Scan line algorithm – CharacterGeneration – attributes of lines, curves and characters – Antialiasing. |
| **UNIT IIITwo-dimensional graphics Transformations and viewing** | Lecture 9Hrs |
| Two-dimensional Geometric Transformations – Windowing and Clipping – Clipping of lines and Clipping of polygons. |
| **UNIT IVThree-dimensional graphics and viewing** | Lecture 8Hrs |
| Three-dimensional concepts – Object representations- Polygon table, Quadric surfaces,Splines, Bezier curves and surfaces – Geometric and Modelling transformations – Viewing -Parallel and perspective projections. |
| **UNIT VRemoval of hidden surfaces** | Lecture 8Hrs |
| Visible Surface Detection Methods – Computer Animation. |
| **Textbooks:** |
| 1. Hearn, D. and Pauline Baker,M., Computer Graphics (C-Version),2nd Edition, Pearson Education.
 |
| **Reference Books:** |
| 1. Neuman, W.M., and Sproull, R.F., Principles of Interactive Computer Graphics, McGraw Hill., 1979.
2. Roger, D.F., Procedural elements for Computer Graphics, Mc Graw Hill, 1985.
3. Asthana, R.G.S and Sinha, N.K., Computer Graphics, New Age Int. Pub., 1996.
4. Floey, J.D., Van Dam, A, Feiner, S.K. and Hughes, J.F, Computer Graphics, PearsonEducation, 2001.
 |
| **Online Learning Resources:** |
| 1. <http://math.hws.edu/eck/cs424/downloads/graphicsbook-linked.pdf>
2. <https://nptel.ac.in/courses/106/106/106106090/>
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**B.TechCSE(DS)– III-II Sem L T P C**

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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 prospectives 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:** 1. The programs can be implemented in either JAVA or Python.
2. For Problems 1 to 6 and 10, programs are to be developed without using the built-in classes or APIs of Java/Python.
3. Data sets can be taken from standard repositories (https://archive.ics.uci.edu/ml/datasets.html) or constructed by the students.
4. 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.
5. 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.
6. 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. 1. Build an Artificial Neural Network by implementing the Back-propagation algorithm and test the same using appropriate data sets.
2. 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.
3. 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.
4. 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.
5. 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.
6. 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.
7. 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
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](https://www.udemy.com/course/machinelearning/?matchtype=p&msclkid=98d1e794a45f13b60192850107a857d7&utm_campaign=BG-LongTail_la.EN_cc.INDIA&utm_content=deal4584&utm_medium=udemyads&utm_source=bing&utm_term=_._ag_1214960761643591_._ad__._kw_%2BMachine+%2BLearning+%2Btutorial_._de_c_._dm__._pl__._ti_kwd-75935360750084%3Aloc-90_._li_148619_._pd__._)
2. [Machine Learning | Coursera](https://www.coursera.org/learn/machine-learning?utm_source=bg&utm_medium=sem&utm_campaign=94-BrandedSearch-IN&utm_content=94-BrandedSearch-IN&campaignid=415374026&adgroupid=1211662289904340&device=c&keyword=programs%20machine%20learning&matchtype=e&network=o&devicemodel=&adpostion=&creativeid=&hide_mobile_promo&msclkid=96f80c9fa62914c42a766e0a020f97aa&utm_term=programs%20machine%20learning)
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**B.TechCSE(DS)– III-II Sem L T P C**

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| **(20A32601P) DATA VISUALIZATION LAB** |
| **Course Objectives:** |
| * Discuss concepts and principles of data visualization particularly related to decision making.
* Investigate technologies and practices for visualizing data as part of a data management and analytics system.
* Apply user interface design principles and practices to develop interactive data visualizations.
* Design effective dashboard for decision making at various levels.
* Conduct research on relevant data visualization topics.
 |
| **Course Outcomes:** |
| At the end of the course students will be able to:* Understand and describe the main concepts of data visualization
* Publish the created visualizations to Tableau Server and Tableau Public
* How to recognize good (and bad) data visualizations, how to interpret a data visualization, and Using shapes, colors, text and layout appropriately
* Identifying stories and insights in data, preparing data for visualization, and create several different charts using Tableau.
 |
| **List of Experiments**: |
| 1. Connecting to the data
2. Formatting and insertion of data
3. Creating worksheets, navigating the sheets, applying filters, aggregating the data
4. Organize the data into dashboards
5. Create story
6. Develop interactive plots in Python
7. Create Time series Data Visualization in Python
8. Visualization of Semi-Structured data
9. Create Sales Growth Dashboard – for the tracking of sales teams progress
10. Design Social media Dashboard – find how well your sponsored social activating are performing, monitor your PPC campaigns
11. Develop Healthcare Data Dashboard – Allows hospital administrators to manage and identify patient hazards from a single screen.
 |
| **References:** |
| 1. Andy Kirk, Data Visualization A Handbook for Data Driven Design, Sage Publications, 2016
2. Philipp K. Janert, Gnuplot in Action, Understanding Data with Graphs, Manning Publications, 2010
 |
| **Online Learning Resources/Virtual Labs:** |
| 1. [Data Visualization with Tableau | Coursera](https://www.coursera.org/specializations/data-visualization)
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**B.TechCSE (DS)– III-II Sem L T P C**

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| **(20A12604P) CLOUD COMPUTING LAB****Common to IT, CSE(AI), CSE(AI&ML), CSE(DS), AI&DS** |
| **Course Objectives:** |
| * Demonstrate application development using Cloud
* Explain features of Hadoop
 |
| **Course Outcomes (CO):** |
| On completion of this course, the students will be able to:* Configure various virtualization tools such as Virtual Box, VMware workstation.
* Design and deploy a web application in a PaaS environment.
* Learn how to simulate a cloud environment to implement new schedulers.
* Install and use a generic cloud environment that can be used as a private cloud.
* Manipulate large data sets in a parallel environment.
 |
| **List of Experiments:** |
| 1. Install VirtualBox/VMware Workstation with different flavours of Linux or windows OS on top of windows operating systems.
2. Install a C compiler in the virtual machine created using virtual box and execute Simple Programs
3. Install Google App Engine. Create hello world app and other simple web applications using python/java.
4. Use GAE launcher to launch the web applications.
5. Simulate a cloud scenario using CloudSim and run a scheduling algorithm that is not present in CloudSim.
6. Find a procedure to transfer the files from one virtual machine to another virtual machine.
7. Find a procedure to launch virtual machine using try stack (Online Open stack Demo Version)
8. Install Hadoop single node cluster and run simple applications like wordcount
9. Establish an AWS account. Use the AWS Management Console to launch an EC2 instance and connect to it.
10. Develop a Guestbook Application using Google App Engine
11. Develop a Serverless Web App using AWS
12. Design a Content Recommendation system using AWS
13. Design a Cloud based smart traffic management system
14. Design Cloud based attendance management system
15. Design E-learning cloud-based system
16. Using Amazon Lex build a Chatbot
 |
| **References:** |
| 1. https://www.vmware.com/products/workstation-pro/workstation-pro-evaluation.html.
2. <http://code.google.com/appengine/downloads.html>
3. http://code.google.com/appengine/downloads.html
 |
| **Online Learning Resources/Virtual Labs:** |
| 1. Google Cloud Computing Foundations Course - Course (nptel.ac.in)
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**B.TechCSE(DS)– III-II Sem L T P C**

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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:** |
| 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** | **10Hrs** |
| 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 | **10Hrs** |
| 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 | **10Hrs** |
| 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** | **10Hrs** |
| 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** | **10Hrs** |
| 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](https://www.ikbooks.com/author-details/dr-shikhakapoor/1099)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_2iUCG87CQhELCytvXh0E_y-bOO1_q>
2. <https://youtu.be/xBaLgJZ0t6A?list=PLzf4HHlsQFwJZel_j2PUy0pwjVUgj7KlJ>
3. <https://youtu.be/-Y-R9hDl7lU>
4. <https://youtu.be/gkLsn4ddmTs>
5. <https://youtu.be/2bf9K2rRWwo>
6. <https://youtu.be/FchfE3c2jzc>
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**JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY ANANTAPUR**

**B.TechCSE(DS)– III-II Sem L T P C**

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| **(20A99601) INTELLECTUAL PROPERTY RIGHTS AND PATENTS****(Mandatory Non-Credit Course)** |
| **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 IIntroduction 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.
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**B.TechCSE(DS)– IV-I Sem L T P C**

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**(20A05705a) CYBER SECURITY**

**Common to IT, CSE(DS), CSE(IOT)**

**(Professional Elective course - III)**

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| **Course Objectives:** |
| The course is designed to provide awareness on different cyber crimes, cyber offenses, tools and methods used in cyber crime. |
| **Course Outcomes:** |
| After completion of the course, students will be able to* Classify the cyber crimes and understand the Indian ITA 2000
* Analyse the vulnerabilities in any computing system and find the solutions
* Predict the security threats of the future
* Investigate the protection mechanisms
* Design security solutions for organizations
 |
| **UNIT I** | **Introduction to Cybercrime** | Lecture 8Hrs |
| Introduction, Cybercrime, and Information Security, Who are Cybercriminals, Classifications of Cybercrimes, And Cybercrime: The legal Perspectives and Indian Perspective, Cybercrime and the Indian ITA 2000, A Global Perspective on Cybercrimes. |
| **UNIT II** | **Cyber Offenses: How Criminals Plan Them** | Lecture 9Hrs |
| Introduction, How Criminals plan the Attacks, Social Engineering, Cyber stalking, Cyber cafe and Cybercrimes, Botnets: The Fuel for Cybercrime, Attack Vector, Cloud Computing |
| **UNIT III** | **Cybercrime: Mobile and Wireless Devices** | Lecture 9Hrs |
| Introduction, Proliferation of Mobile and Wireless Devices, Trends in Mobility, Credit card Frauds in Mobile and Wireless Computing Era, Security Challenges Posed by Mobile Devices, Registry Settings for Mobile Devices, Authentication service Security, Attacks on Mobile/Cell Phones, Mobile Devices: Security Implications for Organizations, Organizational Measures for Handling Mobile, Organizational Security Policies an Measures in Mobile Computing Era, Laptops. |
| **UNIT IV** | **Tools and Methods Used in Cybercrime** | Lecture 8Hrs |
| Introduction, Proxy Servers and Anonymizers, Phishing, Password Cracking, Keyloggers and Spywares, Virus and Worms, Trojan Horse and Backdoors, Steganography, DoS and DDoS attacks, SQL Injection, Buffer Overflow. |
| **UNIT V** | **Cyber Security: Organizational Implications** | Lecture 8Hrs |
| Introduction, Cost of Cybercrimes and IPR issues, Web threats for Organizations, Security and Privacy Implications, Social media marketing: Security Risks and Perils for Organizations, Social Computing and the associated challenges for Organizations. |
| **Textbooks:** |
| 1. Cyber Security: Understanding Cyber Crimes, Computer Forensics and Legal Perspectives, Nina Godbole and Sunil Belapure, Wiley INDIA.
 |
| **Reference Books:** |
| 1. Cyber Security Essentials, James Graham, Richard Howard and Ryan Otson, CRC Press.
2. Introduction to Cyber Security ,Chwan-Hwa(john) Wu,J.DavidIrwin.CRC Press T&F Group
 |
| Online Learning Resources: |
| <http://nptel.ac.in/courses/106105031/40><http://nptel.ac.in/courses/106105031/39><http://nptel.ac.in/courses/106105031/38> |

**JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY ANANTAPUR**

**B.TechCSE (DS)– IV-I Sem L T P C**

 **3 0 0 3**

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| **(20A32701a) USER INTERFACE DESIGN****(Professional Elective Course– III)** |
| **Course Objectives:** |
| * Understand what user experience (UX) means and how it matters
* Understand how to approach UX and usability
* Understand how to approach UI design
 |
| **Course Outcomes:** |
| After completion of the course, students will be able to* Understand Importance and Characteristics of User interface design
* Understand User Interface Design process AND Business functions
* Apply System menus,navigation schemes and windows characteristics
* Understand screen-based controls and device-based controls
* Design the prototypes and test plans of user interface
 |
|  **UNIT I** |  | Lecture 8Hrs |
| **The Importance of User Interface:** Defining the User Interface, The Importance OfGood Design, The Benefits of Good Design, A Brief History of The Human-ComputerInterface-Introduction of The Graphical User Interface, The Blossoming of The WorldWide Web, A Brief History of Screen Design**Characteristics of Graphical and Web User Interfaces:**  The Graphical User Interface,The Web User Interface, Principles of User Interface Design. |
| **UNIT II** |  | Lecture 9Hrs |
| **The User Interface Design Process:** Obstacles and Pitfalls in the Development Path, Usability, The Design Team**Know Your User or Client**: Understanding How People Interact with Computers,Important Human Characteristics in Design, Perception, Memory, Sensory Storage, Visual Acuity, Human Considerations in Design-The User’s Knowledge and Experience, The User’s Tasks andNeeds, The User’s Psychological Characteristics, The User’s Physical Characteristics, Human Interaction Speeds. |
| **UNIT III** |  | Lecture 8Hrs |
| **Understand the Business Function:** Business Definition and Requirements Analysis, Determining Basic Business Functions, Design Standards or Style Guides, System Training and Documentation Needs.**Understand the Principles of Good Screen Design:** Human Considerations InScreen Design, Interface Design Goals, Statistical Graphs  |
| **UNIT IV** |  | Lecture 8Hrs |
| **Develop System Menus and Navigation Schemes**: Structures of Menu, Functions Of Menus, Formatting AndPhrasing Of Menus, Navigating Menus, Kinds Of Graphical Menus, WindowCharacteristics, Components Of A Window, Types Of Windows, Window Operations,Web Systems. |
| **UNIT V** |  | Lecture 9 Hrs |
| Selecting the Proper Device-Based Controls: Characteristics of Device-BasedControls, Presentation Controls, Write Clear Text and Messages, Provide EffectiveFeedback and Guidance and Assistance, Create Meaningful Graphics, Icons AndImages, Multimedia, Graphics, Organize and Layout Windows and Pages, The PurposeOf Usability Testing, Developing and Conducting The Test. |
| **Textbooks:** |
| 1. The Essential Guide to User Interface Design, Second Edition, Wilbert O. Galitz, 2002. |
| **Reference Books:** |
| 1. User Interface Design, A Software Engineering Perspective, Soren Lauesen.2. User Interface Design and Evolution, Debbie Stone, Caroline Jarrett, Mark Woodroffe, ShaileyMinocha, 2005 |
| **Online Learning Resources:** |
| 1. [Google UX Design Professional Certificate | Coursera](https://www.coursera.org/professional-certificates/google-ux-design?utm_source=gg&utm_medium=sem&utm_campaign=15-GoogleUXDesign-IN&utm_content=B2C&campaignid=12609829815&adgroupid=120289736376&device=c&keyword=ui%20ux%20design&matchtype=b&network=g&devicemodel=&adpostion=&creativeid=509135993267&hide_mobile_promo&gclid=EAIaIQobChMImYyd3a-O-AIVTTsrCh10kwGSEAMYASAAEgJry_D_BwE)
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| **JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY ANANTAPUR****B.Tech CSE (DS)– IV-I Sem L T P C** **3 0 0 3****(20A32701b) PROCESS MINING****(Professional Elective Course– III)** |
| **Course Objectives:** |
| * Discuss the basic concepts of Process mining
* Demonstrate how to apply process mining
 |
| **Course Outcomes:** |
| At the end of the course students will be able to:* To Learn Transparency Is a Prerequisite for Digital Transformation
* Understand Process Modelling and Analysis
* To learn and apply process discovery techniques
* Applying process mining e
* Analysis of Lasagna and Spaghetti process and future of process mining.
 |
| **UNIT I** |  | Lecture 8Hrs |
| **Introduction:**Process Mining in a Nutshell, Purpose: Identifying the Right Use Cases, Challenges, Pitfalls, and Failures. Process Mining, RPA, BPM, and DTO. |
| **UNIT II** |  | Lecture 9Hrs |
| **Process Mining: The Missing Link**- LimitationsofModelling, Process Mining, AnalysinganExampleLog, Play-In, Play-Out, andReplay, Positioning Process Mining.**Process Modelling and Analysis:** The Art of Modelling, Process Models, Model-Based Process Analysis. |
| **UNIT III** |  | Lecture 8Hrs |
| **Process Discovery:** A Simple Algorithm for Process Discovery, Rediscovering Process Models, Challenges.**Advanced Process Discovery Techniques:** Characteristics, Heuristic Mining, Genetic Process Mining, Region-Based Mining, Inductive Mining. |
| **UNIT IV** |  | Lecture 8Hrs |
| **Process Mining Software:** Process Mining Not Included, Different Types of Process Mining Tools, ProM: An Open-Source Process Mining Platform, Commercial Software.**Process Mining in the Large:** BigEventData, Case-Based Decomposition, Activity-Based Decomposition, Process Cubes, Streaming Process Mining |
| **UNIT V** |  | Lecture 9 Hrs |
| **Analyzing “Lasagna Processes” –** Characterization, UseCases, Approach, Applications**Analyzing “Spaghetti Processes”**- Characterization, Approach, Applications**Outlook: Future of Process Mining-** Academic View: Development of the Process Mining Discipline. Business View: Towards a Digital Enabled Organization |
| **Textbooks:** |
| 1. Reinkemeyer, Lars. "Process mining in action." Principles, Use Cases and Outlook, Santa Barbara, 2020.
2. Aalst, Wil van der. "Data science in action." Process mining. Springer, Berlin, Heidelberg, 2016.
 |
| **Reference Books**: |
| 1. Ferreira, Diogo R. A primer on process mining: Practical skills with python and graphviz. Cham: Springer International Publishing, 2017.
2. Burattin, Andrea. "Process mining techniques in business environments." volume 207 of Lecture Notes in Business Information Processing. Springer International Publishing, 2015.
3. Huser, Vojtech. "Process mining: Discovery, conformance and enhancement of business processes." 2012.
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**JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY ANANTAPUR**

**B.TechCSE (DS)– IV-I Sem L T P C**

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|  **(20A32702a) BIO INFORMATICS****(Professional Elective Course– IV)** |
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| **Course Objectives:** |
| * Discuss basic knowledge on various techniques and areas of applications in bioinformatics.
* Explore common problem in bioinformatics, alignment techniques, ethical issues, public data sources, and evolutionary modelling.
* Discover the practical use of tools for specific bioinformatic areas.
 |
| **Course Outcomes:** |
| * To get introduced to the basic concepts of Bioinformatics and its significance in Biological data analysis.
* Describe the history, scope and importance of Bioinformatics and role of internet in Bioinformatics.
* Explain about the methods to characterise and manage the different types of Biological data
* Classify different types of Biological Databases.
* Introduction to the basics of sequence alignment and analysis.
* Summarize biological macromolecular structures and structure prediction methods.
 |
| **UNIT I** |  | Lecture 8Hrs |
| **Bioinformatics and The Internet:**Internet Basics,Connecting to The Internet, Electronic Mail, File Transfer Protocol,The World Wide Web. **The NCBI Data Model:** Introduction,PUBs:Publicationsorperish, SEQ-Ids: What’s In A Name?BIOSEQs: Sequences, BIOSEQ-SETs: Collections Of Sequences,SEQ-ANNOT: Annotating The Sequence, SEQ-DESCR: Describing The Sequence, Using The Model . |
| **UNIT II** |  | Lecture 9Hrs |
| **The GenBank sequence database:**Introduction, Primary and Secondary Databases,Formatvs.Content:Computersvs.Humans,Thedatabase.The GenBankFlat file: A Dissection.**SUBMITTING DNA SEQUENCES TO THE DATABASES:**Introduction, Why, Where, and What to Submit? DNA/RNA,Population, Phylogenetic, and Mutation Studies, Protein-Only Submissions,How to Submit on the World Wide Web,How to Submit with Sequin, Updates, Consequences of the Data Model, EST/STS/GSS/HTG/SNP and Genome Centres, Concluding Remarks, Contact Points for Submission of Sequence Data to DDBJ/EMBL/GenBank. |
| **UNIT III** |  | Lecture 8Hrs |
| **STRUCTURE DATABASES:**Introduction to Structures, PDB: Protein Data Bank at the Research Collaboratory for Structural Bioinformatics (RCSB), MMDB: Molecular Modelling Database at NCBI, Structure File Formats, Visualizing Structural Information,Database Structure Viewers,Advanced StructureModelling,StructureSimilaritySearching,ProblemSet **GENOMIC MAPPING AND MAPPING DATABASE:** Interplay of Mapping and Sequencing, Genomic Map Elements,Types of Maps,Complexities and Pitfalls of Mapping, DataRepositories, Mapping Projects and Associated Resources,Practical Uses of Mapping Resources, Problem Set. |
| **UNIT IV** |  | Lecture 8Hrs |
| **INFORMATION RETRIEVAL FROM BIOLOGICAL DATABASES**: Integrated Information Retrieval: The Entrez System,LocusLink,Sequence Databases Beyond NCBI, Medical Databases, Problem Set**SEQUENCE ALIGNMENT AND DATABASE SEARCHING:**Introduction, The Evolutionary Basis of Sequence Alignment, The Modular Nature of Proteins, Optimal Alignment Methods,Substitution Scores and Gap Penalties, Statistical Significance of Alignments, Database Similarity Searching, FASTA,BLAST, Database Searching Artifacts,Position-Specific Scoring Matrices Spliced Alignments. |
| **UNIT V** |  | Lecture 9 Hrs |
| **PHYLOGENETIC ANALYSIS:** Fundamental Elements of Phylogenetic Models,Tree Interpretation—The Importance of Identifying Paralogs and Orthologs, Phylogenetic Data Analysis: The Four Steps,Alignment: Building the Data Model , Alignment: Extraction of a Phylogenetic Data Set, Determining the Substitution model, Tree-Building Methods,Distance, Parsimony, and Maximum Likelihood: What’s the Difference?,Tree Evaluation,Phylogenetics Software,Internet-Accessible Phylogenetic Analysis Software,Some Simple Practical Considerations.**COMPARATIVE GENOME ANALYSIS:**Progress in Genome Sequencing, Genome Analysis and Annotation,Application of Comparative Genomics—Reconstruction of Metabolic Pathways,Avoiding Common Problems in Genome Annotation.**LARGE-SCALE GENOME ANALYSIS:**Introduction, Technologies for Large-Scale Gene Expression, Computational Tools for Expression Analysis,Hierarchical Clustering, Prospects for the Future |
| **Textbooks:** |
| 1. D. Baxevanis and F. Oulette, (2002) “Bioinformatics: A practical guide to the analysis of genes and proteins”, Wiley Indian Edition 2. Cynthia Gibas and Per Jambeck (2001), “Developing Bioinformatics Computer Skills”. O’Reilly press, Shorff Publishers and Distributors Pvt. Ltd., Mumbai. 3. Bryan Bergeron MD (2003), “Bioinformatics Computing”. Prentice Hall India (Economy Edition) 4. Stuart Brown (2000) “Bioinformatics – A biologists guide to Biocomputing and Internet”. Eaton Publishing |
| **Reference Books:** |
| 1. T. K. Attwood & D. J. Parry-Smith (2001), “Introduction to Bioinformatics”, Pearson Education Ltd, Low Price Edition. 2. Bioinformatics: Sequence and Genome Analysis. D. W. Mount (2001) Cold Spring Harbor Laboratory Press. 3. Arthur M. Lesk (2002) “Introduction to Bioinformatis” Oxford University Press |
| **Online Learning Resources:** |
| 1. [Bioinformatics | Coursera](https://www.coursera.org/specializations/bioinformatics)
2. [Learn Bioinformatics with Online Courses, Classes, & Lessons | edX](https://www.edx.org/learn/bioinformatics)
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**JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY ANANTAPUR**

**B.Tech (CSE)– IV-I Sem L T P C**

 **3 0 0 3**

**(20A05702c) NATURAL LANGUAGE PROCESSING**

**(Professional Elective Course– IV)**

**Course Objectives:**

* Explain and apply fundamental algorithms and techniques in the area of natural language processing (NLP)
* Discuss approaches to syntax and semantics in NLP.
* Examine current methods for statistical approaches to machine translation.
* Teach machine learning techniques used in NLP.

**Course Outcomes:**

After completion of the course, students will be able to

* Understand the various NLP Applications and Organization of Natural language, able to learn and implement realistic applications using Python.
* Apply the various Parsing techniques, Bayes Rule, Shannon game, Entropy and Cross Entropy.
* Understand the fundamentals of CFG and parsers and mechanisms in ATN’s.
* Apply Semantic Interpretation and Language Modelling.
* Apply the concept of Machine Translation and multilingual Information Retrieval systems and Automatic Summarization.

**UNIT IIntroduction to Natural language** Lecture 8Hrs

The Study of Language, Applications of NLP, Evaluating Language Understanding Systems,

Different Levels of Language Analysis, Representations and Understanding, Organization of

Natural language Understanding Systems, Linguistic Background: An outline of English Syntax.

**UNIT IIGrammars and Parsing** Lecture 9Hrs

Grammars and Parsing- Top-Down and Bottom-Up Parsers, Transition Network Grammars,

Feature Systems and Augmented Grammars, Morphological Analysis and the Lexicon, Parsing with Features, Augmented Transition Networks, Bayees Rule, Shannon game, Entropy and Cross Entropy.

**UNIT IIIGrammars for Natural Language** Lecture 8Hrs

Grammars for Natural Language, Movement Phenomenon in Language, Handling questions in Context Free Grammars, Hold Mechanisms in ATNs, Gap Threading, Human Preferences in Parsing, Shift Reduce Parsers, Deterministic Parsers.

**UNIT IV** Lecture 8Hrs

**Semantic Interpretation**

Semantic & Logical form, Word senses & ambiguity, The basic logical form language, Encoding ambiguity in the logical Form, Verbs & States in logical form, Thematic roles, Speech acts &embedded sentences, Defining semantics structure model theory.

**Language Modelling**

Introduction, n-Gram Models, Language model Evaluation, Parameter Estimation, Language

Model Adaption, Types of Language Models, Language-Specific Modelling Problems,

Multilingual and Cross lingual Language Modelling.

**UNIT V**  Lecture9 Hrs

**Machine Translation**

Survey: Introduction, Problems of Machine Translation, Is Machine Translation Possible, Brief History, Possible Approaches, Current Status. Anusaraka or Language Accessor: Background, Cutting the Gordian Knot, The Problem, Structure of Anusaraka System, User Interface, Linguistic Area, Giving up Agreement in Anusarsaka Output, Language Bridges.

**Multilingual Information Retrieval**

Introduction, Document Pre-processing, Monolingual Information Retrieval, CLIR, MLIR, Evaluation in Information Retrieval, Tools, Software and Resources.

**Multilingual Automatic Summarization**

Introduction, Approaches to Summarization, Evaluation, How to Build a Summarizer, Competitions and Datasets.

**Textbooks:**

1. James Allen, Natural Language Understanding, 2nd Edition, 2003, Pearson Education.
2. Multilingual Natural Language Processing Applications: From Theory To Practice-Daniel M.Bikel and ImedZitouni, Pearson Publications.
3. Natural Language Processing, A paninian perspective, AksharBharathi, Vineetchaitanya, Prentice–Hall of India.

**Reference Books:**

1. Charniack, Eugene, Statistical Language Learning, MIT Press, 1993.
2. Jurafsky, Dan and Martin, James, Speech and Language Processing, 2nd Edition, Prentice Hall, 2008.
3. Manning, Christopher and Henrich, Schutze, Foundations of Statistical Natural Language Processing, MIT Press, 1999.

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| **Online Learning Resources:** |
| https://nptel.ac.in/courses/106/105/106105158/http://www.nptelvideos.in/2012/11/natural-language-processing.html |

**JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY ANANTAPUR**

**B.Tech (CSE)– IV-I Sem L T P C**

 **3 0 0 3**

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|  | **(20A32702b) SOCIAL NETWORK ANALYSIS****Professional Elective Course– IV** |  |  |  |  |
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| **Course Objectives:** |
| * Discuss the characteristics of different social networks
* Demonstrate the functioning of different social networks
 |
| **Course Outcomes:** |
| After completion of the course, students will be able to* Explore the functionality of different social networks
* Analyze social networks
 |
| **UNIT I** |  | Lecture 8Hrs |
| Hacking on Twitter data, Micro formats: Semantic Markup and common sense collide |
| **UNIT II** |  | Lecture 9Hrs |
| Mailboxes: Oldies but Goodies, Titter: Friends, Followers and Set wise operations |
| **UNIT III** |  | Lecture 8Hrs |
| Twitter: The Tweet, the Whole Tweet, and Nothing but the Tweet |
| **UNIT IV** |  | Lecture 8Hrs |
| LinkedIn: Clustering your professional network for Fun (and profit) |
| **UNIT V** |  | Lecture 9 Hrs |
| Face book: The All-in-one Wonder |
| **Textbooks:** |
| Matthew A. Russel, Mining the Social Web, O’Reilly, 2013 |
| **Reference Books:** |
| 1. Social Network Analysis: A Introduction with an Extensive Implementation to a LargeScale Online Network using Pajek, SeifedineKadry, Mohammed Taie, 2014.2. An Introduction to Social Network Data Analytics, Charu C. Aggarwal, IBM T. J.Watson Research Center. |
| **Online Learning Resources:** |
| 1. [Social Network Analysis | Coursera](https://www.coursera.org/learn/social-network-analysis)
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**JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY ANANTAPUR**

**B.TechCSE(DS)– IV-I Sem L T P C**

 **3 0 0 3**

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| **(20A05703b) BLOCKCHAIN TECHNOLOGY AND APPLICATIONS****(Professional Elective Course– V)** |
| **Course Objectives:** |
| * Understand how blockchain systems (mainly Bitcoin and Ethereum) work and to securely interact with them,
* Design, build, and deploy smart contracts and distributed applications,
* Integrate ideas from blockchain technology into their own projects.
 |
| **Course Outcomes:** |
| After completion of the course, students will be able to* Demonstrate the foundation of the Block chain technology and understand the processes in payment and funding.
* Identify the risks involved in building Blockchain applications.
* Review of legal implications using smart contracts.
* Choose the present landscape of Blockchain implementations and Understand Cryptocurrency markets.
* Examine how to profit from trading cryptocurrencies.
 |
| **UNIT I Introduction** | Lecture 8Hrs |
| Introduction, Scenarios, Challenges Articulated, Blockchain, Blockchain Characteristics, Opportunities Using Blockchain, History of Blockchain. Evolution of Blockchain: Evolution of Computer Applications, Centralized Applications, Decentralized Applications, Stages in Blockchain Evolution, Consortia, Forks, Public Blockchain Environments, Type of Players in Blockchain Ecosystem, Players in Market. |
| **UNIT IIBlock chain Concepts** | Lecture 9Hrs |
| Blockchain Concepts: Introduction, Changing of Blocks, Hashing, Merkle-Tree, Consensus, Mining and Finalizing Blocks, Currency aka tokens, security on blockchain, data storage on blockchain, wallets, coding on blockchain: smart contracts, peer-to-peer network, types of blockchain nodes, risk associated with blockchain solutions, life cycle of blockchain transaction. |
| **UNIT IIIArchitecting Blockchain solutions** | Lecture 9Hrs |
| Architecting Blockchain solutions: Introduction, Obstacles for Use of Blockchain, Blockchain Relevance Evaluation Framework, Blockchain Solutions Reference Architecture, Types of Blockchain Applications. Cryptographic Tokens, Typical Solution Architecture for Enterprise Use Cases, Types of Blockchain Solutions, Architecture Considerations, Architecture with Blockchain Platforms, Approach for Designing Blockchain Applications. |
| **UNIT IVEthereum Block chain Implementation** | Lecture 8Hrs |
| Ethereum Blockchain Implementation: Introduction, Tuna Fish Tracking Use Case, Ethereum Ecosystem, Ethereum Development, Ethereum Tool Stack, Ethereum Virtual Machine, Smart Contract Programming, Integrated Development Environment, Truffle Framework, Ganache, Unit Testing, Ethereum Accounts, MyEtherWallet, Ethereum Networks/Environments, Infura, Etherscan, Ethereum Clients, Decentralized Application, Metamask, Tuna Fish Use Case Implementation, OpenZeppelin Contracts |
| **UNIT VHyperledger Blockchain Implementation** | Lecture 8Hrs |
| Hyperledger Blockchain Implementation, Introduction, Use Case – Car Ownership Tracking, Hyperledger Fabric, Hyperledger Fabric Transaction Flow, FabCar Use Case Implementation, Invoking Chaincode Functions Using Client Application.Advanced Concepts in Blockchain: Introduction, Inter Planetary File System (IPFS), Zero-Knowledge Proofs, Oracles, Self-Sovereign Identity, Blockchain with IoT and AI/ML Quantum Computing and Blockchain, Initial Coin Offering, Blockchain Cloud Offerings, Blockchain and its Future Potential. |
| **Textbooks:** |
| 1. Ambadas, Arshad SarfarzAriff, Sham “Blockchain for Enterprise Application Developers”, Wiley* + - 1. Andreas M. Antonpoulos, “Mastering Bitcoin: Programming the Open Blockchain” , O’Reilly
 |
| **Reference Books:** |
| Blockchain: A Practical Guide to Developing Business, Law, and Technology Solutions, Joseph Bambara, Paul R. Allen, Mc Graw Hill. Blockchain: Blueprint for a New Economy, Melanie Swan, O’Reilly |
| **Online Learning Resources:** |
| 1. https://github.com/blockchainedindia/resources
2. Hyperledger Fabric - https://www.hyperledger.org/projects/fabric
3. Zero to Blockchain - An IBM Redbooks course, by Bob Dill, David Smits https://www.redbooks.ibm.com/Redbooks.nsf/RedbookAbstracts/crse0 401.htm
4. https://nptel.ac.in/courses/106105184
5. https://onlinecourses.nptel.ac.in/noc22\_cs44/preview
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**JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY ANANTAPUR**

**B.TechCSE(DS)– IV-I Sem L T P C**

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| **(20A05703c) DEEP LEARNING****(Professional Elective Course– V)** |
| **Course Objectives:** |
| * + Demonstrate the major technology trends driving Deep Learning
	+ Build, train, and apply fully connected deep neural networks
	+ Implement efficient (vectorized) neural networks
	+ Analyse the key parameters and hyper parameters in a neural network's architecture
 |
| **Course Outcomes:** |
| After completion of the course, students will be able to* + Demonstrate the mathematical foundation of neural network
	+ Describe the machine learning basics
	+ Differentiate architecture of deep neural network
	+ Build a convolutional neural network
	+ Build and train RNN and LSTMs
 |
| **UNIT I** |  | Lecture 8Hrs |
| Linear Algebra: Scalars, Vectors, Matrices and Tensors, Matrix operations, types of matrices, Norms, Eigen decomposition, Singular Value Decomposition, Principal Components Analysis.Probability and Information Theory: Random Variables, Probability Distributions, MarginalProbability, Conditional Probability, Expectation, Variance and Covariance, Bayes’ Rule, Information Theory. Numerical Computation: Overflow and Underflow, Gradient-Based Optimization, Constrained Optimization, Linear Least Squares. |
| **UNIT II** |  | Lecture 9Hrs |
| Machine Learning: Basics and Under fitting, Hyper parameters and Validation Sets, Estimators, Bias and Variance, Maximum Likelihood, Bayesian Statistics, Supervised and Unsupervised Learning, Stochastic Gradient Descent, Challenges Motivating Deep Learning. Deep Feed forward Networks: Learning XOR, Gradient-Based Learning, Hidden Units, Architecture Design, Back-Propagation and other Differentiation Algorithms. |
| **UNIT III** |  | Lecture 8Hrs |
| Regularization for Deep Learning: Parameter Norm Penalties, Norm Penalties as Constrained Optimization, Regularization and Under-Constrained Problems, Dataset Augmentation, Noise Robustness, Semi-Supervised Learning, Multi-Task Learning, Early Stopping, Parameter Tying and Parameter Sharing, Sparse Representations, Bagging and Other Ensemble Methods, Dropout, Adversarial Training, Tangent Distance, Tangent Prop and Manifold Tangent Classifier. Optimization for Training Deep Models: Pure Optimization, Challenges in Neural Network Optimization, Basic Algorithms, Parameter Initialization Strategies, Algorithms with Adaptive Learning Rates, Approximate Second-Order Methods, Optimization Strategies and Meta-Algorithms. |
| **UNIT IV** |  | Lecture 9Hrs |
| Convolutional Networks: The Convolution Operation, Pooling, Convolution, Basic Convolution Functions, Structured Outputs, Data Types, Efficient Convolution Algorithms, Random or Unsupervised Features, Basis for Convolutional Networks. |
| **UNIT V** |  | Lecture 8Hrs |
| Sequence Modeling: Recurrent and Recursive Nets: Unfolding Computational Graphs, Recurrent Neural Networks, Bidirectional RNNs, Encoder-Decoder Sequence-to-Sequence Architectures, Deep Recurrent Networks, Recursive Neural Networks, Echo State Networks, LSTM, Gated RNNs, Optimization for Long-Term Dependencies, Auto encoders, Deep Generative Models. |
| **Textbooks:** |
| * 1. Ian Goodfellow, YoshuaBengio, Aaron Courville, “Deep Learning”, MIT Press,2016.
	2. Josh Patterson and Adam Gibson, “Deep learning: A practitioner's approach”, O'Reilly Media, First Edition,2017.
 |
| **Reference Books:** |
| 1. Fundamentals of Deep Learning, Designing next-generation machine intelligence algorithms, Nikhil Buduma, O’Reilly, Shroff Publishers,2019.
2. Deep learning Cook Book, Practical recipes to get started Quickly,DouweOsinga, O’Reilly, Shroff Publishers,2019.
 |
| **Online Learning Resources:** |
| 1. https://keras.io/datasets/
2. http://deeplearning.net/tutorial/deeplearning.pdf
3. https://arxiv.org/pdf/1404.7828v4.pdf
4. https://www.cse.iitm.ac.in/~miteshk/CS7015.html
5. https://www.deeplearningbook.org
6. https://nptel.ac.in/courses/106105215
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**JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY ANANTAPUR**

**B.TechCSE(DS)– IV-I Sem L T P C**

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| **(20A05702b) CRYPTOGRAPHY & NETWORK SECURITY****(Professional Elective Course – V)** |
| **Course Objectives:** |
| This course aims at training students to master the:* The concepts of classical encryption techniques and concepts of finite fields and number theory
* Working principles and utilities of various cryptographic algorithms including secret key cryptography, hashes, and message digests, and public key algorithms
* Design issues and working principles of various authentication protocols, PKI standards
* Various secure communication standards including Kerberos, IPsec, TLS and email
* Concepts of cryptographic utilities and authentication mechanisms to design secure applications
 |
| **Course Outcomes**: |
| * After completion of the course, students will be able to
* Identify information security goals, classical encryption techniques and acquire fundamental knowledge on the concepts of finite fields and number theory
* Compare and apply different encryption and decryption techniques to solve problems related to confidentiality and authentication
* Apply the knowledge of cryptographic checksums and evaluate the performance of different message digest algorithms for verifying the integrity of varying message sizes.
* Apply different digital signature algorithms to achieve authentication and create secure applications
* Apply network security basics, analyse different attacks on networks and evaluate the performance of firewalls and security protocols like TLS, IPSec, and PGP
* Apply the knowledge of cryptographic utilities and authentication mechanisms to design secure applications
 |
| **UNIT I** |  | Lecture 9Hrs |
| Computer and Network Security Concepts : Computer Security Concepts, The OSI Security Architecture, Security Attacks ,Security Services , Security Mechanisms ,A Model for Network Security, Classical Encryption Techniques : Symmetric Cipher Model ,Substitution Techniques ,Transposition Techniques ,Steganography, Block Ciphers : Traditional Block Cipher Structure, The Data Encryption Standard, Advanced Encryption Standard :AES Structure, AES Transformation Functions |
| **UNIT II** |  | Lecture 9Hrs |
| Number Theory:The Euclidean Algorithm, Modular Arithmetic, Fermat’s and Euler’s Theorems, The Chinese Remainder Theorem, Discrete Logarithms, Finite Fields: Finite Fields of the Form GF(p), Finite Fields of the Form GF(2n). Public Key Cryptography: Principles, Public Key Cryptography Algorithms, RSA Algorithm, Diffie Hellman Key Exchange, Elliptic Curve Cryptography. |
| **UNIT III** |  | Lecture 9Hrs |
| Cryptographic Hash Functions: Application of Cryptographic Hash Functions,Requirements & Security, Secure Hash Algorithm, Message Authentication Functions, Requirements & Security, HMAC & CMAC. Digital Signatures: NIST Digital Signature Algorithm, Distribution of Public Keys, X.509 Certificates, Public-Key Infrastructure |
| **UNIT IV** |  | Lecture 9Hrs |
| User Authentication: Remote User Authentication Principles, Kerberos. Electronic Mail Security: Pretty Good Privacy (PGP) And S/MIME. IP Security: IP Security Overview, IP Security Policy, Encapsulating Security Payload, Combining Security Associations, Internet Key Exchange. |
| **UNIT V** |  | Lecture 8Hrs |
| Transport Level Security: Web Security Requirements, Transport Layer Security (TLS), HTTPS, Secure Shell(SSH)Firewalls: Firewall Characteristics and Access Policy, Types of Firewalls, Firewall Location and Configurations. |
| **Textbooks:** |
| 1. Cryptography and Network Security- William Stallings, Pearson Education, 7thEdition.
2. Cryptography, Network Security and Cyber Laws – Bernard Menezes, Cengage Learning, 2010 edition.
 |
| **Reference Books:** |
| 1. Cryptography and Network Security- Behrouz A Forouzan, DebdeepMukhopadhyaya, Mc-GrawHill, 3rd Edition,2015.
2. Network Security Illustrated, Jason Albanese and Wes Sonnenreich, MGH Publishers, 2003.
 |
| **Online Learning Resources:** |
| 1. <https://nptel.ac.in/courses/106/105/106105031/lecture>

Dr.DebdeepMukhopadhyayIITKharagpur [VideoLecture]1. <https://nptel.ac.in/courses/106/105/106105162/lecture>

Dr.SouravMukhopadhyay IIT Kharagpur [VideoLecture]1. <https://www.mitel.com/articles/web-communication-cryptography-and-network-security>web articles by Mitel Power Connections
 |

**JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY ANANTAPUR**

**B.Tech CSE (DS)– IV-I Sem L T P C**

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 **(20A52701a) ENTREPRENEURSHIP & INCUBATION**

**(HUMANITIES ELECTIVE II)**

|  |
| --- |
| **Course Objectives:** |
|  | * To make the student understand about Entrepreneurship
 |
|  | * To enable the student in knowing various sources of generating new ideas in setting up of New enterprise
 |
|  | * To facilitate the student in knowing various sources of finance in starting up of a business
 |
|  | * To impart knowledge about various government sources which provide financial assistance to entrepreneurs/ women entrepreneurs
 |
|  | * To encourage the student in creating and designing business plans
 |

|  |
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| **Course Outcomes:** |
|  | * Understand the concept of Entrepreneurship and challenges in the world of competition.
 |
|  | * Apply the Knowledge in generating ideas for New Ventures.
 |
|  | * Analyze various sources of finance and subsidies to entrepreneur/women Entrepreneurs.
 |
|  | * Evaluate the role of central government and state government in promoting Entrepreneurship.
 |
|  | * Create and design business plan structure through incubations.
 |

**UNIT I**

Entrepreneurship - Concept, knowledge and skills requirement - Characteristics of successful entrepreneurs - Entrepreneurship process - Factors impacting emergence of entrepreneurship - Differences between Entrepreneur and Intrapreneur - Understanding individual entrepreneurial mindset and personality - Recent trends in Entrepreneurship.

**UNIT II**

Starting the New Venture - Generating business idea – Sources of new ideas & methods of generating ideas - Opportunity recognition - Feasibility study - Market feasibility, technical/operational feasibility - Financial feasibility - Drawing business plan - Preparing project report - Presenting business plan to investors.

**UNIT III**

Sources of finance - Various sources of Finance available - Long term sources - Short term sources - Institutional Finance – Commercial Banks, SFC's in India - NBFC's in India - their way of financing in India for small and medium business - Entrepreneurship development programs in India - The entrepreneurial journey- Institutions in aid of entrepreneurship development

**UNIT IV**

Women Entrepreneurship - Entrepreneurship Development and Government - Role of Central Government and State Government in promoting women Entrepreneurship - Introduction to various incentives, subsidies and grants – Export- oriented Units - Fiscal and Tax concessions available - Women entrepreneurship - Role and importance - Growth of women entrepreneurship in India - Issues & Challenges - Entrepreneurial motivations.

**UNIT V**

Fundamentals of Business Incubation - Principles and good practices of business incubation- Process of business incubation and the business incubator and how they operate and influence the Type/benefits of incubators - Corporate/educational / institutional incubators - Broader business incubation environment - Pre-Incubation and Post - Incubation process - Idea lab, Business plan structure - Value proposition

**Textbooks:**

1. D F Kuratko and T V Rao, “Entrepreneurship**”** - A South-Asian Perspective – Cengage Learning, 2012. (For PPT, Case Solutions Faculty may visit : login.cengage.com)
2. Nandan H, “ Fundamentals of Entrepreneurship”, PHI, 2013

**References:**

1. Vasant Desai, “Small Scale Industries and Entrepreneurship”, Himalaya Publishing 2012.
2. Rajeev Roy “Entrepreneurship”, 2nd Edition, Oxford, 2012.
3. B.JanakiramandM.Rizwana‖ “Entrepreneurship Development: Text & Cases”, Excel Books, 2011.
4. Stuart Read, Effectual “Entrepreneurship”, Routledge, 2013.

**E-Resources**

1. Entrepreneurship-Through-the-Lens-of-enture Capital
2. http://www.onlinevideolecture.com/?course=mba-programs&subject=entrepreneurship
3. http://nptel.ac.in/courses/122106032/Pdf/7\_4.pd
4. http://freevideolectures.com/Course/3514/Economics-/-Management-/-Entrepreneurhip/50

**JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY ANANTAPUR**

**B.Tech CSE (DS)– IV-I Sem L T P C**

 **3 0 0 3**

**(20A52701b) MANAGEMENT SCIENCE**

**(HUMANITIES ELECTIVE-II)**

**Course Objectives:**

* To provide fundamental knowledge on Management, Administration, Organization & its concepts.
* To make the students understand the role of management in Production
* To impart the concept of HRM in order to have an idea on Recruitment, Selection,Training& Development, job evaluation and Merit rating concepts
* To create awareness on identify Strategic Management areas & the PERT/CPM for better Project Management
* To make the students aware of the contemporary issues in management

**Course Outcomes:**

* Understand the concepts & principles of management and designs of organization in a practical world
* Apply the knowledge of Work-study principles & Quality Control techniques in industry
* Analyze the concepts of HRM in Recruitment, Selection and Training & Development.
* Evaluate PERT/CPM Techniques for projects of an enterprise and estimate time & cost of project & to analyze the business through SWOT.
* Create Modern technology in management science.

**UNITI** I**NTRODUCTION TO MANAGEMENT**

Management - Concept and meaning - Nature-Functions - Management as a Science and Art and both. Schools of Management Thought - Taylor’s Scientific Theory-Henry Fayol’s principles - Eltan Mayo’s Human relations - Systems Theory - **Organisational Designs** - Line organization - Line & Staff Organization - Functional Organization - Matrix Organization - Project Organization - Committee form of Organization - Social responsibilities of Management.

**UNIT II OPERATIONS MANAGEMENT**

Principles and Types of Plant Layout - Methods of Production (Job, batch and Mass Production), Work Study - Statistical Quality Control- Deming‘s contribution to Quality. **Material Management -** Objectives - Inventory-Functions - Types, Inventory Techniques - EOQ-ABC Analysis - Purchase Procedure and Stores Management - **Marketing Management -** Concept - Meaning - Nature-Functions of Marketing - Marketing Mix - Channels of Distribution - Advertisement and Sales Promotion - Marketing Strategies based on Product Life Cycle.

**UNIT III HUMAN RESOURCES MANAGEMENT (HRM)**

HRM - Definition and Meaning – Nature - Managerial and Operative functions - Evolution of HRM - Job Analysis - Human Resource Planning(HRP) - Employee Recruitment-Sources of Recruitment - Employee Selection - Process and Tests in Employee Selection - Employee Training and Development - On-the- job & Off-the-job training methods - Performance Appraisal Concept - Methods of Performance Appraisal – Placement - Employee Induction - Wage and Salary Administration

**UNIT IV STRATEGIC & PROJECT MANAGEMENT**

Definition& Meaning - Setting of Vision - Mission - Goals - Corporate Planning Process - Environmental Scanning - Steps in Strategy Formulation and Implementation - SWOT Analysis - **Project Management -** Network Analysis - Programme Evaluation and Review Technique (PERT) - Critical Path Method (CPM) Identifying Critical Path - Probability of Completing the project within given time - Project Cost- Analysis - Project Crashing (Simple problems).

**UNIT V CONTEMPORARY ISSUES IN MANAGEMENT**

The concept of Management Information System(MIS) - Materials Requirement Planning (MRP) - Customer Relations Management(CRM) - Total Quality Management (TQM) - Six Sigma Concept - Supply Chain Management(SCM) - Enterprise Resource Planning (ERP) - Performance Management - Business Process Outsourcing (BPO) - Business Process Re-engineering and Bench Marking - Balanced Score Card - Knowledge Management.

**Textbooks:**

1. A.R Aryasri, “Management Science”, TMH, 2013

2. Stoner, Freeman, Gilbert, Management, Pearson Education, New Delhi, 2012.

**References:**

1. Koontz &Weihrich, “Essentials of Management”, 6th edition, TMH, 2005.

2. Thomas N.Duening& John M.Ivancevich, “Management Principles and Guidelines”, Biztantra.

3. Kanishka Bedi, “Production and Operations Management”, Oxford University Press, 2004.

4. Samuel C.Certo, “Modern Management”, 9th edition, PHI, 2005

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**B.Tech CSE(DS)– IV-I Sem L T P C**

 **3 0 0 3**

**(20A52701c) ENTERPRISE RESOURCE PLANNING**

**(HUMANITIES ELECTIVE-II)**

**Course Objectives:**

* To provide a contemporary and forward-looking on the theory and practice of Enterprise Resource Planning
* To enable the students in knowing the Advantages of ERP
* To train the students to develop the basic understanding of how ERP enriches the
* Business organizations in achieving a multidimensional growth.
* Impart knowledge about the historical background of BPR
* To aim at preparing the students, technologically competitive and make them ready to self-upgrade with the higher technical skills.

**Course Outcomes:**

* Understand the basic use of ERP Package and its role in integrating business functions.
* Explain the challenges of ERP system in the organization
* Apply the knowledge in implementing ERP system for business
* Evaluate the role of IT in taking decisions with MIS
* Create reengineered business processes with process redesign

**UNITI**

Introduction to ERP: Enterprise – An Overview Integrated Management Information, Business Modeling, Integrated Data Model Business Processing Reengineering(BPR), Data Warehousing, Data Mining, On-line Analytical Processing(OLAP), Supply Chain Management (SCM), Customer Relationship Management(CRM),

**UNITII**

Benefits of ERP: Reduction of Lead-Time, On-time Shipment, Reduction in Cycle Time, Improved Resource Utilization, Better Customer Satisfaction, Improved Supplier Performance, Increased Flexibility, Reduced Quality Costs, Improved Information Accuracy and Design-making Capability

**UNITIII**

ERP Implementation Lifecycle: Pre-evaluation Screening, Package Evaluation, Project Planning Phase, Gap Analysis, Reengineering, Configuration, Implementation Team Training, Testing, Going Live, End-user Training, Post-implementation (Maintenance mode)

**UNITIV**

BPR: Historical background: Nature, significance and rationale of business process reengineering (BPR), Fundamentals of BPR. Major issues in process redesign: Business vision and process objectives, Processes to be redesigned, Measuring existing processes,

**UNITV**

IT in ERP: Role of information technology (IT) and identifying IT levers. Designing and building a prototype of the new process: BPR phases, Relationship between BPR phases. MIS - Management Information System, DSS - Decision Support System, EIS - Executive Information System.

**Textbooks:**

1. Pankaj Sharma. “Enterprise Resource Planning”. Aph Publishing Corporation, New Delhi, 2004.
2. Alexis Leon, “Enterprise Resource Planning”, IV Edition, Mc.Graw Hill, 2019

**References:**

 1. Marianne Bradford “Modern ERP”, 3rd edition.

 2. “ERP making it happen Thomas f. Wallace and Michael

 3. Directing the ERP Implementation Michael w pelphrey

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**B.Tech CSE(DS)– IV-I Sem L T P C**

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**(20A32703) NoSQL using MongoDB**

**Skill Oriented Course - V**

Pre-requisite DBMS, Basic knowledge of DataScience

**Course Objectives:**

* This course elucidates concepts related to Mongodb.
* The students will get hands- on experience in working with NoSQL and Mongodb.

**Course Outcomes (CO):**

After completion of the course, students will be able to

* Understand the working of NoSQL, Mongodb, its features
* Explain and compare different types of Data
* Demonstrate the detailed architecture and performance tune of Document-oriented databases.
* Explain performance tune of Key-Value Pair NoSQL databases.
* Apply NoSQL development tools on MongoDB

**UNIT - I**

Introduction, Getting Started- Documents, Collections, Databases, Getting and Starting MongoDB, Introduction to MongoDB Shell, Data Types, Using the MongoDB Shell

Creating, Updating, and Deleting Documents: Inserting and Saving Documents, Updating Documents, Setting a write concern

**UNIT - II**

Indexing: Introduction to Indexing, Using explain () and hint(), When Not to use Index,Types of Indexes, Index Administration

Special Index and Collection Types: Capped Collections, Time-To-Live Indexes, Full-Text Indexes, Geospatial Indexing, Storing Files with GridFS

**UNIT - III**

Aggregation: The Aggregation Framework, Pipeline Operations, MapReduce, Aggregation Commands

Application Design: Normalization versus Denormalization, Optimizations for Data Manipulation, Planning Out Databases and Collections, Managing Consistency, Migrating, Schemas, When Not to use MongoDB

Setting Up a Replica Set: Introduction to Replication, A One-minute Test Setup, configuring a ReplicaSet, changing your ReplicaSet Configuration, How to design a Set, Member Configuration Options

**UNIT - IV**

Administration: Starting Members in Standalone Mode, Replica Set Configuration, Manipulating Member State, Monitoring Replication, Master-Slave

Sharding Administration: Seeing the Current State, Tracking Network Connections, Server Administration, Balancing Data

Data Administration: Setting Up Authentication, Creating and Deleting Indexes, Preheating Data, Compacting Data, Moving Collections, Pre-allocating Data Files

**UNIT - V**

Starting and Stopping MongoDB: Starting from the Command Line, Stopping MongoDB, Security, Logging

Monitoring MongoDB: Monitoring Memory Usage, Calculating the Working Set, Tracking Performance, Monitoring Replication

Making Backups: Backing Up a server, Backing Up a ReplicaSet, Backing Up a Sharded Cluster, Cresting Incremental Backups with mongoopolog

Designing the System, Virtualization, Configuring System Settings, Configuring your network, System Housekeeping

**Textbooks:**

1. “MongoDB: The Definitive Guide”, SECOND EDITION by Kristina Chodorow, Published by O’Reilly Media, Inc.
2. “The Definitive Guide to MongoDB: The NoSQL Database for Cloud and Desktop Computing”, by EelcoPlugge, Peter Membrey and Tim Hawkins, Apress

**Reference Books:**

1. MongoDB Complete Guide: Develop Strong Understanding of Administering MongoDB, CRUD Operations, MongoDB Commands,2021

**Online Learning Resources:**

What Is NoSQL? NoSQL Databases Explained | MongoDB

**List of Experiments**

1. Install MongoDB
2. Install MongDB Shell and Practice
3. Connect to a MobgoDB Deployment
4. Perform CRUD operations
5. Run Aggregation pipeline
6. Perform Client side Field level encryption
7. Write scripts to modify data and perform some administrative operations

**Projects**

Build a Content Management System using MongoDB

Build a File sharing application similar to Dropbox and Google drive using MongoDB

**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 protectionof buildings-general principles of design of openings-various types of fire protection measures to be considered while panning 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 11th 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 |

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**B.Tech III-I Sem L T P C**

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| **(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**

**(20A03505) 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 Applicationsof 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), Ballastic 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>

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**B.Tech III-I Sem L T P C**

 **3 0 0 3**

**(20A04505) DIGITAL ELECTRONICS**

**(Open Elective Course- I)**

**Course Objectives:**

* To provide the fundamental concepts associated with the digital logic and circuit design.
* To introduce the basic concepts and laws involved in the Boolean algebra and logic families and digital circuits.
* To familiarize with the different number systems, logic gates, and combinational and sequential circuits, memory elements utilized in the different digital circuits and systems.
* To introduce different digital logic families

**Course Outcomes:**

* Become familiar with the Boolean algebra, logic gates, logical variables, the truth table, number systems, codes, and their conversion from to others
* Learn the minimization techniques to simply the hardware requirements of digital circuits, implement it, design and apply for real time digital systems
* Understand the working mechanism and design guidelines of different combinational, sequential circuits, memory elements and their role in the digital system design.
* Understand different logic families and use the best combination of ICs during the design of a digital system

**UNIT 1**

DIGITAL FUNDAMENTALS: Number Systems - Decimal, binary, octal, Hexadecimal,1's and 2's complements,Codes - Binary, BCD, Excess 3, Gray, Alphanumeric codes, Booleantheorems. Logic gates: Universal gates, Sum of products and product of sums, Minterms and Maxterms, Karnaugh map Minimization.

**UNIT II**

COMBINATIONAL CIRCUITS: Half and Full Adders, Half and FullSubtractors, Binary Parallel Adder Carry look ahead Adder, BCD 'Adder, Multiplexer,Demultiplexer, MagniudeComparator, Decoder, Encoder, Priority Encoder.

**UNIT III**

SYNCHRONOUS SEQUENTIAL CIRCUITS: Flip flops - SR, JK, T, D, Master/Slave FF- operation and excitation tables, Triggering of FF, conversion of FF. Counters- Ripple Counters, Ring Counters, Shift registers, Universal Shift Register.

**UNIT IV**

MEMORY DEVICES: Basic memory structure - ROM, PROM, EPROM, EEPROM, EAPROM, RAM, Static and dynamic RAM.Programmable Logic Devices: Programmable Logic Array (PLA), Programmable Array Logic (PAL), Field Programmable Gate Arrays (FPGA).

**UNIT V**

Digital Logic Families: Logic levels,propagation delay, power dissipation, fan-out and fan-in, noise margin, RTL, TTL, ECL, CMOS.

**Textbooks:**

1. Modern Digital Electronics(Edition III) : R. P. Jarn; TMH
2. Digital Fundamentals: Thomas I. Floyd
3. Digital circuits and design: S. Salivahanan, and S. Anvzzhagan

**References:**

1. Digital Integrated Electronics: Taub & Schilling; MGH
2. Digital Design: Morris Mano; PHI.Course

**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 I**V

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.

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**B.Tech III-I Sem L T P C**

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|  | **(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> |

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**B.Tech III-I Sem L T P C**

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**(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](https://www.wiley.com/en-us/search?pq=%7Crelevance%7Cauthor%3AYang+Leng)- John Wiley & Sons

4. **Characterization of Materials 2nd Edition, 3 Volumes-Kaufmann E N -John Wiley (Bp)**

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**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 batterie**s.**

**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. Liquifaction 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

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**B.Tech IV-I Sem L T P C**

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| **(20A01704) ENVIRONMENTAL ECONOMICS****(Open Elective Course - II)**  |
| **Course Objectives:** |
| * To impart knowledge on sustainable development and economics of energy
* To teach regarding environmental degradation and economic analysis of degradation
* To inculcate the knowledge of economics of pollution and their management
* To demonstrate the understanding of cost benefit analysis of environmental resources
* To make the students to understand principles of economics of biodiversity
 |
| **Course Outcomes :** |
| After the completion of the course, the students will be able to know* The information on sustainable development and economics of energy
* The information regarding environmental degradation and economic analysis of degradation
* The identification of economics of pollution and their management
* The cost benefit analysis of environmental resources
* The principles of economics of biodiversity
 |
|  **UNIT I** |  |  |
| Sustainable Development: Introduction to sustainable development - Economy-Environment inter-linkages - Meaning of sustainable development - Limits to growth and the environmental Kuznets curve – The sustainability debate - Issues of energy and the economics of energy – Nonrenewable energy, scarcity, optimal resources, backstop technology, property research, externalities, and the conversion of uncertainty. |
| **UNIT II** |  |  |
|  Environmental Degradation: Economic significance and causes of environmental degradation - The concepts of policy failure, externality and market failure - Economic analysis of environmental degradation – Equi –marginal principle.  |
| **UNIT - III** |  |  |
| Economics of Pollution: Economics of Pollution - Economics of optimal pollution, regulation, monitoring and enforcement - Managing pollution using existing markets: Bargaining solutions – Managing pollution through market intervention: Taxes, subsidies and permits.  |
| **UNIT IV** |  |  |
|  Cost – Benefit Analysis: Economic value of environmental resources and environmental damage - Concept of Total Economic Value - Alternative approaches to valuation – Cost-benefit analysis and discounting.  |
| **UNIT V** |  |  |
| Economics of biodiversity: Economics of biodiversity conservation - Valuing individual species and diversity of species -Policy responses at national and international levels. Economics of Climate Change – stern Report  |
| **Textbooks:** |
| * + - 1. An Introduction to Environmental Economics by N. Hanley, J. Shogren and B. White Oxford University Press.(2001)
			2. Blueprint for a Green Economy by D.W. Pearce, A. Markandya and E.B. Barbier Earthscan, London.(1989)
 |
| **Reference Books:** |
| * + - 1. Environmental Economics: An Elementary Introduction by R.K. Turner, D.W. Pearce and I. Bateman Harvester Wheatsheaft, London. (1994),
			2. Economics of Natural Resources and the Environment by D.W. Pearce and R.K. Turner Harvester Wheat sheaf, London. (1990),
			3. Environmental and Resource Economics: An Introduction by Michael S. Common and Michael Stuart 2ndEdition, Harlow: Longman.(1996),
			4. Natural Resource and Environmental Economics by Roger Perman, Michael Common, Yue Ma and James Mc Gilvray 3rdEdition, Pearson Education.(2003),
 |
| **Online Learning Resources:**<https://nptel.ac.in/courses/109107171> |
|  |

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**B.Tech III-II Sem L T P C**

 **3 0 0 3**

**(20A02605) SMART ELECTRIC GRID**

**(Open Elective Course-II)**

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| **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 IV-I Sem L T P C**

 **3 0 0 3**

**(20A03605) NON – CONVENTIONAL SOURCES OF ENERGY**

**(Open Elective-II)**

**Course Objectives:**

* To explain concept of various forms of renewable energy
* To outline division aspects and utilization of renewable energy sources for both domestics and industrial applications
* To analyse the environmental and cost economics of using renewable energy sources compared to fossil fuels*.*

**Course Outcomes:**

* Explain the basic concepts of solar radiation and solar collectors
* Develop Bio - Energy
* Explain the geothermal Energy
* Apply the principles of electrical technology to develop MHD power generator
* Utilize different wind parameters for design of rotor
* Make use of power curve for energy estimation

**UNIT I**

**Principles of Solar Radiation**:

Role and potential of new and renewable source, the solar energy option, Environmental impact of solar power, physics of the sun, the solar constant, extraterrestrial and terrestrial solar radiation, solar radiation on titled surface, instruments for measuring solar radiation and sun shine, solar radiation data.

**UNIT II**

**Solar Energy Collection & Storage**

**Solar Energy Collection**: Flat plate and concentrating collectors, classification of concentrating collectors, orientation and thermal analysis, advanced collectors.

**Solar Energy Storage and Applications**:

Different methods, Sensible, latent heat and stratified storage, solar ponds. Solar Applications solar heating technique, solar distillation and drying, photovoltaic energy conversion.

**UNIT III**

**Wind Energy &Biomass**

**Wind Energy**: Sources and potentials, horizontal and vertical axis windmills, performance characteristics, Betz criteria

**Biomass**: Principles of Bio-Conversion, Anaerobic/aerobic digestion, types of Bio-gas digesters, gas yield, combustion characteristics of bio-gas, utilization for cooking, I.C. Engine operation and economic aspects.

**UNIT IV**

**Geothermal Energy & Ocean Energy**

**Geothermal Energy**: Resources, types of wells, methods of harnessing the energy, potential in India.

**Ocean Energy**: OTEC, Principles utilization, setting of OTEC plants, thermodynamic cycles. **Tidal and wave energy:** Potential and conversion techniques, mini-hydel power plants, and their economics.

**UNIT V**

**Direct Energy Conversion**

Need for DEC, Carnot cycle, limitations, principles of DEC. Thermo-electric generators, Seebeck, Peltier and Joule Thomson effects, Figure of merit, materials, applications, MHD generators, principles, dissociation and ionization, hall effect, magnetic flux, Fuel cells, principles, faraday's law's, thermodynamic aspects, selection of fuels and operating conditions.

**Textbooks:**

* + - 1. Tiwari and Ghosal, Renewable energy resources, Narosa Publishing House-2004.
			2. G.D. Rai, Non-Conventional Energy Sources, Khanna Publications-1988.

**Reference Books:**

1. Twidell& Weir, Renewable Energy Sources, Routledge; 3/e, 2015.
2. Sukhatme S.P., Nayak.J.P, ‘Solar Energy – Principle of Thermal Storage and collection”, Tata McGraw Hill, 2008.
3. Sathyajith Mathew, Wind Energy Fundamentals, Resource Analysis and Economics, Springer Publications, 2006.
4. Wei Tong, Wind Power Generation and Wind Turbine Design, WIT Press, 2010.
5. Wind Power, Revised Edition: Renewable Energy for Home, Farm, and Business, Paul Gipe, Chelsea Green Publishing, 2004.
6. S.S. Rao, B.B. Parulekar, Energy Technology (Non Conventional, Renewable and Conventional), Khanna publications, 1994.

**Online Learning Resources:**

* https://nptel.ac.in/courses/103103206
* https://nptel.ac.in/courses/108108078
* https://onlinecourses.nptel.ac.in/noc21\_ph33/preview
* https://nptel.ac.in/courses/121106014
* https://mrcet.com/downloads/digital\_notes/EEE/31082020/IV-I%20SOLAR%20&%20WIND%20ELECTRICAL%20SYSTEMS%20DIGITAL%20NOTES%201.pdf
* <https://www.vssut.ac.in/lecture_notes/lecture1428910296.pdf>

**JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY ANANTAPUR**

**B.Tech IV-I Sem L T P C**

 **3 0 0 3**

**(20A04605) SIGNAL PROCESSING**

**(Open Elective Course –II)**

**Course objectives:**

* Understand, represent and classify continuous time and discrete time signals and systems, together with the representation of LTI systems.
* Ability to represent continuous time signals (both periodic and non-periodic) in the time domain, sdomain and the frequency domain
* Understand the properties of analog filters, and have the ability to design Butterworth filters
* Understand and apply sampling theorem and convert a signal from continuous time to discrete time or from discrete time to continuous time (without loss of information)
* Able to represent the discrete time signal in the frequency domain
* Able to design FIR and IIR filters to meet given specifications

**Course Outcomes**:

* Understand and explain continuous time and discrete time signals and systems, in time and frequency domain
* Apply the concepts of signals and systems to obtain the desired parameter/ representation
* Analyse the given system and classify the system/arrive at a suitable conclusion
* Design analog/digital filters to meet given specifications
* Design and implement the analog filter using components/ suitable simulation tools
* Design and implement the digital filter using suitable simulation tools, and record the input and output of the filter for the given audio signal

**UNIT I**

Signal Definition, Signal Classification, System definition, System classification, for both continuous time and discrete time. Definition of LTI systems

**UNIT II**

Introduction to Fourier Transform, Fourier Series, Relating the Laplace Transform to Fourier Transform, Frequency response of continuous time systems

**UNIT III**

Frequency response of ideal analog filters, Salient features of Butterworth filters Design and implementation of Analog Butterworth filters to meet given specifications

**UNIT IV**

Sampling Theorem- Statement and proof, converting the analog signal to a digital signal. Practical sampling. The Discrete Fourier Transform, Properties of DFT. Comparing the frequency response of analog and digital systems.

**UNIT V**

Definition of FIR and IIR filters. Frequency response of ideal digital filters

Transforming the Analog Butterworth filter to the Digital IIR Filter using suitable mapping techniques, to meet given specifications. Design of FIR Filters using the Window technique, and the frequency sampling technique to meet given specifications Comparing the designed filter with the desired filter frequency response

**Textbooks:**

1. ‘Signals and Systems’, by Simon Haykin and Barry Van Veen, Wiley.

**References:**

1. 'Theory and Application of Digital Signal Processing', Rabiner and Gold
2. ‘Signals and Systems’, Schaum’s Outline series
3. ‘Digital Signal Processing’, Schaum’s Outline series

**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, convicted heat, internal heat sources, heat of respiration, peak load; etc.

**Textbooks:**

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

**References:**

1. Adithan, M. and Laroiya, S. C. “Practical Refrigeration and Air Conditioning”. Wiley Estern Ltd., New Delhi 1991

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**B.Tech III-II Sem L T P C**

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| **(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 ad 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> |

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**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 cellulosics

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 cellulosics: 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

**JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY ANANTAPUR**

**B.Tech IV-I Sem L T P C**

 **3 0 0 3**

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| **(20A01705) COST EFFECTIVE HOUSING TECHNIQUES****(Open Elective Course - III)** |
| **Course Objectives:** |
| * To understand the requirements of structural safety for future construction.
* To know about the housing scenario, housing financial systems land use and physical
* planning for housing and housing the urban poor
* To know the traditional practices of rural housing
* To know the different innovative cost effective construction techniques
* To know the alternative building materials for low cost housing.
 |
| **Course Outcomes :** |
| * To know the repair and restore action of earthquake damaged non engineered buildings and ability to understand the requirements of structural safety for future construction
* To know about the housing scenario, housing financial systems land use and physical planning for housing and housing the urban poor
* Apply the traditional practices of rural housing
* Understand the different innovative cost effective construction techniques
* Suggest the alternative building materials for low cost housing
 |
| **UNIT I** |  |  |
| 1. **Housing Scenario :**Introducing - Status of urban housing - Status of Rural Housing
2. **Housing Finance**: Introducing - Existing finance system in India - Government role as facilitator - Status at Rural Housing Finance - Impedimently in housing finance and related issues
3. **Land use and physical planning for housing :**Introduction - Planning of urban land - Urban land ceiling and regulation act - Efficiency of building bye lass - Residential Densities
4. **Housing the urban poor :**Introduction - Living conditions in slums - Approaches and strategies for housing urban poor
 |
| **UNIT II** |  |  |
| **Development and adoption of low cost housing technology**Introduction - Adoption of innovative cost effective construction techniques - Adoption of precast elements in partial prefatroices - Adopting of total prefactcation of mass housing in India- General remarks on pre cast rooting/flooring systems -Economical wall system - Single Brick thick loading bearing wall - 19cm thick load bearing masonry walls - Half brick thick load bearing wall – Fly-ash gypsum thick for masonry - Stone Block masonry - Adoption of precast R.C. plank and join system for roof/floor in the building |
| **UNIT III** |  |  |
| **Alternative building materials for low cost housing**Introduction - Substitute for scarce materials – Ferro-cement - Gypsum boards - Timber substitutions - Industrial wastes - Agricultural wastes - alternative building maintenance**Low cost Infrastructure services:**Introduce - Present status - Technological options - Low cost sanitation - Domestic wall - Water supply, energy |
| **UNIT IV** |  |  |
| **Rural Housing:** Introduction traditional practice of rural housing continuous - Mud Housing technology Mud roofs - Characteristics of mud - Fire treatment for thatch roof - Soil stabilization - Rural Housing programs |
| **UNIT V** |  |  |
| **Housing in Disaster prone areas:**Introduction – Earthquake - Damages to houses - Traditional prone areas - Type of Damages and Railways of non-engineered buildings - Repair and restore action of earthquake Damaged non-engineered buildings recommendations for future constructions. Requirement’s of structural safety of thin precast roofing units against Earthquake forces Status of R& D in earthquake strengthening measures - Floods, cyclone, future safety |
| **Textbooks:** |
| 1. Building materials for low – income houses – International council for building research studies and documentation.
2. Hand book of low cost housing by A.K.Lal – Newage international publishers.
3. Low cost Housing – G.C. Mathur by South Asia Books
 |
| **Reference Books:** |
| 1. Properties of concrete – Neville A.m. Pitman Publishing Limited, London.
2. Light weight concrete, Academic Kiado, Rudhai.G – Publishing home of Hungarian Academy of Sciences 1963.
3. Modern trends in housing in developing countries – A.G. Madhava Rao, D.S. Rama chandra Murthy &G.Annamalai. E. & F. N. Spon  Publishers
 |
| **Online Learning Resources:** |
| <https://nptel.ac.in/courses/124107001> |

**JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY ANANTAPUR**

**B.Tech IV-I Sem L T P C**

 **3 0 0 3**

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| **(20A02704) IoT APPLICATIONS IN ELECTRICAL ENGINEERING****(Open Elective Course – III)** |
|  |  |  |  |
| **Course Objectives:** |
| * Understand basics of Internet of Things and Micro Electro Mechanical Systems (MEMS) fundamentals in design and fabrication process
* Analyze motion less and motion detectors in IoT applications
* Understand about Analyze applications of IoT in smart grid
* Apply the concept of Internet of Energy for various applications
 |
| **Course Outcomes:** |
| * Understand the concept of IoT in Electrical Engineering
* Analyze various types of motionless sensors and various types of motion detectors
* Apply various applications of IoT in smart grid
* Design future working environment with Energy internet
 |
| **UNIT I** | **SENSORS** |  |
| Definitions, Terminology, Classification, Temperature sensors, Thermoresistive, Resistance, temperature detectors, Silicon resistive thermistors, Semiconductor, Piezoelectric, Humidity and moisture sensors. Capacitive, Electrical conductivity, Thermal conductivity, time domain reflectometer, Pressure and Force sensors: Piezoresistive, Capacitive, force, strain and tactile sensors, Strain gauge, Piezoelectric  |
| **UNIT II** | **OCCUPANCY AND MOTION DETECTORS** |  |
| Capacitive occupancy, Inductive and magnetic, potentiometric - Position, displacement and level sensors, Potentiometric, Capacitive, Inductive, magnetic velocity and acceleration sensors, Capacitive, Piezoresistive, piezoelectric cables, Flow sensors, Electromagnetic, Acoustic sensors - Resistive microphones, Piezoelectric, Photo resistors |
| **UNIT III** | **MEMS** |  |
| Basic concepts of MEMS design, Beam/diaphragm mechanics, electrostatic actuation and fabrication, Process design of MEMS based sensors and actuators, Touch sensor, Pressure sensor, RF MEMS switches, Electric and Magnetic field sensors |
| **UNIT IV** | **IoT FOR SMART GRID** |  |
| Driving factors, Generation level, Transmission level, Distribution level, Applications, Metering and monitoring applications, Standardization and interoperability, Smart home |
| **UNIT V INTERNET of ENERGY (IoE)**Concept of Internet of Energy, Evaluation of IoE concept, Vision and motivation of IoE, Architecture, Energy routines, information sensing and processing issues, Energy internet as smart grid  |
| **Textbooks:** |
| 1. Jon S. Wilson, Sensor Technology Hand book, Newnes Publisher, 2004
2. Tai Ran Hsu, MEMS and Microsystems: Design and manufacture, 1st Edition, Mc Grawhill Education, 2017
3. Ersan Kabalci and Yasin Kabalci, From Smart grid to Internet of Energy, 1st Edition, Academic Press, 2019
 |
| **Reference Books:** |
| 1. Raj Kumar Buyya and Amir Vahid Dastjerdi, Internet of Things: Principles and Paradigms, Kindle Edition, Morgan Kaufmann Publisher, 2016
2. Yen Kheng Tan and Mark Wong, Energy Harvesting Systems for IoT Applications: Generation, Storage and Power Management, 1st Edition, CRC Press, 2019
3. RMD Sundaram Shriram, K. Vasudevan and Abhishek S. Nagarajan, Internet of Things, Wiley, 2019
 |
| **Online Learning Resources:** |
| 1.<https://onlinecourses.nptel.ac.in/noc22_cs96/preview>2. <https://nptel.ac.in/courses/108108123>3. <https://nptel.ac.in/courses/108108179>  |

**JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY ANANTAPUR**

**B.Tech IV-I Sem L T P C**

 **3 0 0 3**

**(20A03704) INTRODUCTION TO HYBRID AND ELECTRICAL VEHICLES**

**(Open Elective-III)**

**Course Objectives:**

* Provide good foundation on hybrid and electrical vehicles.
* To address the underlying concepts and methods behind power transmission in hybrid and electrical vehicles.
* Familiarize energy storage systems for electrical and hybrid transportation.
* To design and develop basic schemes of electric vehicles and hybrid electric vehicles.

**Course Outcomes:**

* Explain the working of hybrid and electric vehicles
* Choose a suitable drive scheme for developing an hybrid and electric vehicles depending on resources
* Develop the electric propulsion UNIT and its control for application of electric vehicles
* Choose proper energy storage systems for vehicle applications
* Design and develop basic schemes of electric vehicles and hybrid electric vehicles

**UNIT I Electric Vehicle Propulsion and Energy Sources**

Introduction to electric vehicles, vehicle mechanics - kinetics and dynamics, roadway fundamentals propulsion system design - force velocity characteristics, calculation of tractive power and energy required, electric vehicle power source - battery capacity, state of charge and discharge, specific energy, specific power, Ragone plot. Battery modelling - run time battery model, first principle model, battery management system- soc measurement, battery cell balancing. Traction batteries - nickel metal hydride battery, Li-Ion, Li-polymer battery.

**UNIT II Electric Vehicle Power Plant and Drives**

Introduction electric vehicle power plants. Induction machines, permanent magnet machines, switch reluctance machines. Power electronic converters-DC/DC converters - buck boost converter, isolated DC/DC converter. Two quadrant chopper and switching modes. AC drives- PWM, current control method. Switch reluctance machine drives - voltage control, current control.

**UNIT III Hybrid and Electric Drive Trains**

Introduction hybrid electric vehicles, history and social importance, impact of modern drive trains in energy supplies. Hybrid traction and electric traction. Hybrid and electric drive train topologies. Power flow control and energy efficiency analysis, configuration and control of DC motor drives and induction motor drives, permanent magnet motor drives, switch reluctance motor drives, drive system efficiency.

**UNIT IV Electric and Hybrid Vehicles - Case Studies**

Parallel hybrid, series hybrid -charge sustaining, charge depleting. Hybrid vehicle case study –Toyota Prius, Honda Insight, Chevrolet Volt. 42 V systems for traction applications. Lightly hybridized vehicles and low voltage systems. Electric vehicle case study - GM EV1, Nissan Leaf, Mitsubishi Miev. Hybrid electric heavy-duty vehicles, fuel cell heavy duty vehicles.

**UNIT V Electric and Hybrid Vehicle Design**

Introduction to hybrid vehicle design. Matching the electric machine and the internal combustion engine. Sizing of propulsion motor, power electronics, drive system. Selection of energy storage technology, communications, supporting subsystem. Energy management strategies in hybrid and electric vehicles - energy management strategies- classification, comparison, implementation.

**Textbooks:**

1. Iqbal Hussein, Electric and Hybrid Vehicles: Design Fundamentals, 2/e, CRC Press, 2003.
2. Amir Khajepour, [M. Saber Fallah](https://www.google.co.in/search?tbo=p&tbm=bks&q=inauthor:%22M.+Saber+Fallah%22&source=gbs_metadata_r&cad=4), [AvestaGoodarzi](https://www.google.co.in/search?tbo=p&tbm=bks&q=inauthor:%22Avesta+Goodarzi%22&source=gbs_metadata_r&cad=4), Electric and Hybrid Vehicles: Technologies, Modeling and Control - A Mechatronic Approach, illustrated edition, John Wiley & Sons, 2014.
3. Mehrdad Ehsani, YimiGao, Sebastian E. Gay, Ali Emadi, Modern Electric, Hybrid Electric and Fuel Cell Vehicles: Fundamentals, Theory and Design, CRC Press, 2004.

**Reference Books:**

1. James Larminie, John Lowry, Electric Vehicle Technology Explained, Wiley, 2003.
2. John G. Hayes, [G. Abas Goodarzi](https://www.amazon.in/s/ref%3Ddp_byline_sr_book_2?ie=UTF8&field-author=G.+Abas+Goodarzi&search-alias=stripbooks), Electric Powertrain: Energy Systems, Power Electronics and Drives for Hybrid, Electric and Fuel Cell Vehicles, 1/e, Wiley-Blackwell, 2018.

**Online Learning Resources:**

* https://archive.nptel.ac.in/courses/108/103/108103009/
* https://www.youtube.com/watch?v=wypbLRe9xUg
* https://www.youtube.com/watch?v=q6BYr5-fq5U
* https://www.youtube.com/watch?v=3E1SXG7VkQk
* https://www.iare.ac.in/sites/default/files/IARE\_HEV\_LN\_0.pdf
* <https://nptel.ac.in/courses/108102121>

**JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY ANANTAPUR**

**B.Tech IV-I Sem L T P C**

 **3 0 0 3**

**(20A04704) ELECTRONIC SENSORS**

**(Open Elective Course –III)**

**Course Objectives:**

* Learn the characterization of sensors.
* Known the working of Electromechanical, Thermal, Magnetic and radiation sensors
* Understand the concepts of Electro analytic and smart sensors
* Able to use sensors in different applications

**Course Outcomes**:

* Learn about sensor Principle, Classification and Characterization.
* Explore the working of Electromechanical, Thermal, Magnetic, radiation and Electro analytic sensors
* Understand the basic concepts of Smart Sensors
* Design a system with sensors

**UNIT I**

**Sensors / Transducers**: Principles, Classification, Parameters, Characteristics, Environmental

Parameters (EP), Characterization

**Electromechanical Sensors:** Introduction, Resistive Potentiometer, Strain Gauge, Resistance Strain Gauge, Semiconductor Strain Gauges -Inductive Sensors: Sensitivity and Linearity of the Sensor – Types-Capacitive Sensors: Electrostatic Transducer, Force/Stress Sensors Using Quartz Resonators, Ultrasonic Sensors

**UNIT II**

**Thermal Sensors**: Introduction, Gas thermometric Sensors, Thermal Expansion Type Thermometric Sensors, Acoustic Temperature Sensor ,Dielectric Constant and Refractive Index thermo sensors, Helium Low Temperature Thermometer ,Nuclear Thermometer ,Magnetic Thermometer ,Resistance Change Type Thermometric Sensors, Thermo emf Sensors, Junction Semiconductor Types, Thermal Radiation Sensors, Quartz Crystal Thermoelectric Sensors, NQR Thermometry, Spectroscopic Thermometry, Noise Thermometry, Heat Flux Sensors

**UNIT III**

Magnetic sensors: Introduction, Sensors and the Principles Behind, Magneto-resistive Sensors,

Anisotropic Magneto resistive Sensing, Semiconductor Magneto resistors, Hall Effect and Sensors, Inductance and Eddy Current Sensors, Angular/Rotary Movement Transducers, Synchros.

**UNIT IV**

Radiation Sensors: Introduction, Basic Characteristics, Types of Photo resistors/ Photo detectors, Xray and Nuclear Radiation Sensors, Fibre Optic Sensors

Electro analytical Sensors: The Electrochemical Cell, The Cell Potential - Standard Hydrogen

Electrode (SHE), Liquid Junction and Other Potentials, Polarization, Concentration Polarization, Reference Electrodes, Sensor Electrodes, Electro ceramics in Gas Media.

**UNIT V**

**Smart Sensors:** Introduction, Primary Sensors, Excitation, Amplification, Filters, Converters,

Compensation, Information Coding/Processing - Data Communication, Standards for Smart Sensor Interface, the Automation Sensors –Applications: Introduction, On-board Automobile Sensors (Automotive Sensors), Home Appliance Sensors, Aerospace Sensors, Sensors for Manufacturing –Sensors for environmental Monitoring

**Textbooks:**

1. “Sensors and Transducers - D. Patranabis” –PHI Learning Private Limited., 2003.
2. Introduction to sensors- John veteline, aravindraghu, CRC press, 2011

**References:**

1. Sensors and Actuators, D. Patranabis, 2nd Ed., PHI, 2013.
2. Make sensors: Terokarvinen, kemo, karvinen and villeyvaltokari, 1st edition, maker media,2014.
3. Sensors handbook- Sabriesoloman, 2nd Ed. TMH, 2009

**JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY ANANTAPUR**

**B.Tech IV-I Sem L T P C**

 **3 0 0 3**

**(20A27704) HUMAN NUTRITION**

**(OPEN ELECTIVE-III)**

**Course Objectives:**

* To get knowledge on Concepts and content of nutrition source and metabolic functions.
* To know about Balanced diets for various groups; Diets and disorders, recommended dietary allowances
* To learn about Epidemiology of under nutrition and over nutrition.
* To understand Nutrition and immunity.

**Course Outcomes:**

* To study the Salient features of Concepts and content of nutrition, Malnutrition, Nutrition education
* Assessment of nutritional status, disorders Food fad and faddism.

**UNIT I**

Concepts and content of nutrition: Nutrition agencies; Nutrition of community; Nutritional policies and their implementation; Metabolic function of nutrients. Nutrients: Sources, functions, digestion, absorption, assimilation and transport of carbohydrates, proteins and fats in human beings;

**UNIT II**

Water and energy balance: Water intake and losses; Basal metabolism- BMR; Body surface area and factors affecting BMR Formulation of diets: Classification of balanced diet; Balanced diets for various groups; Diets and disorders. Recommended dietary allowances (RDA); For various age group; According physiological status; Athletic and sports man; Geriatric persons

**UNIT III**

Malnutrition: Type of Malnutrition; Multi-factorial causes; Epidemiology of under nutrition and over nutrition; Nutrition and immunity.

**UNIT IV**

Nutrition education Assessment of nutritional status: Diet surveys; Anthropometry; Clinical examination; Biochemical assessment; Additional medical information

**UNIT V**

Blood constituents; Hormone types; Miscellaneous disorders Food fad and faddism. Potentially toxic substances in human food.

**Textbooks:**

1. Swaminathan M, Advanced Text Book on Food & Nutrition (Volume I and II) , The Bangalore Printing and Publishing Co.Ltd, Bangalore. 2006
2. Stewart Truswell, ABC of Nutrition (4th edition) , BMJ Publishing Group 2003, ISBN 0727916645.
3. Martin Eastwood, Principles of Human Nutrition , Blackwell Publishing, Boca Rotan

**Reference:**

1. Mike Lean and E. Combet ,Barasi’s Human Nutrition – A Health Perspective , Second Edition CRC Press, London
2. Introduction to Human Nutrition, Micheal J. G., Susan A.L. Aedin C. and Hester H.V, Wiley-Blackwell Publication, UK 2009 , ISBN 9781405168076
3. Bogert L.J., Goerge M.B, Doris H.C., Nutrition and Physical Fitness, W.B. Saunders Company, Toronto, Canada

**JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY ANANTAPUR**

**B.Tech IV-I Sem L T P C**

 **3 0 0 3**

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|  | **(20A54702) NUMERICAL METHODS FOR ENGINEERS** **(OPEN ELECTIVE-III)** |
|  |
| **Course Objectives:** |
| This course aims at providing the student with the knowledge on various numerical methods for solving equations, interpolating the polynomials, evaluation of integral equations and solution of differential equations. |
| **Course Outcomes:**  |
| * Apply numerical methods to solve algebraic and transcendental equations.
* Understand fitting of several kinds of curves.
* Derive interpolating polynomials using interpolation formulae.
* Solve differential and integral equations numerically.
 |
| **UNIT I** | **Solution of Algebraic & Transcendental Equations** |  |
| Introduction-Bisection Method-Iterative method-Regula falsi method-Newton Raphson method. System of Algebraic equations: Gauss Jordan method-Gauss Siedal method. |
| **UNIT II** | **Curve Fitting** |  |
| Principle of Least squares- Fitting of curves- Fitting of linear, quadratic and exponential curves.  |
| **UNIT III** | **Interpolation** |  |
| Finite differences-Newton’s forward and backward interpolation formulae – Lagrange’s formulae Gauss forward and backward formula, Stirling’s formula, Bessel’s formula |
| **UNIT IV** | **Numerical Integration**  |  |
| Numerical Integration: Trapezoidal rule – Simpson’s 1/3 Rule – Simpson’s 3/8 Rule |
| **UNIT V Solution of Initial value problems to Ordinary differential equations** |
| Numerical solution of Ordinary Differential equations: Solution by Taylor’s series-Picard’s Method of successive Approximations-Modified Euler’s Method-Runge-Kutta Methods.  |
| **Textbooks:** |
| 1. Higher Engineering Mathematics, B.S.Grewal, Khanna publishers.
2. Probability and Statistics for Engineers and Scientists, Ronald E. Walpole,PNIE.
3. Advanced Engineering Mathematics, by Erwin Kreyszig, Wiley India
 |
| **Reference Books:** |
| 1. Higher Engineering Mathematics, by B.V.Ramana, Mc Graw Hill publishers.
2. Advanced Engineering Mathematics, by Alan Jeffrey, Elsevier.
 |
| **Online Learning Resources**: |
| <https://slideplayer.com/slide/8588078/> |

**JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY ANANTAPUR**

**B.Tech IV-I Sem L T P C**

 **3 0 0 3**

**(20A56702) SENSORS AND ACTUATORS FOR ENGINEERING APPLICATIONS**

**(OPEN ELECTIVE-III)**

**Course Objectives**:

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

**Course Outcomes:**

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

**UNIT I Introduction to Sensors and Actuators**

**Sensors**: Types of sensors: temperature, pressure, strain, active and passive sensors, General characteristics of sensors (Principles only), Materials used and their fabrication process: Deposition: Chemical Vapor Deposition, Pattern: photolithography and Etching: Dry and Wet Etching.

**Actuators:** Functional diagram of actuators, Types of actuators and their basic principle of working: Hydraulic, Pneumatic, Mechanical, Electrical, Magnetic, Electromagnetic, piezo-electric and piezo-resistive actuators, Simple applications of Actuators.

**UNIT II Temperature and Mechanical Sensors**

**Temperature Sensors**: Types of temperature sensors and their basic principle of working: Thermo-resistive sensors: Thermistors, Resistance temperature sensors, Silicon resistive sensors, Thermo-electric sensors: Thermocouples, PN junction temperature sensors

**Mechanical Sensors**: Types of Mechanical sensors and their basic principle of working: Force sensors: strain gauges, tactile sensors, Pressure sensors: semiconductor, piezoresistive, capacitive, VRP.

**UNIT III Optical and Acoustic Sensors**

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

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

**UNIT IV Magnetic, Electromagnetic Sensors and Actuators**

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

**UNIT V Chemical and Radiation Sensors**

**Chemical Sensors**: Principle and working of Electro-chemical, Thermo-chemical, Gas, pH, Humidity and moisture sensors.

**Radiation Sensors**: Principle and working of Ionization detectors, Scintillation detectors, Geiger-Mueller counters, Semiconductor radiation detectors and Microwave sensors (resonant, reflection, transmission)

**Textbooks:**

1. Sensors and Actuators – Clarence W. de Silva, CRC Press, 2nd Edition, 2015

2. Sensors and Actuators, D.A.Hall and C.E.Millar, CRC Press, 1999

**Reference Books:**

1. Sensors and Transducers- D.Patranabhis, Prentice Hall of India (Pvt) Ltd. 2003

2. Measurement, Instrumentation, and Sensors Handbook-John G.Webster, CRC press 1999

3. Sensors – A Comprehensive Sensors- Henry Bolte, John Wiley.

4. Handbook of modern sensors, Springer, Stefan Johann Rupitsch.

5. Principles of Industrial Instrumentation By D. Patranabhis

**NPTEL courses links**

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

**JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY ANANTAPUR**

**B.Tech IV-I Sem L T P C**

 **3 0 0 3**

**(20A51702) CHEMISTRY OF NANOMATERIALS AND APPLICATIONS**

**(OPEN ELECTIVE-III)**

**Course Objectives:**

* To understand synthetic principles of Nanomaterials by various methods
* To characterize the synthetic nanomaterials by various instrumental methods
* To enumerate the applications of nanomaterials in engineering

**Course Outcomes:**

* Understand the state of art synthesis of nano materials
* Characterize nano materials using ion beam, scanning probe methodologies, position sensitive atom probe and spectroscopic ellipsometry.
* Analyze nanoscale structure in metals, polymers and ceramics
* Analyze structure-property relationship in coarser scale structures
* Understand structures of carbon nano tubes

**UNIT I**

Introduction: Scope of nanoscience and nanotecnology, nanoscience in nature, classification of nanostructured materials, importance of nano materials.

Synthetic Methods**:** Bottom-Up approach**:** Sol-gel synthesis, microemulsions or reverse micelles, co-precipitation method, solvothermal synthesis, hydrothermal synthesis, microwave heating synthesis and sonochemical synthesis.

**UNIT II**

Top-Down approach: Inert gas condensation, arc discharge method, aerosol synthesis, plasma arc technique, ion sputtering, laser ablation, laser pyrolysis, and chemical vapour deposition method, electrodeposition method, high energy ball milling.

**UNIT III**

Techniques for characterization: Diffraction technique, spectroscopy techniques, electron microscopy techniques for the characterization of nanomaterials, BET method for surface area analysis, dynamic light scattering for particle size determination.

**UNIT IV**

Studies of Nano-structured Materials: Synthesis, properties and applications of the following nanomaterials, fullerenes, carbon nanotubes, core-shell nanoparticles, nanoshells, self- assembled monolayers, and monolayer protected metal nanoparticles, nanocrystalline materials, magnetic nanoparticles and important properties in relation to nanomagnetic materials, thermoelectric materials, non-linear optical materials, liquid crystals.

**UNIT V**

Engineering Applications of Nanomaterials

**Textbooks:**

1. NANO: The Essentials: T Pradeep, MaGraw-Hill, 2007.
2. Textbook of Nanoscience and nanotechnology: B S Murty, P Shankar, BaldevRai, BB Rath and James Murday, Univ. Press, 2012.

**References:**

1. Concepts of Nanochemistry; Ludovico Cademrtiri and Geoffrey A. Ozin& Geoffrey A. Ozin, Wiley-VCH, 2011.
2. Nanostructures & Nanomaterials; Synthesis, Properties & Applications: Guozhong Cao, Imperial College Press, 2007.
3. Nanomaterials Chemistry, C. N. R. Rao, Achim Muller, K.Cheetham, Wiley-VCH, 2007.

**JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY ANANTAPUR**

**B.Tech IV-I Sem L T P C**

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| **(20A01706) HEALTH, SAFETY AND ENVIRONMENTAL MANAGEMENT PRACTICES****(Open Elective Course-IV)** |
| **Course Objectives:** |
| * To understand safety, health and environmental management.
* To be familiar with hazard classification and assessment, hazard evaluation and hazard . control, environmental issues and management
* To get exposed to accidents modeling, accident investigation and reporting, concepts of. HAZOP and PHA
* To be familiar with safety measures in design and process operations.
* To get exposed to risk assessment and management, principles and methods
 |
| **Course Outcomes :** |
| * To understand safety, health and environmental management.
* To be familiar with hazard classification and assessment, hazard evaluation and hazard.
* To get exposed to accidents modelling, accident investigation and reporting control, environmental issues and management
* To get concepts of HAZOP and PHA.
* To be familiar with safety measures in design and process operations.
 |
| **UNIT I** |  |  |
| Introduction to safety, health and environmental management - Basic terms and their definitions - Importance of safety - Safety assurance and assessment - Safety in design and operation - Organizing for safety.  |
| **UNIT II** |  |  |
| Hazard classification and assessment - Hazard evaluation and hazard control. Environmental issues and Management - Atmospheric pollution - Flaring and fugitive release - Water pollution - Environmental monitoring - Environmental management.  |
| **UNIT III** |  |  |
| Accidents modelling - Release modelling - Fire and explosion modelling - Toxic release and dispersion Modelling  |
| **UNIT IV** |  |  |
| Accident investigation and reporting - concepts of HAZOP and PHA. Safety measures in design and process operations - Inserting, explosion, fire prevention, sprinkler systems.  |
| **UNIT V** |  |  |
| Risk assessment and management - Risk picture - Definition and characteristics - Risk acceptance criteria - Quantified risk assessment - Hazard assessment - Fatality risk assessment - Risk management principles and methods. |
| **Textbooks:** |
| * + - 1. Process Safety Analysis, by Skelton. B, Gulf Publishing Company, Houston, 210pp., 1997.
			2. Risk Management with Applications from Offshore Petroleum Industry, by TerjeAven and Jan Erik Vinnem, Springer, 200pp., 2007.
 |
| **Reference Books:** |
| 1. Introduction to Safety and Reliability of Structures, by Jorg Schneider
2. Structural Engineering Documents Vol. 5, International Association for Bridge and Structural Engineering (IABSE), 138pp., 1997.
3. Safety and Health for Engineers, by Roger L. Brauer, John Wiley and Sons Inc. pp. 645-663, 2006.
4. Health, Safety and Environmental Management in Offshore and Petroleum Engineering, Srinivasan Chandrasekaran, John Wiley and Sons, 2016.
 |
| **Online Learning Resources:** |
| <https://nptel.ac.in/courses/114106017> |

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**B.Tech IV-I Sem L T P C**

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| **(20A02705) RENEWABLE ENERGY SYSTEMS****(Open Elective Course – IV)** |
| **Course Objectives:** |
| * Understand various sources of Energy and the need of Renewable Energy Systems.
* Understand the concepts of Solar Radiation, Wind energy and its applications.
* Analyze solar thermal and solar PV systems
* Understand the concept of geothermal energy and its applications, biomass energy, the concept of Ocean energy and fuel cells.
 |
| **Course Outcomes:** |
| * Understand various alternate sources of energy for different suitable application requirements
* Understand the concepts of solar energy generation strategies and wind energy system
* Analyze Solar and Wind energy systems
* Understand the basics of Geothermal Energy Systems, various diversified energy scenarios of ocean, biomass and fuel cells
 |
| **UNIT I** | **SOLAR ENERGY** |  |
| Solar radiation - beam and diffuse radiation, solar constant, earth sun angles, attenuation and measurement of solar radiation, local solar time, derived solar angles, sunrise, sunset and day length. flat plate collectors, concentrating collectors, storage of solar energy-thermal storage. |
| **UNIT II** | **PV ENERGY SYSTEMS** |  |
| Introduction, The PV effect in crystalline silicon basic principles, the film PV, Other PV technologies, Electrical characteristics of silicon PV cells and modules, PV systems for remote power, Grid connected PV systems. |
| **UNIT III** | **WIND ENERGY** |  |
| Principle of wind energy conversion; Basic components of wind energy conversion systems; windmill components, various types and their constructional features; design considerations of horizontal and vertical axis wind machines: analysis of aerodynamic forces acting on wind mill blades and estimation of power output; wind data and site selection considerations. |
| **UNIT IV** | **GEOTHERMAL ENERGY**  |  |
| Estimation and nature of geothermal energy, geothermal sources and resources like hydrothermal, geo-pressured hot dry rock, magma. Advantages, disadvantages and application of geothermal energy, prospects of geothermal energy in India. |
| **UNIT V** | **MISCELLANEOUS ENERGY TECHNOLOGIES** |  |
| **Ocean Energ**y: Tidal Energy-Principle of working, performance and limitations. Wave Energy-Principle of working, performance and limitations. **Bio mass Energy**: Biomass conversion technologies, Biogas generation plants, Classification, advantages and disadvantages, constructional details, site selection, digester design consideration**Fuel cell**: Principle of working of various types of fuel cells and their working, performance and limitations. |
| **Textbooks:** |
| 1. Stephen Peake, “Renewable Energy Power for a Sustainable Future”, Oxford International Edition, 2018.
2. G. D. Rai, “Non-Conventional Energy Sources”, 4th Edition, Khanna Publishers, 2000.
 |
| **Reference Books:** |
| 1. S. P. Sukhatme, “Solar Energy”,3rd Edition, Tata Mc Graw Hill Education Pvt. Ltd, 2008.
2. B H Khan , “ Non-Conventional Energy Resources”, 2nd Edition, Tata Mc Graw Hill Education Pvt Ltd, 2011.
3. S. Hasan Saeed and D.K.Sharma,“Non-Conventional Energy Resources”,3rd Edition, S.K.Kataria& Sons, 2012.
4. G. N. Tiwari and M.K.Ghosal, “Renewable Energy Resource: Basic Principles and Applications”, Narosa Publishing House, 2004.
 |
| **Online Learning Resources:** |
| 1. <https://nptel.ac.in/courses/103103206>2. <https://nptel.ac.in/courses/108108078> |

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**B.Tech IV-I Sem L T P C**

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**(20A03705) INTRODUCTION TO COMPOSITE MATERIALS**

**(Open Elective-IV)**

**Course Objectives:**

* Introduce composite materials and their applications.
* Build proper background for stress analysis in the design of composite structures.
* Familiarize various properties of composite materials.
* Focus on biodegradable composites.

**Course Outcomes:**

* Identify the practical applications of composites. (L3)
* Identify the polymer matrix composites. (L3)
* Classify of bio- degradable composites. (L2)
* Outline the various types of ceramic matrix materials. (L2)

**UNIT I Introduction to composites**

Fundamentals of composites – Definition – classification– based on Matrix – based on structure – Advantages and applications of composites - Reinforcement – whiskers – glass fiber – carbon fiber - Aramid fiber – ceramic fiber – Properties and applications.

**UNIT II Polymer matrix composites**

Polymers - Polymer matrix materials – PMC processes - hand layup processes – spray up processes – resin transfer moulding – Pultrusion – Filament winding – Auto clave based methods - Injection moulding – sheet moulding compound – properties and applications of PMCs.

**UNIT III Metal matrix composites**

Metals - types of metal matrix composites – Metallic Matrices. Processing of MMC – Liquid state processes – solid state processes – In-situ processes. Properties and applications of MMCs.

**UNIT IV Ceramic matrix composites**

Ceramic matrix materials – properties – processing of CMCs –Sintering - Hot pressing – Infiltration – Lanxide process – Insitu chemical reaction techniques – solgel polymer pyrolsis –SHS - Cold isostatic pressing (CIPing) – Hot isostatic pressing (HIPing). Properties and Applications of CCMs.

**UNIT V Advances & Applications of composites**

Advantages of carbon matrix – limitations of carbon matrix carbon fibre – chemical vapour deposition of carbon on carbonfibre perform. Properties and applications of Carbon-carbon composites. Composites for aerospace applications.Bio degradability, introduction of bio composites, classification, processing of bio composites, applications of bio composites - Mechanical, Biomedical, automobile Engineering.

**Textbooks:**

1. Chawla K.K, Composite materials, 2/e, Springer – Verlag, 1998.
2. Mathews F.L. and Rawlings R.D., Chapman and Hall, Composite Materials: Engineering and Science, 1/e, England, 1994.

**Reference Books:**

1. H K Shivanand, B V Babu Kiran, Composite Materials, ASIAN BOOKS, 2011.
2. A.B. Strong , Fundamentals of Composite Manufacturing, SME Publications, 1989.
3. S.C. Sharma, Composite materials, Narosa Publications, 2000.
4. Maureen Mitton, Hand Book of Bio plastics & Bio composites for Engineering applications, John Wiley publications, 2011.

**Online Learning Resources:**

* https://nptel.ac.in/courses/112104229
* https://nptel.ac.in/courses/112104168
* https://nptel.ac.in/courses/101104010
* https://nptel.ac.in/courses/105108124
* <https://nptel.ac.in/courses/112104221>

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**B.Tech IV-I Sem L T P C**

 **3 0 0 3**

**(20A04705) MICROCONTROLLERS & APPLICATIONS**

**(Open Elective Course –IV)**

**Course Objectives:**

* Describe the Architecture of 8051 Microcontroller and Interfacing of 8051 to external memory.
* Write 8051 Assembly level programs using 8051 instruction set.
* Describe the Interrupt system, operation of Timers/Counters and Serial port of 8051.
* Interface simple switches, simple LEDs, ADC 0804, LCD and Stepper Motor to 8051.

**Course Outcomes:**

* Understand the importance of Microcontroller and Acquire the knowledge of Architecture of 8051 Microcontroller.
* Apply and Interface simple switches, simple LEDs, ADC 0804, LCD and Stepper Motor to using 8051 I/O ports.
* Develop the 8051 Assembly level programs using 8051 Instruction set
* Design the Interrupt system, operation of Timers/Counters and Serial port of 8051

**UNIT 1** 8051 Microcontroller:

Microprocessor Vs Microcontroller, Embedded Systems, Embedded Microcontrollers, 8051 Architecture- Registers, Pin diagram, I/O ports functions, Internal Memory organization. External Memory (ROM & RAM) interfacing.

**UNIT II**

Addressing Modes, Data Transfer instructions, Arithmetic instructions, Logical instructions, Branch instructions, Bit manipulation instructions. Simple Assembly language program examples to use these instructions.

**UNIT III**

8051 Stack, Stack and Subroutine instructions. Simple Assembly language program examples to use subroutine instructions.8051 Timers and Counters – Operation and Assembly language programming to generate a pulse using Mode-1 and a square wave using Mode- 2 on a port pin.

**UNIT IV**

8051 Serial Communication- Basics of Serial Data Communication, RS- 232 standard, 9 pin RS232 signals, Simple Serial Port programming in Assembly and C to transmit a message and to receive data serially.8051 Interrupts. 8051 Assembly language programming to generate an external interrupt using a switch.

**UNIT V**

8051 C programming to generate a square waveform on a port pin using a Timer interrupt. Interfacing 8051 to ADC-0804, DAC, LCD and Interfacing with relays and opto isolators, Stepper Motor Interfacing, DC motor interfacing, PWM generation using 8051.

**Textbooks:**

1. Muhammad Ali Mazidi and Janice Gillespie Mazidi and Rollin D. McKinlay; “The 8051 Microcontroller and Embedded Systems – using assembly and C”, PHI, 2006 / Pearson, 2006.
2. Kenneth J. Ayala, “The 8051 Microcontroller”, 3rd Edition, Thomson/Cengage Learning.

**References:**

1. Manish K Patel, “The 8051 Microcontroller Based Embedded Systems”, McGraw Hill, 2014, ISBN: 978-93-329-0125-4.
2. Raj Kamal, “Microcontrollers: Architecture, Programming, Interfacing and System Design”, Pearson Education, 2005.

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**B.Tech IV-I Sem L T P C**

 **3 0 0 3**

**(20A27705) WASTE AND EFFLUENT MANAGEMENT**

**(OPEN ELECTIVE-IV)**

**Course Objectives:**

* To understand the wastewater treatment process.
* To gain knowledge on waste disposal in various ways.
* To know about advances in wastewater treatment.

**Course Outcomes:**

* Acquires knowledge on technologies used for chemical and biological methods of waste water and effluent treatment

**UNIT I**

Wastewater Treatment an Overview: Terminology – Regulations – Health and Environment Concerns in waste water management – Constituents in waste water inorganic – Organic and metallic constituents. Process Analysis and Selection: Components of waste water flows – Analysis of Data – Reactors used in waste water treatment – Mass Balance Analysis – Modeling of ideal and non ideal flow in Reactors – Process Selection

**UNIT II**

Waste disposal methods – Physical, Chemical & Biological; Economical aspects of waste treatment and disposal. Treatment methods of solid wastes: Biological composting, drying and incineration; Design of Solid Waste Management System: Landfill Digester, Vermicomposting Pit.

**UNIT III**

Introduction: Classification and characterization of food industrial wastes from Fruit and Vegetable processing industry, Beverage industry; Fish, Meat & Poultry industry, Sugar industry and Dairy industry.

Chemical Unit Processes: Role of unit processes in waste water treatment chemical coagulation – Chemical precipitation for improved plant performance chemical oxidation – Neutralization – Chemical Storage

**UNIT IV**

Biological Treatment: Overview of biological Treatment – Microbial metabolism – Bacterial growth and energetics – Aerobic biological oxidation – Anaerobic fermentation and oxidation – Trickling filters – Rotating biological contractors – Combined aerobic processes – Activated sludge film packing.

**UNIT V**

Advanced Wastewater Treatment: Technologies used in advanced treatment – Classification of technologies. Removal of Colloids and suspended particles – Depth Filtration – Surface Filtration – Membrane Filtration- Absorption – Ion Exchange – Advanced oxidation process.

**Textbooks:**

1. Herzka A & Booth RG; “Food Industry Wastes: Disposal and Recovery”; Applied Science Pub Ltd. 1981,
2. Fair GM, Geyer JC & Okun DA; “Water & Wastewater Engineering”; John Wiley & Sons, Inc. 1986,

**References:**

1. GE; “Symposium: Processing Agricultural & Municipal Wastes”; AVI. 1973,
2. Inglett Green JH & Kramer A; “Food Processing Waste Management”; AVI. 1979,
3. Rittmann BE & McCarty PL; “Environmental Biotechnology: Principles and Applications”; Mc-Grow-Hill International editions2001,.
4. Bhattacharyya B C & Banerjee R; “Environmental Biotechnology”; Oxford University Press.
5. Bartlett RE; “ Wastewater Treatment; Applied Science” Pub Ltd.
6. G. Tchobanoglous, FI Biston, “Waste water Engineering Treatment and Reuse”: Mc Graw Hill, 2002.
7. “Industrial Waste Water Management Treatment and Disposal by Waste Water” 3rd Edition Mc Graw Hill 2008

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**B.Tech IV-I Sem L T P C**

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| **(20A54703) NUMBER THEORY AND ITS APPLICATIONS****(OPEN ELECTIVE-IV)** |
| **Course Objectives:** |
| This course enables the students to learn the concepts of number theory and its applications to information security. |
| **Course Outcomes:** |
| * Understand number theory and its properties.
* Understand principles on congruences
* Develop the knowledge to apply various applications
* Develop various encryption methods and its applications.
 |
| **UNIT I Integers, Greatest common divisors and prime Factorization** |
| The well-ordering property-Divisibility-Representation of integers-Computer operations with integers-Prime numbers-Greatest common divisors-The Euclidean algorithm -The fundamental theorem of arithmetic-Factorization of integers and the Fermat numbers-Linear Diophantine equations |
| **UNIT II Congruences** |
| Introduction to congruences -Linear congruences-The Chinese remainder theorem-Systems of linear congruences |
| **UNIT III Applications of Congruences** |
| Divisibility tests-The perpetual calendar-Round-robin tournaments-Computer file storage and hashing functions. Wilson's theorem and Fermat's little theorem- Pseudo primes- Euler's theorem- Euler's p hi-function- The sum and number of divisors- Perfect numbers and Mersenne primes. |
| **UNIT IV Finite fields & Primality, factoring** |
| Finite fields- quadratic residues and reciprocity-Pseudo primes-rho method-fermat factorization and factor bases. |
| **UNIT V Cryptology** |
| Basic terminology-complexity theorem-Character ciphers-Block ciphers-Exponentiation ciphers- Public-key cryptography-Discrete logarithm-Knapsack ciphers- RSA algorithm-Some applications to computer science. |
| **Textbooks:** |
| 1. Elementary number theory and its applications, Kenneth H Rosen, AT & T Information systems & Bell laboratories.
2. A course in Number theory & Cryptography, Neal Koblitz, Springer.
 |
| **Reference Books:** |
| 1. An Introduction To The Theory Of Numbers, [Herbert S. Zuckerman](https://www.amazon.in/Herbert-S-Zuckerman/e/B00288HHJ4/ref%3Ddp_byline_cont_book_1), [Hugh L. Montgomery](https://www.amazon.in/s/ref%3Ddp_byline_sr_book_2?ie=UTF8&field-author=Hugh+L.+Montgomery&search-alias=stripbooks), [Ivan Niven](https://www.amazon.in/s/ref%3Ddp_byline_sr_book_3?ie=UTF8&field-author=Ivan+Niven&search-alias=stripbooks), wiley publishers
2. Introduction to Analytic number theory-Tom M Apostol, springer
3. Elementary number theory, VK Krishnan, Universities press
 |
| Online Learning Resources: |
| <https://www.slideshare.net/ItishreeDash3/a-study-on-number-theory-and-its-applications> |

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**B.Tech IV-I Sem L T P C**

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**(20A56703) SMART MATERIALS AND DEVICES**

**(OPEN ELECTIVE-IV)**

**Course Objectives**:

* To provide exposure to smart materials and their engineering applications.
* To impart knowledge on the basics and phenomenon behind the working of smart materials
* To enlighten the properties exhibited by smart materials
* To educate various techniques used to synthesize and characterize smart materials
* To identify the required smart material for distinct applications/devices

**Course Outcomes:**

* to recognize the need of smart materials
* to understand the working principles of smart materials
* to know different techniques used to synthesize and characterize smart materials
* to exploit the properties of smart materials
* to make use of smart materials for different applications

**UNIT I**

**Introduction**: Historical account of the discovery and development of smart materials, Two phases: Austenite and Martensite, Temperature induced phase changes, Shape memory effect, Pseudoelasticity, One-way shape memory effect, Two-way shape memory effect.

**UNIT II: Properties of Smart Materials**: Physical principles of optical, Electrical, Dielectric, Piezoelectric, Ferroelectric, Pyroelectric and Magnetic properties of smart materials

**UNIT III: Synthesis of smart materials**: Solid state reaction technique, Chemical route: Chemical vapour deposition, Sol-gel technique, Hydrothermal method, Co-precipitaiton. Green synthesis, Mechanical alloying and Thin film deposition techniques: Chemical etching, Sol-gel, spray pyrolysis.

**UNIT IV: Characterization techniques**: X-ray diffraction, Raman spectroscopy (RS), Fourier-transform infrared reflection (FTIR), UV-Visible spectroscopy, Scanning electron microscopy (SEM), Transmission electron microscopy, Atomic force microscopy (AFM) and Differential Scanning Calorimetry (DSC).

**UNIT V: Materials and Devices:** Characteristics of shape memory alloys, Magnetostrictive, Optoelectronic, Piezoelectric, Metamaterials, Electro-rheological and Magneto-rheological materials and Composite materials.

Devices based on smart materials: Sensors & Actuators, MEMS and intelligent devices, Future scope of the smart materials.

 **Textbooks:**

1. Encyclopaedia of Smart Materials- Mel Schwartz, John Wiley & Sons, Inc.2002
2. Smart Materials and Structures - M. V. Gandhi and B.S. Thompson, Champman and Hall, 1992

**References:**

1. Smart Materials and Technologies- M. Addington and D. L. Schodek, , Elsevier, 2005.
2. Characterization and Application of smart Materials -R. Rai, Synthesis, , Nova Science, 2011.
3. Electroceramics: Materials, Properties, Applications -A.J. Moulson and J.M. Herbert, 2ndEdn., John Wiley & Sons, 2003.
4. Piezoelectric Sensorics: Force, Strain, Pressure, Acceleration and Acoustic 1. Emission Sensors, Materials and Amplifiers, G. Gautschi, Springer, 2002.
5. Optical Metamaterials: Fundamentals and Applications -W. Cai and V. Shalaev, springer,2010.
6. Smart Materials and Structures - P. L Reece, New Research, Nova Science, 2007

**NPTEL courses links**

<https://nptel.ac.in/courses/112/104/112104173/>

<https://nptel.ac.in/courses/112/104/112104251/>

https://nptel.ac.in/content/storage2/courses/112104173/Mod\_1\_smart\_mat\_lec

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**B.Tech IV-I Sem L T P C**

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**(20A51703) GREEN CHEMISTRY AND CATALYSIS FOR SUSTAINABLE ENVIRONMENT (OPEN ELECTIVE-IV)**

**Course Objectives:**

* Learn an interdisciplinary approach to the scientific and societal issues arising from industrial chemical production, including the facets of chemistry and environmental health sciences that can be integrated to promote green chemistry and the redesign of chemicals, industrial processes and products.
* Understand the use of alternatives assessments that combine chemical, environmental health, regulatory, and business considerations to develop safer products.

**Course Outcomes:**

* Recognize and acquire green chemistry concepts and apply these ideas to develop respect for the inter connectedness of our world and an ethic of environmental care and sustainability.

**UNIT I: PRINCIPLES AND CONCEPTS OF GREEN CHEMISTRY**

Introduction, Green chemistry Principles, sustainable development and green chemistry, atom economy, atom economic: Rearrangement and addition reactions and un-economic reactions: Substitution, elimination and Wittig reactions, Reducing Toxicity. Waste - problems and Prevention: Design for degradation, Polymer recycling.

**UNIT II: CATALYSIS AND GREEN CHEMISTRY**

Introduction to catalysis, Heterogeneous catalysts: Basics of Heterogeneous Catalysis, Zeolites and the Bulk Chemical Industry, Heterogeneous Catalysis in the Fine Chemical and Pharmaceutical Industries, Catalytic Converters, Homogeneous catalysis: Transition Metal Catalysts with Phosphine Ligands, Greener Lewis Acids, Asymmetric Catalysis, Heterogenising the Homogenous catalysts, Phase transfer catalysis: Hazard Reduction, C–C Bond Formation, Oxidation Using Hydrogen Peroxide, Bio-catalysis and photo-catalysis with examples.

**UNIT III: ORGANIC SOLVENTS: ENVIRONMENTALLY BENIGN SOLUTIONS**

Organic solvents and volatile organic compounds, solvent free systems, supercritical fluids: Super critical carbondioxide, super critical water and water as a reaction solvent: water-based coatings, Ionic liquids as catalyst and solvent

**UNIT IV: EMERGING GREENER TECHNOLOGIES AND ALTERNATIVE ENERGY SOURCES**

Biomass as renewable resource, Energy: Fossil Fuels, Energy from Biomass, Solar Power, Other Forms of Renewable Energy, Fuel Cells, Chemicals from Renewable feedstocks: Chemicals from Renewable Feedstocks: Chemicals from Fatty Acids, Polymers from Renewable Resources, Some Other Chemicals from Natural Resources, Alternative Economies: The Syngas Economy, The Biorefinery, Design for energy efficiency: Photochemical Reactions: Advantages of and Challenges Faced by Photochemical Processes, Examples of Photochemical Reactions, Chemistry Using Microwaves: Microwave Heating, Microwave-assisted Reactions, Sonochemistry: Sonochemistry and Green Chemistry, Electrochemical Synthesis: Examples of Electrochemical Synthesis. Industrial applications of alternative environmentally benign catalytic systems for carrying out the important reactions such as selective oxidation, reduction and C-C bond formations (specific reactions).

**UNIT V: GREEN PROCESSES FOR GREEN NANOSCIENCE**

Introduction and traditional methods in the nanomaterials synthesis, Translating green chemistry principles for practicing Green Nanoscience. Green Synthesis of Nanophase Inorganic Materials and Metal Oxide Nanoparticles: Hydrothermal Synthesis, Reflux Synthesis, Microwave-Assisted Synthesis, Other methods for Green synthesis of metal and metal oxide nanoparticles, Green chemistry applications of Inorganic nanomaterials

**Textbooks:**

1. M. Lancaster, Green Chemistry an introductory text, Royal Society of Chemistry, 2002.
2. Paul T. Anastas and John C. Warner, Green Chemistry Theory and Practice, 4th Edition, Oxford

University Press, USA

**References:**

# Green Chemistry for Environmental Sustainability, First Edition, Sanjay K. Sharma and AckmezMudhoo, CRC Press, 2010.

# Edited by AlvisePerosa and Maurizio Selva , Hand Book of Green chemistry Volume 8:Green Nanoscience, wiley-VCH, 2013.

**HONOURS**

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**B.TechCSE(DS) L T P C**

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|  | **(20A32H01) DATA SCIENCE FOR BUSINESS** |  |  |  |  |
|  |  |  |  |  |
| **Pre-requisite**  | **Data Science** |  |  |
| **Course Objectives:** |
| * Expose with the basic rudiments of business intelligence system
* Expose with different data analysis tools and techniques
 |
| **Course Outcomes:** |
| At the end of the course the students will be able to* Understand the fundamentals of business intelligence.
* Applying link to data mining with business intelligence.
* Apply various modelling techniques.
* Understand the data analysis and knowledge delivery stages.
* Apply business intelligence methods to various situations and decide on appropriate

technique. |
| **UNIT I** |  | Lecture 8 Hrs |
| Introduction – Business problems and Data Science Solutions, Introduction to Predictive modeling: From Correlation to Supervised Segmentation |
| **UNIT II** |  | Lecture 8 Hrs |
| Fitting the Data- Fitting a Model to Data, Overfitting and its Avoidance |
| **UNIT III** |  | Lecture 9Hrs |
| Similarity, Neighbors, and Clusters, Decision Analytic Thinking: What is a Good model |
| **UNIT IV** |  | Lecture 8 Hrs |
| Representing and Mining text, Decision Analytic Thinking II: Toward Analytic Engineering |
| **UNIT V** |  | Lecture 9 Hrs |
| Other Data Science Tasks and Techniques, Data Science and Business Strategy |
| **Textbooks:** |
| 1. Foster Provost and Tom Fawcett, Data Science for Business, O’Reilly, 2013. |
| **Reference Books:** |
| 1. Efraim Turban, Ramesh Sharda, DursunDelen, “Decision Support and Business Intelligence Systems”, 9 th Edition, Pearson 2013.
2. Larissa T. Moss, S. Atre, “Business Intelligence Roadmap: The Complete ProjectLifecycle of Decision Making”, Addison Wesley, 2003.
3. Carlo Vercellis, “Business Intelligence: Data Mining and Optimization for DecisionMaking”, Wiley Publications, 2009.
4. David Loshin Morgan, Kaufman, “Business Intelligence: The Savvy Manager’sGuide”, Second Edition, 2012.
 |
| **Online Learning Resources:** |
| 1. Edx: IBM Data Warehousing and BI Analytics
 |

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**B.TechCSE(DS) L T P C**

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| **(20A32H02) SOFTWARE PROJECT MANAGEMENT USING AGILE** |
| **Pre-requisite**  | **Software Engineering Fundamentals** |  |  |
|  |
| **Course Objectives:** |
| * Teach how to manage a Project
* Discuss Agile method of handling projects
 |
| **Course Outcomes:** |
| After completion of the course, students will be able to* Apply Agile methodology for software development
* Critically analyze quality of software
* Estimate the software cost
 |
| **UNIT I** | Introduction, The Agile Business Case | Lecture 8Hrs |
| History, Background, and the Manifesto, Traditional Lifecycle, Agile Lifecycle, Scaling for Enterprise Agile, Four Agile MethodologiesThe Agile Business Case: The Business Case, Business Value Models, Project Balance Sheet, Building the Business Case by Levels |
| **UNIT II** | Quality in the Agile Space | Lecture 9Hrs |
| Quality Values and Principles, Thought Leaders and Agile Quality, Sampling for Quality Validation, Agile in the Waterfall: First Principles and Requisite Conditions, The Black Box, Interfaces, and Connectivity, Governing |
| **UNIT III** | Scope and Requirements | Lecture 9Hrs |
| Developing the Scope and Requirements: Agile Scope, Envisioning, Requirements, Planning at a DistancePlanning and Scheduling: Planning in the Enterprise Context, Scheduling, Other Plans in the Enterprise Agile Project |
| **UNIT IV** | Estimating Cost and Schedule | Lecture 8Hrs |
| The Nature of Estimates, Drivers on Cost and Schedule, Building EstimatesTeams Are Everything: The Social Unit, Principle and Values Guide Teams, Teams Are Building Blocks, Some Teams Work; Others Do Not, Matrix Management in the Agile Space |
| **UNIT V** | Governance, Managing Value | Lecture 8Hrs |
| Governance Is Built on Quality Principles, Governance Verifies ComplianceManaging Value: Defining and Accounting for Value, Burn-down Charts and Value Scorecards |
| **Textbooks:** |
| 1. John C. Goodpasture, PMP, “Project Management the Agile Way”, Second Edition, J. Ross Publishing 2016. |
| **Reference Books:** |
| 1. Kalpesh Ashar, Agile Essentials you always wanted to know, Vibrant publishers, 20202. Jutta Eckstein, Agile Software development in the large: Diving into the Deep, Jutta Eckstein Publisher, 2022 |
| **Online Learning Resources:** |
| 1. Coursera: Agile Project Management offered by Google2. Coursera: Alex Cowan, Agile Development Specialization  |

**JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY ANANTAPUR**

**B.TechCSE(DS) L T P C**

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|  | **(20A30H03) ETHICS AND PRIVACY IN AI** |  |  |  |  |
| **Pre-requisite**  | **Artificial Intelligence** |  |  |
| **Course Objectives:** |
| The course is designed to* To understand the need for ensuring ethics in AI
* To understand ethical issues with the development of AI agents
* To apply the ethical considerations in different AI applications
* To evaluate the relation of ethics with nature
* To overcome the risk for Human rights and other fundamental values
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| **Course Outcomes:** |
| After completion of the course, students will be able to* Understand the ethical issues in the development of AI agents
* Learn the ethical considerations of AI with perspectives on ethical values
* Apply the ethical policies in AI based applications and Robot development
* To implement the AI concepts to societal problems by adapting the legal concepts by securing fundamental rights.
* This study will help to overcome the evil genesis in the concepts of AI.
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| **UNIT IIntroduction, WhatDoWeNeedtoUnderstandAboutEthics?** | Lecture 8 Hrs |
| Introduction:ArtificialIntelligenceandEthics, WhyEthicsinAI?WhyNow? CurrentInitiativesinAIandEthics, CodesofEthicsinContext:OtherApproachestoEthical QuestionsinAIWhatDoWeNeedtoUnderstandAboutEthics?: APreliminaryPlea:EthicsIsNotAbout‘Banning’Things, NormativeEthicalTheories, EthicsandEmpiricalEvidence, SoWhyDoWeEvenNeedEthics?, So,WithWhatSortofIssuesIsEthicsConcerned?, Who(orWhat)IsTheProperObjectofMoralConcerns,and HowWidelyShouldOurConcernsExtend?, FourDomainsofEthics:Self,Friend,Stranger,World, WhatCountsasAdequateJustificationandArgumentinEthics?, MoralRelativism,MoralJustificationandAI, ADistributedMorality?, MoralAgents, Moral Motivation, AI, Codes of Ethics and the Law |
| **UNIT IIDoesAIRaiseAnyDistinctiveEthicalQuestions? CodesofProfessionalEthics**Lecture 10 Hrs |
| DoesAIRaiseAnyDistinctiveEthicalQuestions? Methodology: Focusing in on Ethical Questions, ManyEthicalIssuesinAIAreSharedwithOtherRapidly DevelopingTechnology, Ethical Questions Arise from AI’s Typical Use to Enhance, Supplement, or Replace the Work of Humans, We Also Need to Consider the Methods of Production of AI, Hype in AI and Implications for Methodology in EthicsCodesofProfessionalEthics:Introduction: The Varieties of Ethical Codes, ProfessionalCodesofEthicsTendtoHaveCertain Commonalities, Codes of Ethics and Institutional Backing, The Context of Codes of Ethics, Can Codes of Ethics Make the Situation Worse? Yes |
| **UNIT IIIHow AI Challenges Professional Ethics, Developing Codes of Ethics Amidst Fast Technological Change** | Lecture 8 Hrs |
| HowAIChallengesProfessionalEthics: AIProfessionalOrganisationsandCompanies,andtheNature ofItsDevelopmentandProduction, Gradients of Professional Power and Vulnerability in AI, AThirdLayerofComplexityinCodesofProfessionalEthics forAI:TheBehaviourofMachines, The Authority of Any Resulting Codes.DevelopingCodesofEthicsAmidstFastTechnological Change: Social, Cultural and Technological Change and Ethics, Social,Cultural,EconomicandTechnologicalChange: TheExampleofAIandEmployment, RegulatingforWhom?TheGlobalReachofAI,Universalism, andRelativism, Diversity in Participation as Part of the Solution. |
| **UNIT IVSomeCharacteristicPitfallsinConsideringtheEthicsofAI,and WhattoDoAboutThem, SomeSuggestionsforHowtoProceed** | Lecture 9 Hrs |
| SomeCharacteristicPitfallsinConsideringtheEthicsofAI,andWhattoDoAboutThem:TheIdealisation of Human and of Machine Agency,Building Ethics into AI and the Idealisation of Moral Agency,Replacing and Enhancing Human Agency, Boundaries and AI,Addressing the Increased Gradient of Vulnerability, CommonLanguage,MiscommunicationandtheSearchfor Clarity.SomeSuggestionsforHowtoProceed:Organisations and Codes,Procedures for Drawing Up and Implementing Codes,The Content of Codes, ThinkingAboutEthicalIssuesinDevelopingandImplementing CodesofEthics, Asilomar AI Principles |
| **UNIT VAn Introduction to Privacy Aspects of Information and Communication Technologies,Data Mining in Large Databases**  | Lecture 8 Hrs |
| Introduction, Privacy and the Internet, Privacy in Databases, Privacy in Ubiquitous Computing.Data Mining in Large Databases — Strategies for Managing the Trade-Off Between Societal Benefit and Individual Privacy: Introduction, Examples of data-collecting institutions and data users, Strategies for controlling privacy, Measures of the utility of published data sets and outputs. |
| **Textbooks:** |
| Paula Boddington,” Towards a Code of Ethics for Artificial Intelligence”, Springer.AgustiSolanas& Antoni Martínez-Ballesté “Advances in Artificial Intelligence for Privacy Protection and Security” World Scientific  |
| **Reference Books:** |
| 1. “Oxford Handbook of Ethics of AI”, Markus D. Dubber frank pasqualesunit Das, oxford university press. |
| **Online Learning Resources:** |
| 1. Coursera: Ethics of Artificial Intelligence
2. Coursera: Artificial Intelligence Privacy and Convenience
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| **(20A30H04) MEDICAL IMAGE DATA PROCESSING** |
| **Pre-requisite**  | **Computer Graphics Fundamentals** |  |  |
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| **Course Objectives:*** Understand the significance of image process in medical industry
* Teach the process of extracting correct information in medical images
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| **Course Outcomes:**The course is designed to* Analyze medical images
* Apply image processing techniques to medical images
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| **UNIT I** | Basics of Medical Image Sources | Lecture 8 Hrs |
| Radiology, The Electromagnetic Spectrum, Basic X-Ray Physics, Attenuation and Imaging, Computed Tomography, Magnetic Resonance Tomography, Ultrasound, Nuclear Medicine and Molecular Imaging, Other Imaging Techniques, Radiation Protection and DosimetryImage Processing in Clinical Practice: Application Examples, Image Databases, Intensity Operations, Filter Operations, Segmentation, Spatial Transforms, Rendering and Surface Models, Registration, CT Reconstruction |
| **UNIT II** | Image Representation | Lecture 10 Hrs |
| Pixels and Voxels, Gray Scale and Color Representation, Image File Formats, Dicom, Other Formats – Analyze 7.5, NIFTI And Interfile, Image Quality and The Signal-To-Noise Ratio, Practical LessonsOperations in Intensity Space: The Intensity Transform Function and TheDynamic Range, Windowing, Histograms and Histogram Operations, Dithering and Depth, Practical Lessons |
| **UNIT III** | Filtering and Transformations, Segmentation | Lecture 8 Hrs |
| The Filtering Operation, The Fourier Transform, Other Transforms, Practical LessonsSegmentation: The Segmentation Problem, ROI Definition and Centroids, Thresholding, Region Growing, More Sophisticated Segmentation Methods, Morphological Operations, Evaluation of Segmentation Results |
| **UNIT IV** | Spatial Transforms | Lecture 9 Hrs |
| Discretization – Resolution and Artifacts, Interpolation and Volume Regularization, Translation and Rotation, Reformatting, Tracking and Image-Guided TherapyRendering and Surface Models: Visualization, Orthogonal and Perspective Projection, and The Viewpoint, Raycasting, Surface–Based Rendering |
| **UNIT V** | Registration, CT Reconstruction | Lecture 8 Hrs |
| Fusing Information, Registration Paradigms, Merit Functions, Optimization Strategies, Some General Comments, Camera Calibration, Registration to Physical Space, Evaluation of Registration ResultsCT Reconstruction: Introduction, Radon Transform, Algebraic Reconstruction, Some Remarks on Fourier Transform and Filtering, Filtered Back projection |
| **Textbooks:** |
| 1. Wolfgang Birkfellner, “Applied Medical Image Processing”, Second Edition, CRC Press.**Reference Books:**1. Sinha G.R., Medical Image Processing Concepts and Application, PHI, 2014
2. Geoff Dougherty, Digital Image Processing for Medical Applications, Cambridge university press, 2010

**Online Learning Resources:** Coursera: Pranav Rajpurkar, AI for Medical Diagnosis |