CHAITANYA BHARATHI INSTITUTE OF TECHNOLOGY (A)
Kokapet ( Village), Gandipet, Hyderabad, Telangana-500075. www.cbit.ac.in
ISO Certified 9001:2015
COMMITTED TO RESEARCH, INNOVATION AND EDUCATION 43 years

# Scheme of Instruction and Syllabi

**of**

**VII - VIII SEMESTERS**

**of**

**FOUR YEAR DEGREE COURSE**

**in**

**B.E. - COMPUTER SCIENCE AND ENGINEERING**
**(IOT & CYBER SECURITY INCLUDING BLOCKCHAIN TECHNOLOGY)**
(AICTE Model Curriculum with effect from AY 2023-24)

**R-20 Regulation**

**CHAITANYA BHARATHI INSTITUTE OF TECHNOLOGY**
**(An Autonomous Institution)**
**Affiliated to Osmania University**
**Kokapet Village, Gandipet Mandal, Hyderabad – 500075. Telangana**
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# CHAITANYA BHARATHI INSTITUTE OF TECHNOLOGY(A)

## SCHEME OF INSTRUCTION AND EXAMINATION

## Model Curriculum(R-20) 2023-24

## B.E. (CSE - IOT & Cyber Security including Blockchain Technology)

**SEMESTER –VII**

| S. No | Course Code | Title of the Course | Scheme of Instruction | | | Scheme of Examination | | | Credits |
|---|---|---|---|---|---|---|---|---|---|
| | | | Hours per Week | | | Duration of SEE in Hours | Maximum Marks | | |
| | | | L | T | P/D | | CIE | SEE | |
| **THEORY** | | | | | | | | | |
| 1 | 20CSC30 | Cryptography and Network Security | 3 | - | - | 3 | 40 | 60 | 3 |
| 2 | | Professional Elective-III | 3 | - | - | 3 | 40 | 60 | 3 |
| 3 | | Professional Elective-IV | 3 | - | - | 3 | 40 | 60 | 3 |
| 4 | | Open Elective-III | 3 | - | - | 3 | 40 | 60 | 3 |
| 5 | 20EGM01 | Indian Constitution and Fundamental Principles | 2 | - | - | 2 | - | 50 | No Credit |
| 6 | 20EGM02 | Indian Traditional Knowledge | 2 | - | - | 2 | - | 50 | No Credit |
| **PRACTICAL** | | | | | | | | | |
| 7 | 20CSC31 | Cryptography and Network Security Lab | - | - | 2 | 3 | 50 | 50 | 1 |
| 8 | | Professional Elective-IV Lab | - | - | 2 | 3 | 50 | 50 | 1 |
| 9 | 20CIC10 | Technical Seminar | - | - | 2 | - | 50 | - | 1 |
| 10 | 20CIC11 | Project Part - 1 | - | - | 4 | - | 50 | - | 2 |
| 11 | 20CII03 | Internship-III | 5-6 weeks / 135 hours | | | - | 50 | - | 3 |
| **TOTAL** | | | **16** | **-** | **10** | - | **410** | **440** | **20** |

L: Lecture T: Tutorial D: Drawing P: Practical

CIE - Continuous Internal Evaluation SEE - Semester End Examination

| PROFESSIONAL ELECTIVE-III | |
|---|---|
| 20CIE08 | IoT Automation and Security |
| 20CIE09 | Social Engineering |
| 20CIE10 | Crypto Currencies |
| 20CSE11 | Natural Language Processing |
| 20CSE22 | Big Data Analytics |

| PROFESSIONAL ELECTIVE-IV | |
|---|---|
| 20CIE11 | Malware Analysis |
| 20CIE12 | Building Secure and Reliable Systems |
| 20CSE08 | Enterprise Application Development |
| 20CSE21 | Deep Learning |
| 20CSE34 | Cloud Computing |

| OPEN ELECTIVE-III | |
|---|---|
| 20PYO01 | History of Science and Technology |
| 20MEO03 | Research Methodologies |
| 20MEO04 | Entrepreneurship |
| 20ECO05 | Systems Automation and Control |
| 20EEO03 | Energy Auditing |

| PROFESSIONAL ELECTIVE-IV Lab | |
|---|---|
| 20CIE13 | Malware Analysis Lab |
| 20CIE14 | Building Secure and Reliable Systems Lab |
| 20CSE17 | Enterprise Application Development Lab |
| 20CSE30 | Deep Learning Lab |
| 20CSE38 | Cloud Computing Lab |

**20CSC30**

## CRYPTOGRAPHY AND NETWORK SECURITY

| | |
|---|---|
| Instruction | 3 Hours per week |
| Duration of End Examination | 3 Hours |
| Semester End Examination | 60 Marks |
| Continuous Internal Evaluation | 40 Marks |
| Credits | 3 |

**Pre-requisites:** Data Communication and computer networks.

**Course Objectives:** The objectives of this course are,

1. To understand the importance of confidentiality, integrity, availability and authentication.
2. To understand various cryptographic algorithms.
3. To understand categories of threats to computer networks.
4. To describe public-key cryptosystem, key generation and distribution.
5. To understand implementation of Firewalls and web security.

**Course Outcomes:** On Successful completion of this course, student will be able to,

1. Analyze and design classical encryption techniques and block ciphers.
2. Analyze and design hash and MAC algorithms, and digital signatures.
3. Design network application security schemes like PGP, S/MIME, IPSec, SSL, TLS, HTTPS, SSH, etc.
4. Evaluate the authentication and hash algorithms.
5. Create and configure simple firewall architectures.
6. Understand digital sign in emails and files.

**UNIT - I**

**Security Concepts**: Introduction, The need for security, Security approaches, Principles of security, Types of Security attacks, Security services, Security Mechanisms, A model for Network Security.

**Cryptography Concepts and Techniques**: Introduction, plain text and cipher text, substitution techniques, transposition techniques, encryption and decryption, symmetric and asymmetric key cryptography, steganography, key range and key size, possible types of attacks.

**UNIT - II**

**Symmetric key Ciphers:** Block Cipher principles, DES, AES, Blowfish, RC5, IDEA, Block cipher operation, Stream ciphers, RC4.

**Asymmetric key Ciphers:** Principles of public key cryptosystems, RSA algorithm, Elgamal Cryptography, Diffie-Hellman Key Exchange, Knapsack Algorithm.

**UNIT - III**

**Cryptographic Hash Functions:** Message Authentication, Secure Hash Algorithm (SHA-512).

**Message authentication codes:** Authentication requirements, HMAC, CMAC, Digital signatures, Elgamal Digital Signature Scheme.

**Key Management and Distribution:** Symmetric Key Distribution Using Symmetric & Asymmetric Encryption, Distribution of Public Keys, Kerberos, X.509 Authentication Service, Public – Key Infrastructure.

**UNIT - IV**

**Transport-level Security:** Web security considerations, Secure Socket Layer and Transport Layer Security, HTTPS, Secure Shell (SSH).

**Wireless Network Security:** Wireless Security, Mobile Device Security, IEEE 802.11 Wireless LAN, IEEE 802.11i Wireless LAN Security.

**UNIT - V**

**E-Mail Security:** Pretty Good Privacy, S/MIME.

**IP Security:** IP Security overview, IP Security architecture, Authentication Header, Encapsulating security payload, combining security associations, Internet Key Exchange.

**Case Studies on Cryptography and security:** Secure Multiparty Calculation, Virtual Elections, Single sign On, Ransomware.

**Text Books:**

1. Cryptography and Network Security - Principles and Practice: William Stallings, Pearson Education, 6th Edition.
2. Cryptography and Network Security: Atul Kahate, Mc Graw Hill, 3rd Edition.

**Suggested Reading:**

1. Cryptography and Network Security: C K Shyamala, N Harini, Dr T R Padmanabhan, Wiley India, 1st Edition.
2. Cryptography and Network Security: Forouzan Mukhopadhyay, Mc Graw Hill, 3rd Edition.
3. Information Security, Principles, and Practice: Mark Stamp, Wiley India.
4. Principles of Computer Security: WM. Arthur Conklin, Greg White, TMH.
5. Introduction to Network Security: Neal Krawetz, CENGAGE Learning.
6. Network Security and Cryptography: Bernard Menezes, CENGAGE Learning.

**Online Resources**

1. https://onlinecourses.nptel.ac.in/noc21_cs16/

**20CIE08**

**IOT AUTOMATION AND SECURITY**
**(Professional Elective – III)**

| | |
|---|---|
| Instruction | 3 Hours per week |
| Duration of End Examination | 3 Hours |
| Semester End Examination | 60 Marks |
| Continuous Internal Evaluation | 40 Marks |
| Credits | 3 |

**Pre-requisites:** IoT development, application and practice.

**Course Objectives:** The objectives of this course are to

1. Explore new evolution in hardware, software, data to connect physical world to the digital world.
2. Learn the security principles and methodologies for Internet of Things.
3. Understand authentication credentials, trust models and cloud security.

**Course Outcomes:** On successful completion of the course, students will be able to

1. Explain the key IIoT concepts and technological developments.
2. Comprehend the value created by collecting, communicating, coordinating, and leveraging the data from connected devices.
3. Analyze the Security requirements in IoT.
4. Illustrate authentication credentials and access control.
5. Describe various types of Trust models.
6. Identify and perform Cloud services for IoT Automation.

**UNIT – I**

**Introduction:** What is IIoT and connected world? the difference between IoT and IIoT, Architecture of IIoT, IOT node, Challenges of IIOT.

**Visualization and Data Types of IIoT**: Enterprise data for IIoT, Emerging descriptive data standards for IIoT, Cloud data base.

**UNIT – II**

**Retrieving Data**: Extraction from Web: Grabbing the content from a web page, Sending data on the web, Types of IoT interaction, Machine to Machine interaction (M2M).

**Control & Supervisory Level of Automation**: Programmable logic controller (PLC), Real-time control system, Supervisory Control & Data Acquisition (SCADA). HMI in an automation process, ERP & MES.

**UNIT – III**

**Securing the Internet of Things:** Security Requirements in IoT Architecture - Security in Enabling Technologies - Security Concerns in IoT Applications. Security Architecture in the Internet of Things - Security Requirements in IoT - Insufficient Authentication/Authorization - Insecure Access Control - Threats to Access Control, Privacy, and Availability - Attacks Specific to IoT. Vulnerabilities – Secrecy and Secret-Key Capacity - Authentication/Authorization for Smart Devices - Transport Encryption – Attack & Fault trees.

**UNIT – IV**

**Identity and access management solutions for IoT:**

Identity lifecycle – authentication credentials – IoT IAM infrastructure – Authorization with Publish / Subscribe schemes – access control.

**Privacy preservation:** Concerns in data dissemination – Lightweight and robust schemes for Privacy protection.

**UNIT – V**

**Trust models and cloud security for IoT:**

Trust and Trust models for IoT – self-organizing Things - Preventing unauthorized access. Cloud services and IoT – offerings related to IoT from cloud service providers – Cloud IoT security controls – An enterprise IoT cloud security architecture.

**Text Books:**

1. Russell, Brian and Drew Van Duren, “Practical Internet of Things Security”, Packt Publishing, 2016.
2. Securing the Internet of Things Elsevier jan 2017.
3. Fei HU, “Security and Privacy in Internet of Things (IoTs): Models, Algorithms, and Implementations”, CRC Press, 2016.
4. Mahmood, Zaigham, The Internet of Things in the Industrial Sector, Springer Publication.
5. Jerker Delsing, IoT Automation, Arrow head framework CRC Press.

**Suggested Reading:**

1. Mohamed Abdel-Basset, Nour Moustafa, Hossam Hawash, Weiping, “Deep Learning Techniques for IoT Security and Privacy:”, Ding Springer, Year: 2021 ISBN: 3030890244,9783030890247.
2. David M. Wheeler, Damilare D. Fagbemi, “The IoT Architect's Guide to Attainable Security and Privacy:”, Auerbach Publications, Year: 2019 ISBN: 081536816X,9780815368168.

**Online Resources:**

1. https://geekflare.com/iot-platform-tools/
2. https://www.iotsecurityfoundation.org/iot-security-resources/

**20CIE09**

**SOCIAL ENGINEERING**
**(Professional Elective – III)**

| | |
|---|---|
| Instruction | 3 Hours per week |
| Duration of End Examination | 3 Hours |
| Semester End Examination | 60 Marks |
| Continuous Internal Evaluation | 40 Marks |
| Credits | 3 |

**Pre requite:** Programming and Problem Solving, Operating System, Computer Networks, Cyber Security.

**Course objectives**

1. Understand social engineering, identify common attacks and provide strategies for overcoming it.
2. Apply behavioral and technical controls in Social Engineering.
3. Identify how to communicate basic security awareness to others.

**Course Outcome:** The Students will be able to

1. Apply up to date social engineering techniques and ethical consideration.
2. Extract Intelligence from publicly available sources to support intelligent needs and to discover vulnerabilities in IT Systems.
3. Explore different types of social engineering attack.
4. Identity the attacks and victims.
5. Acquire knowledge on tactics and strategies on how to protect network against attack.

**UNIT - I**

**Introduction:** Social Engineering, Psychological Concepts in Social Engineering, Ethical Considerations in Social Engineering, Social Engineering Process.

**UNIT - II**

**OSINT**: Open-Source Information Categories, OSINT Types, OSINT Organizations, Parties Interested in OSINT Information, Information Gathering Types, OSINT Process, Benefits of OSINT, Challenges of Open-Source Intelligence, Legal and Ethical Constraints.

**Social Media Intelligence:** Social Media Content Types, Classifications of Social Media Platforms, General Resources, social media Psychological Analysis.

**UNIT - III**

**Types of Social Engineering Attacks:** Phishing, Watering hole attacks, Business email compromise attacks, Physical social engineering, USB baiting, DNS Spoofing and Cache Poisoning Attacks, Scareware Attacks, Worm Attacks, Malware Link Delivery Channels, Peer-to-Peer (P2P) Network Attacks, Shaming Infected Users out of Reporting an Attack.

**UNIT - IV**

**Social Engineering Attacks Detection:** Detection, Measurement, And Reporting, Open-Source Intelligence analysis software and tools.

**UNIT - V**

**Social Engineering Attack Defence:** Proactive Défense Techniques: Awareness Programs, Reputation and OSINT Monitoring, Incident Response. How to Prevent Social Engineering Attacks- Safe Communication and Account Management Habits, Safe Network Use Habits, Safe Device Use Habits.

**Text Books:**

1. Practical Social Engineering A Primer for the Ethical Hacker By: Joe Gray,14th June 2022, ISBN: 9781718500983 No Starch Press.
2. Open-Source Intelligence Methods and Tools: A Practical Guide to Online Intelligence by Nihad A. Hassan, Rami Hijazi, 1 July 2018, ISBN-13 (electronic): 978-1-4842-3213-2 1 Apress.

**Online Resources:**

1. https://www.cisco.com/c/en/us/products/security/what-is-social-engineering.html#~types-of-attacks
2. https://www.kaspersky.co.in/resource-center/definitions/what-is-social-engineering
3. https://www.imperva.com/learn/application-security/social-engineering-attack/
4. https://www.itgovernance.co.uk/social-engineering-attacks
5. https://en.wikipedia.org/wiki/Open-source_intelligence
6. https://www.aura.com/learn/types-of-social-engineering-attacks
7. https://www.safeguardcyber.com/identify-prevent-social-engineering-attacks
8. https://www.horangi.com/horangipedia/what-is-social-engineering

**20CIE10**

**CRYPTO CURRENCIES**
**(Professional Elective – III)**

| | |
|---|---|
| Instruction | 3 Hours per week |
| Duration of End Examination | 3 Hours |
| Semester End Examination | 60 Marks |
| Continuous Internal Evaluation | 40 Marks |
| Credits | 3 |

**Course Objectives:** The objectives of this course are to

1. Understand basics of cryptography and cryptocurrencies.
2. Familiarize with architecture and working of different cryptocurrencies.
3. Learn the security and privacy benefits of different cryptocurrencies.
4. Understand creation and deployment of cryptocurrencies.
5. Compare different cryptocurrencies and identify cryptocurrency attacks and regulations.

**Course Outcomes:** On successful completion of the course, students will be able to

1. Understand the core functionality and utility of Blockchain and Cryptocurrency technologies.
2. Familiarize with working of different cryptocurrencies.
3. Explain the positive and negative implications of cryptocurrencies.
4. Differentiate the modern currencies and its market usage.
5. Understand the Regulations of different cryptocurrencies.

**UNIT – I**

**Introduction:** Blockchain & Distributed Ledger Technology (DLT), Elements of Distributed Computing, Elements of Cryptography: Hashing, Signature schemes, Encryption schemes and Elliptic curve cryptography, Verifiable random functions, Zero-knowledge systems, Cryptocurrency Terminology: Tokens and types, ICOs and Wallets.

**UNIT – II**

**Bitcoin:** History and its Significance, Distributed Consensus-Proof-of-Work, Bitcoin Block, Bitcoin Transactions, Transactions lifecycle, Bitcoin scripts-execution, Applications of Bitcoin scripts, Wallets, Bitcoin Network Architecture, Scalability and Performance improvement techniques: Payment Channels and state channels.

**UNIT – III**

**Ethereum:** Overview of differences between Ethereum and Bitcoin, block format, Mining algorithms: Proof-of-Work(PoW), Proof-of-Stake (PoS) algorithm, account management, contracts and transactions.
**Smart Contracts with Solidity and MetaMask:** Creation and Deployment, Error Handling in Smart Contracts, Building Dapps, ERC20 Standards, Best Practices and Auditing, Smart Contract Case Study.

**UNIT – IV**

**Corporate Currencies and Other cryptocurrencies: Monero:** Overview of differences between Monero and Bitcoin, Cryptonote protocol, Ring signatures, confidential transactions, mining algorithm.
**Zcash:** Overview of differences between Zcash and Bitcoin, zero knowledge proofs, zero knowledge succinct non-interactive arguments of knowledge (zK-SNARKS), Equihash mining algorithm.

**UNIT – V**

**Cryptocurrency attacks:** DAO, Parity, Smart Contract, GHOST, Vulnerabilities, Attacks: Sidechain, NameCoin, **Cryptocurrency Regulation**: Stakeholders, Roots of Bitcoin, Legal Aspects - Cryptocurrency Exchange, Black Market and Global Economy.

**Text Books:**

1. Arvind Narayanan, Joseph Bonneau, Edward Felten, Andrew Miller, and Steven Goldfeder, "Bitcoin and Cryptocurrency Technologies: A Comprehensive Introduction", Princeton University Press, 2016.
2. Summers, "Understanding Blockchain and Cryptocurrencies: A Primer for Implementing and Developing Blockchain Projects", CRC Press, 2022.

**Suggested Reading:**

1. Antonopoulos, Andreas M., Mastering Bitcoin: Programming the Open Blockchain. O'Reilly Media, Inc., 2017.
2. Antonopoulos, Andreas M. and Wood, Gavin. Mastering Ethereum. O'Reilly Media, Inc., 2018.
3. David Gerard, Attack of the 50 Foot Blockchain, 2017.
4. Baxter Hines, Digital Finance- Security Tokens and Unlocking the Real Potential of Blockchain, Wiley Publication, 2020.

**Online Resources:**

1. https://www.ethdocs.org/en/latest/
2. https://www.getmonero.org/resources/research-lab/
3. https://z.cash/

**20CSE11**

## NATURAL LANGUAGE PROCESSING
**(Professional Elective-III)**

| | |
|---|---|
| Instruction | 3 Hours per week |
| Duration of End Examination | 3 Hours |
| Semester End Examination | 60 Marks |
| Continuous Internal Evaluation | 40 Marks |
| Credits | 3 |

**Pre-requisites:** Artificial Intelligence, Compiler Design.

**Course Objectives:** The objectives of this course are,
1. To learn the fundamentals of natural language processing.
2. To understand the various text processing techniques in NLP.
3. To understand the role Text Classification Deep Learning for Text Classification techniques of NLP.
4. To use Topic Modelling, Case Studies and apply the NLP techniques to IR applications.

**Course Outcomes**: On successful completion of the course, students will be able to,
1. Understand the basic concepts of Natural language processing pipeline and applications of NLP.
2. Illustrate various text representation techniques in NLP.
3. Analyse text classification techniques and deep learning basics to process natural language text.
4. Explore text summarization methods and example systems.
5. Demonstrate levels of NLP for several case studies.
6. Apply NLP Pipe lines to solve real world applications.

**UNIT - I**

**NLP: A Primer**, NLP in the Real World, NLP Tasks, NLP Levels, What Is Language? Building Blocks of Language, Why Is NLP Challenging? Machine Learning and Overview Approaches to NLP, Heuristics-Based, Machine Learning, Deep Learning for NLP.

**NLP Pipeline:** Data Acquisition, Pre-Processing Preliminaries Frequent Steps, Advanced Processing Feature Engineering Classical NLP/ML Pipeline DL Pipeline Modeling, Evaluation of Models, Post-Modeling Phases.

**UNIT - II**

**Text Representation** Vector Space Models Basic Vectorization Approaches, One-Hot Encoding Bag of Words, Bag of N-Grams, TF-IDF, Distributed Representations, Word Embedding, Going Beyond Words, Distributed Representations.

**UNIT - III**

**Text Classification** Applications One Pipeline, Many Classifiers, Using Neural Embeddings in Text Classification Deep Learning for Text Classification Interpreting Text Classification Models.

**Deep Learning for Text Classification** CNNs for Text Classification, LSTMs for Text Classification.

**UNIT - IV**

**Topic Modelling** Text Summarization, Use Cases Setting Up a Summarizer: An Example Recommender Systems for Textual Data Machine Translation Question-Answering Systems, Social Media, E-Commerce and Retail, Healthcare, Finance, and Law.

**UNIT - V**

**Case Study on NLP Pipeline, Text Classification**: Ticketing, Ecommerce, Social media, health care, Recommender systems and other applications of NLP.

**Text Books:**

1. Sowmya Vajjala, Bodhisattwa Majumder, Anuj Gupta & Harshit Surana "Practical Natural Language Processing: A Comprehensive Guide to Building Real world NLP Systems", O'Reilly Media, Inc., 1st Edition, 2020.
2. James Allen, "Natural Language Understanding", Bejamin Cummings, 2nd edition, 1995.

**Suggested Reading:**

1. Tanveer Siddiqui, U.S. Tiwary, "Natural Language Processing and Information Retrieval", Oxford University Press, 2008.

**Online Resources:**

1. https://nptel.ac.in/courses/106101007/
2. http://www.cs.colorado.edu/~martin/sp2.html
3. https://web.standford.edu/~jurafsky/sp3/

**20CSE22**

**BIG DATA ANALYTICS**
**(Professional Elective-III)**

| | |
|---|---|
| Instruction | 3 Hours per week |
| Duration of End Examination | 3 Hours |
| Semester End Examination | 60 Marks |
| Continuous Internal Evaluation | 40 Marks |
| Credits | 3 |

**Pre-requisites:** Database management systems, Programming for problem solving, OOPs.

**Course Objectives:** The objectives of this course are,

1. To understand the need of Big Data, challenges and different analytical architectures.
2. To understand Hadoop Architecture and its ecosystems.
3. To understand processing of Big Data with advanced architectures like Spark.

**Course Outcomes:** On Successful completion of the course, students will be able to,

1. Demonstrate knowledge of Big Data, Data Analytics, challenges and their solutions in Big Data.
2. Discuss about Hadoop Framework and eco systems.
3. Understand and work on NoSQL environment and MongoDB.
4. Explain and Analyse the Big Data using Map-reduce programming in Both Hadoop and Spark framework.
5. Demonstrate spark programming with Python/R programming languages.
6. Explain and Analyse the data Analytics algorithms in Spark.

**UNIT - I**

**Introduction to big data:** Data, Characteristics of data and Types of digital data: Unstructured, Semi-structured and Structured - Sources of data. Big Data Evolution -Definition of big data-Characteristics and Need of big data-Challenges of big data.

**Big data analytics:** Overview of business intelligence, Data science and Analytics– Big Data Analytics - Typical Analytical Architecture – Classification of analytics.

**UNIT - II**

**Big data technologies and Databases: Hadoop** – Requirement of Hadoop Framework - Design principle of Hadoop –Comparison with other system (SQL,RDBMS) - Hadoop Components – Architecture -Hadoop 1 vs Hadoop 2 – HDFS.

**MapReduce and YARN framework**: Introduction to MapReduce , Processing data with Hadoop using MapReduce, Introduction to YARN, Architecture, Managing Resources and Applications with Hadoop YARN.

**UNIT – III**

**Big data technologies and Databases: NoSQL:** Introduction to NoSQL - Features and Types- Advantages &Disadvantages -Application of NoSQL. **NewSQL**: Overview of NewSQL - Comparing SQL, NoSQL and NewSQL.

**Mongo DB**: Introduction – Features – Data types – Mongo DB Query language – CRUD operations – Arrays – Functions: Count – Sort – Limit – Skip – Aggregate – Map Reduce. Cursors – Indexes – Mongo Import – Mongo Export. Cassandra: Introduction – Features – Data types – CQLSH – Key spaces – CRUD operations – Collections – Counter – TTL – Alter commands – Import and Export – Querying System tables.

**UNIT - IV**

**(Big Data Frame Works for Analytics)**

**Hadoop Frame Work:** Map Reduce Programming: I/O formats, Map side join-Reduce Side Join-Secondary Sorting-Pipelining MapReduce jobs.

**Spark Frame Work:** Introduction to Apache spark-How spark works, Programming with RDDs: Create RDD-spark Operations-Data Frame.

**UNIT - V**

**(Data Analytics using ML)**

**Data Analysis with Spark**

**Data Exploration:** Univariate and Multivariate Analysis. **Data Manipulation**: Feature Extraction- Feature Transform-Feature Selection-**Regression:** Linear Regression.

**Classification:** Decision Trees-Naïve Bayes Classification- **Clustering:** K-means.

**Text Books:**

1. Seema Acharya and Subhashini Chellappan, “Big Data and Analytics”, Wiley India Pvt. Ltd., 2016.
2. Mike Frampton, “Mastering Apache Spark”, Packt Publishing, 2015.

**Suggested Reading:**

1. TomWhite, “Hadoop: The Definitive Guide”, O’Reilly, 4th Edition, 2015.
2. Mohammed Guller, “Big Data Analytics with Spark”, Apress, 2015.
3. Donald Miner, Adam Shook, “Map Reduce Design Pattern”, O’Reilly, 2012.

**20CIE11**

**MALWARE ANALYSIS**
**(Professional Elective-IV)**

| | |
|---|---|
| Instruction | 3 Hours per week |
| Duration of End Examination | 3 Hours |
| Semester End Examination | 60 Marks |
| Continuous Internal Evaluation | 40 Marks |
| Credits | 3 |

**Course Objectives:** The objectives of this course are to

1. Make familiar with various malware analysis techniques to provide sufficient information to respond appropriately to a network intrusion.
2. Learn on static, dynamic analysis and controlled malware execution.
3. To analyse malicious Windows executables and documents and develop professional quality malware analysis reports.
4. Practice on given system scenario using the appropriate tools and to identify the vulnerabilities for performing Malware analysis and behaviour.
5. Understand role of machine learning in malware detection.

**Course Outcomes:** On successful completion of the course, students will be able to

1. Set up a safe virtual environment to analyze malware, quickly extract network signatures and host-based indicators.
2. Use key analysis tools like IDA Pro, OllyDbg, and WinDbg.
3. Overcome malware tricks like obfuscation, anti-disassembly, anti-debugging, and anti-virtual machine techniques.
4. Use knowledge of Windows internals for malware analysis.
5. Analyse malware behaviour, including launching, encoding, and network signatures.
6. Design and deploy machine learning based malware detectors.

**UNIT - I**

Malware Primer. Malware Functionality. Downloaders. Launchers. Backdoors. Credential Stealers. Persistence Mechanisms. Privilege Escalation.

**UNIT - II**

Anatomy of a Binary. The C Compilation Process. Symbols and Stripped Binaries. Disassembling a Binary. Loading and Executing a Binary. The ELF Format and PE Format.

**UNIT - III**

Basic Static Techniques. Antivirus Scanning. Hashing. Finding Strings. Packed and Obfuscated Malware. Malware Analysis in Virtual Machines. Structure of Virtual Machine. Creating Malware Analysis Machine. VMWare Risks.

**UNIT - IV**

Basic Dynamic Analysis. Sandboxes. Running Malware. Monitoring with Process Monitor. Viewing Processes in Process Explorer. Comparing Registry Snapshots with Regshot. Faking a Network. The Windows API. Windows Registry. Networking APIs. Following Running Malware.Covert Malware Launching. Launching. Process Injection. Process Replacement. Hook Injection.

**UNIT - V**

Understanding Machine Learning Based Malware Detectors. Steps for Building ML Detectors. Gathering Examples. Extracting Features. Training. Testing. Understanding Feature Spaces and Decision Boundaries. Major Types of Machine Learning Detectors: Logistic Regression, k-NN, Decision Trees, and Random Forest. Evaluating ML detectors. True and False Positive Rates. ROC Rates.

**Text Book:**

1. Michael Sikorski and Andrew Honig, “Practical Malware Analysis The Hands-On Guide to Dissecting Malicious Software”, February 2012, 800 pp. ISBN l-13: 9781593272906. No Starch Press.

**Suggested Reading:**

1. Dennis Andriesse, “Practical Binary Analysis Build Your Own Linux Tools for Binary Instrumentation, Analysis, and Disassembly” December 2018, 456 pp. ISBN-13:9781593279127. No Starch Press.
2. Joshua Saxe with Hillary Sanders, “Malware Data Science Attack Detection and Attribution”, September 2018, 272 pp. ISBN-13:978-1-59327-859-5 No Starch Press.

**20CIE12**

**BUILDING SECURE AND RELIABLE SYSTEMS**
**(Professional Elective-IV)**

| | |
|---|---|
| Instruction | 3 Hours per week |
| Duration of End Examination | 3 Hours |
| Semester End Examination | 60 Marks |
| Continuous Internal Evaluation | 40 Marks |
| Credits | 3 |

**Course Objectives:** The objectives of this course are to

1. Make the student to understand the underlying infrastructure and Technologies for building, maintaining reliable systems.
2. Understand principles of concurrency and be able to build concurrent software.

**Course Outcomes:** On successful completion of the course, students will be able to

1. Understand the principles and strategies of infrastructure for building secure and reliable systems.
2. Identify various tools and technologies to manage infrastructure and other resources.
3. Create Git-based platforms for collaborative development and maintenance of Software Products
4. Perform various tests including infrastructure, production, fail-over, capacity, security, and compliance tests.
5. Configure infrastructure resources using configuration management tools.
6. Design systems to provide concurrency.

**UNIT - I**

**Principles and Strategies of Infrastructure:** Technical Practices, Modernization of Computer, Network and Storage, Infrastructure Management, scaling production readiness, DevOps and SRE, System Admin; Life Cycles of Physical Hardware and Cloud Services, Challenges to plan infrastructure strategy, Infrastructure Stacks, Infrastructure as Code

**UNIT - II**

**Version Control and Local Development Environments:** Fundamentals of Git, Working with Remote Git Repositories, Conflict Resolution, Fixing local Repositories, Collaboration with Version Control, Editors, Languages, Installation and Configuration of Applications.

**UNIT - III**

**Testing and Security:** Need and types of tests, shape of test strategy, main tests to plan, Flaky Tests; Security collaboration, Data Assets, attack vectors and surfaces, Design for Security Operability, Qualifying issues.

**UNIT - IV**

**Infracode and Security:**-Infracode, Building Machine Images, Provisioning Infrastructure Resources, Terraform, Configuring Infrastructure Resources, Writing Unit Tests and Integration for Infracode, Managing Identiy, Access and Secrets, Securing Compute Infrastructure and Networking, Recommendations for Security Infracode.

**UNIT - V**

**Scaling Production Readiness:** Monitoring building blocks, Monitoring process, Information Presentation, Developing on-call Resilience, Incident Management, and Capacity Management.

**Text Books:**

1. Jennifer Davis, “Modern System Administration – Building and Maintaining Reliable Systems”, O’Reilly, 2022.
2. Jan Schaumann, “Principles of System Administration”, April, 2021.
3. Heather Adkins, Besty Beyer, Paul Blankinship, Piotr Lewandowski, Ana Oprea and Adam Stubblefield, “Building Secure & Reliable Systems”, O’Reilly, 2020.

**Online Resources:**

1. https://www.oreilly.com/library/view/foundations-of-scalable/9781098106058/ch01.html
2. Building Secure and Reliable Systems (googleusercontent.com)
3. Principles-of-system-administration.pdf (netmeister.org)

**20CSE08**

**ENTERPRISE APPLICATION DEVELOPMENT**
**(Professional Elective – IV)**

| | |
|---|---|
| Instruction | 3 Hours per week |
| Duration of End Examination | 3 Hours |
| Semester End Examination | 60 Marks |
| Continuous Internal Evaluation | 40 Marks |
| Credits | 3 |

**Pre-requisites:** Internet and web technologies, OOPs, Database management systems.

**Course Objectives:** The objectives of this course are,

1. To provide good understanding of latest web technologies on client side components like ReactJS and Angular2.
2. To acquire knowledge on web frameworks, develop server side web applications like Node.js and Express.
3. To develop innovative web applications using various technologies.

**Course Outcomes:** On Successful completion of the course, students will be able to,

1. Understand the database connectivity and application servers.
2. Explore the type of forms with validations using ReactJS.
3. Utilize Express framework to develop responsive web applications.
4. Demonstrate the architecture and file system of NodeJs.
5. Identify the significance of component intercommunication with Angular2.
6. Adapt MEAN or MERN stack to implement a real-time web application.

**UNIT - I**

Introduction to Full stack development and NoSQL.
**MongoDB:** Basics, Configuring Server and Client, MongoDB Compass, Creating Database, MongoDB Commands, MongoDB CRUD Operations.
**REST:** Introduction to REST and API, REST Constraints, Representations, Resource Identifier, REST Actions, Status Codes.

**UNIT - II**

**NodeJs:** Introduction, NodeJS Features and Drawbacks, setup Environment for NodeJs, NodeJS Program architecture, NodeJS Web Server, NodeJS Global Objects, NodeJS OS Objects, NodeJS Error Handling, Node JS Event Loop, NodeJS File System, Async and Sync, Connecting with Database, Handling CRUD Operations.

**UNIT - III**

**Building an Express web application:** Introduction to Express, Installation of Express, Create first Express application, the application request and response objects, configuring an Express application, rendering views, Authentication, Authorization.

**UNIT - IV**

**Introduction to ReactJS**: React Components, React State and Props.
**Component intercommunication:** Component Composition, pass data from parent to child, pass data from child to parent, Fetching data API using axioms, Types of forms, Form Validations, Posting Data, React Router, Building & Deploying React App.

**UNIT - V**

**Introduction to Angular2**: Angular2 Architecture (Component-Based Architecture), Consuming API, State Management, Validation, Routing. Passing data from parent to child and Passing data between siblings.
**Angular2 Specific:** Directives, Modules, Components, Observables, Binding, Pipes, Dependency Injection.

**Text Books:**

1. Amos Q. Haviv, MEAN Web Development, Second Edition, Packt Publications, November 2016.
2. Vasan Subramanian, “Pro MERN Stack, Full Stack Web App Development with Mongo, Express, React, and Node”, 2nd Edition, APress.
3. Fernando Doglio, “REST API Development with Node.js”, 2nd Edition, APress.

**Suggested Reading:**

1. Shelly Powers, “Learning Node: Moving to the Server-Side”, 2nd Edition, O’REILLY, 2016.
2. Simon D. Holmes and Clive Harber, “Getting MEAN with Mongo, Express, Angular, and Node”, Second Edition, Manning Publications, 2019.
3. Brad Dayley, “Node.js, MongoDB and Angular Web Development”, 2nd Edition, Addison-Wesley Professional, 2017.

**Online Resources:**

1. https://www.mongodbtutorial.org/mongodb-crud/
2. https://reactjs.org/tutorial/tutorial.html
3. https://www.javatpoint.com/expressjs-tutorial
4. https://www.javatpoint.com/nodejs-tutorial
5. https://angular-training-guide.rangle.io/

**20CSE21**

**DEEP LEARNING**
**(Professional Elective – IV)**

| | |
|---|---|
| Instruction | 3 Hours per week |
| Duration of End Examination | 3 Hours |
| Semester End Examination | 60 Marks |
| Continuous Internal Evaluation | 40 Marks |
| Credits | 3 |

**Pre-requisites:** Artificial Intelligence and Machine Learning.

**Course Objectives:** The objectives of this course are,

1. To learn Deep learning techniques and their applications.
2. To acquire the knowledge of neural network architectures, Deep learning methods, models and algorithms.
3. To understand CNN and RNN algorithms and their applications.

**Course Outcomes:** On Successful completion of the course, students will be able to,

1. Understand various learning models.
2. Design and develop various Neural Network Architectures.
3. Understand approximate reasoning using Convolution Neural Networks.
4. Analyze and design Deep learning algorithms in different applications.
5. Ability to apply CNN and RNN techniques to solve different applications.
6. Evaluate the Performance of different models of Deep learning networks.

**UNIT - I**

**Introduction**: Historical Trends in Deep Learning, McCulloch Pitts Neuron, Thresholding Logic, Perceptrons, Perceptron Learning Algorithm. Representation Power of MLPs, Sigmoid Neurons, FeedForward Neural Networks, Representation Power of Feedforward Neural Networks, Backpropagation, Historical Trends in Deep Learning.

**Optimization**: Gradient Descent (GD), Momentum Based GD, Nesterov Accelerated GD, Stochastic GD, AdaGrad, RMSProp, Adam.

**UNIT - II**

**Autoencoders**: relation to PCA, Regularization in autoencoders, Denoising autoencoders, Sparse autoencoders, Contractive autoencoders, **Regularization:** Bias Variance Tradeoff, L2 regularization, Early stopping, Dataset augmentation, Parameter sharing and tying, Injecting noise at input, Ensemble methods, Dropout, Greedy Layer wise Pre-training, Better activation functions, Better weight initialization methods, Batch Normalization.

**UNIT - III**

**Convolutional Neural Network**: The Convolution Operation, Motivation, Pooling, Convolution and Pooling as an Infinitely Strong Prior, Variants of the Basic Convolution Function, Structured Outputs, Data Types.
LeNet, AlexNet, ZF-Net, VGGNet, GoogLeNet, ResNet, Visualizing Convolutional Neural Networks, Guided Backpropagation, Deep Dream, Deep Art, Fooling Convolutional Neural Networks.

**UNIT – IV**

**Recurrent Neural Networks**, Backpropagation through time (BPTT), Vanishing and Exploding Gradients, Truncated BPTT, GRU, LSTMs.
Encoder Decoder Models, Attention Mechanism, Attention over images, Introduction to Transformers.

**UNIT – V**

**Generative Adversarial Networks (GANs):** Introduction, Discriminator, Generator, Activation, Common activation functions for GANs, BCE loss, Conditional GANs, Controllable generation, real life GANs.

**Text Books:**

1. Goodfellow. I., Bengio. Y. and Courville. A., “Deep Learning “, MIT Press, 2016.
2. Josh Patterson, Adam Gibson "Deep Learning: A Practitioner's Approach", O'Reilly Media, 2017.
3. Ganguly Kuntal, “Learning generative adversarial networks: next-generation deep learning simplified”, Packt Publishing, 2017.

**Suggested Reading:**

1. Tom M. Mitchell, "Machine Learning ",MacGraw Hill, 1997.
2. LiMin Fu, “Neural Networks in Computer Intelligence”, McGraw-Hill edition, 1994.
3. Umberto Michelucci “Applied Deep Learning. A Case-based Approach to Understanding Deep Neural Networks” Apress, 2018.
4. Giancarlo Zaccone, Md. RezaulKarim, Ahmed Menshawy "Deep Learning with TensorFlow: Explore neural networks with Python", Packt Publisher, 2017.
5. Rothman, Denis, “Transformers for Natural Language Processing: Build innovative deep neural network architectures for NLP with Python, PyTorch, TensorFlow, BERT, RoBERTa, and more”, Packt Publishing Ltd, 2021.

**Online Resources:**

1. https://onlinecourses.nptel.ac.in/noc18_cs41/
2. https://onlinecourses.nptel.ac.in/noc22_cs22/
3. https://onlinecourses.nptel.ac.in/noc19_cs85/

**20CSE34**

**CLOUD COMPUTING**
**(Professional Elective-IV)**

| | |
|---|---|
| Instruction | 3 Hours per week |
| Duration of End Examination | 3 Hours |
| Semester End Examination | 60 Marks |
| Continuous Internal Evaluation | 40 Marks |
| Credits | 3 |

**Pre-requisites:** Data communication and computer networks.

**Course Objectives**: The objectives of this course are,

1. To understand the significance services of cloud computing.
2. To understand about the cloud infrastructure and Technologies.
3. To learn the security implementation features in cloud computing.

**Course Outcomes**: On Successful completion of this course, student will be able to,

1. Understand the need of cloud technology and terminology.
2. Identify and understand the cloud infrastructure.
3. Write scripts for the automation of infrastructure and software deployment.
4. Design solutions for the automation and migration of manual data centers.
5. Develop scripts for the automation of cloud services.

**UNIT – I**

**Era of Cloud Computing –** Motivation, Elastic Computing and advantages- Multi-Tenant clouds, Elastic computing, Virtualized servers uses, Business model for Cloud Providers. Types of Clouds and Cloud Providers, Multi-Cloud, Hyperscalers, advantages of clouds; **Data Centre Infrastructure**- racks, aisles, pods, power and cooling, air cooling, thermal containment and hot/cold aisles, exhaust Ducts, lights-out data centers, smart network interfaces.

**UNIT – II**

**Virtualization and Containers** -Virtual machines, hypervisor, approaches to virtualization, advantages and disadvantages of VMs, Virtual I/O devices, VM migration; Traditional apps and elasticity on demand, isolation facilities in an OS, Linux namespaces for isolation, container approaches, Docker.

**UNIT – III**

**Virtual Networks –** Goals of a data center network, Network hierarchies, capacity, Fat Tree Designs. Link aggregation, VLANS, VXLAN, NAT, Managing virtualization and mobility, SDNs, openflow protocol, Programming networks; **Virtual Storage**: NAS, SAS, mapping virtual disks to physical disks.

**UNIT – IV**

**Automation and Cloud Programming -** Need of automation, levels, AIops, automation tools, automation of manual data center practices, evolution of automation; **Orchestration:** legacy of automating procedures, larger scope of automation, Kubernetes MapReduce, Microservices, Serverless computing, event processing, DevOps, Edge Computing and IIoT.

**UNIT – V**

**Cloud security and Privacy** – cloud specific problems, zero trust security model, identity management, privileged access management(PAM), AI technologies and their effects on their security,
Protection of remote access and privacy in a cloud environment, back doors, side channels and other concerns, firewalls.

**Text Books:**

1. Douglas Comer "The Cloud Computing Book: The Future of Computing Explained", Chapman and Hall/CRC, 1st Edition Kindle Edition, 2021.
2. Anthony T Velte, Toby J, Robert Elenpeter, "Cloud Computing – A Practical Approach", McGra Hill, 2010.
3. https://www.amazon.in/Cloud-Computing-Book-Future-Explained/dp/0367706806?asin=B097N7NKJD&revisionId=&format=4&depth=1

**20PYO01**

## HISTORY OF SCIENCE AND TECHNOLOGY
## (Open Elective – III)

| | |
|---|---|
| Instruction | 3 Hours per week |
| Duration of End Examination | 3 Hours |
| Semester End Examination | 60 Marks |
| Continuous Internal Evaluation | 40 Marks |
| Credits | 3 |

**Course Objectives:** The objectives of the course is to make the student

1. Gains the knowledge about origin of science in the Stone Age and its progress during Antiquity period.
2. Familiar with scientific views in the medieval period and during the Industrial revolution. .
3. Aware of modern scientific developments from 19$^{th}$ century onwards.

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

1. Demonstrate the process of beginning of science and civilization, knowledge acquisition and philosophical approach of science and its advancements in the Stone Ages and Antiquity period.
2. Illustrate the advancements in science and technology in the medieval period across Asia and Arab countries and decline and revival of science in Europe.
3. Explain the scientific approach and its advances of the Europeans and how the role of engineer during the industrial revolution and the major advancements.
4. Make use of the advancements in the field of science and technology by adopting new philosophies of 19$^{th}$ and first half of 20$^{th}$ century in finding ethical solutions to the societal problems.
5. Interpret the changes in specializations of science and the technology and build the relation between information and society from second half of 20$^{th}$ century onwards.

**UNIT - I**

**Science - The Beginning (through 599 BCE):** The Stone Ages, Knowledge among hunter gatherers, Agricultural Revolution and other revolutions, Civilization, Major advances.

**Science in Antiquity (600 BCE - 529 CE):** Philosophy- a precursor to science, Hellenistic world and the Roman Empire, Other cultures of the period, major advances.

**UNIT - II**

**Medieval Science (530 CE - 1452 CE):** The decline of science in Europe, Science in China, Science and mathematics in India, Arab science, Revival of science in Europe, Technology revolution of the Middle ages, Major advances.

**The Renaissance and the Scientific Revolution (1453 CE – 1659 CE):** Renaissance, Scientific Revolution, Technology, Major advances.

**UNIT - III**

**Scientific Method: Measurement and Communication (1660 CE – 1734 CE):** European domination, the scientific method, Major advances.

**The Industrial Revolution (1735 CE – 1819 CE):** Industrial Revolution, Rise of the engineer, Major Advances.

**UNIT - IV**

**Science and Technology in the 19th Century (1820 CE – 1894 CE): P**hilosophical basis of 19th-century science, Science and the public, Science and technology, Major advances.

**Rise of Modern Science and Technology (1895 CE – 1945 CE):** The growth of 20$^{th}$century science, new philosophies, Quantum reality, Energy sources, Electricity: a revolution in technology, Major advances.

**UNIT - V**

**Big Science and the Post-Industrial Society (1946 CE – 1972 CE):** Big science, Specialization and changing categories, Technology changes society, Major advances.

**The Information Age (1973 CE – 2015 CE):** Information and society, Globalization, The post-industrial society, Problems of the Information age, Major Advances.

**Text Books:**

1. Bryan Bunch and Alexander Hellemans, “The History of Science and Technology”, Houghton Mifflin Company (New York), 2004.
2. JD Bernal, “Science in History”, 4 Volumes, Eklavya Publishers, 2012.

**Suggested Readings:**

1. “The 100 Most Influential Scientists of All Time”, Edited by Kara Rogers, Britannica Educational Publishing, 2010.
2. Alberto Hernandez, “A Visual History of Science and Technology”, the Rosen Publishing Group, 2016.

**20MEO03**

**RESEARCH METHODOLOGIES**
**(Open Elective – III)**

| | |
|---|---|
| Instruction | 3 Hours per week |
| Duration of End Examination | 3 Hours |
| Semester End Examination | 60 Marks |
| Continuous Internal Evaluation | 40 Marks |
| Credits | 3 |

**Course Objectives:** The main objectives of this course are

1. To make the students to formulate the research problem.
2. To identify various sources for literature review and data collection.
3. To prepare the research design.
4. To equip the students with good methods to analyze the collected data.
5. To explain how to interpret the results and report writing.

**Course Outcomes:** On Successful completion of this course, student will be able to,

1. Define research problem.
2. Review and assess the quality of literature from various sources.
3. Understand and develp various sresearch designs.
4. Analyze problem by sttistical techniques: ANOVA, F-test, Chi-square.
5. Improve the style and ormat of writing a report for technical paper/Journal report.

**UNIT – I**

**Research methodology:** Objectives and motivation of research, types of research- descriptive vs. analytical, applied vs. fundamental, quantitative vs. qualitative, conceptual vs. empirical, research approaches, significance of research, research methods vs. methodology, research process, criteria of good research, problems encountered by researchers in India, technique involved in defining a problem.

**UNIT – II**

**Literature survey:** Importance of literature survey, sources of information-primary, secondary, tertiary, assessment of quality of journals and articles, information through internet.

**UNIT – III**

**Research design:** Meaning of research design, need of research design, feature of a good design important concepts related to research design, different research designs, basic principles of experimental design, steps in sample design.

**UNIT – IV**

**Data collection:** Collection of primary data, Secondary data, measures of central tendency-mean, mode, median, measures of dispersion- range, mean deviation, standard deviation, measures of asymmetry (skewness), important parametric tests -z, t, F, Chi-Square, ANOVA significance.

**UNIT – V**

**Research report formulation and presentation:** Synopsis, dissertation, technical paper and journal paper, writing research grant proposal, making presentation with the use of visual aids, writing a proposal for research grant.

**Text Books:**

1. C.R Kothari “Research Methodology Methods & Technique”, New Age International Publishers, 2004.
2. R. Ganesan “Research Methodology for Engineers”, MJP Publishers, 2011.
3. Vijay Upagade and AravindShende “Research Methodology”, S. Chand & Co. Ltd., New Delhi, 2009.

**Suggested Reading:**

1. G. NageswaraRao “Research Methodology and Quantitative methods”, BS Publications, Hyderabad, 2012.
2. Naval Bajjai “Business Research Methods”, Pearson Education, 2011.

**20MEO04**

**ENTREPRENEURSHIP**
**(Open Elective – III)**

| | |
|---|---|
| Instruction | 3 Hours per week |
| Duration of End Examination | 3 Hours |
| Semester End Examination | 60 Marks |
| Continuous Internal Evaluation | 40 Marks |
| Credits | 3 |

**Course Objectives:** The main objectives of this course are

1. Concept and procedure of idea generation.
2. The nature of industry and related opportunities and challenges.
3. Elements of business plan and it's procedure.
4. Project management and its techniques.
5. Behavioural issues and Time management.

**Course Outcomes:** On Successful completion of this course, student will be able to,

1. Understand the concept and essence of entrepreneurship.
2. Identify business opportunities and nature of enterprise.
3. Analyze the feasibility of new business plan.
4. Apply project management techniques like PERT and CPM for effective planning and execution of projects.
5. Use behavioral, leadership and time management aspects in entrepreneurial journey.

**UNIT - I**

**Entrepreneurship:** Definition, functions of entrepreneurship, qualities of entrepreneurs, identification and characteristics of entrepreneurs, entrepreneur vs. intrapreneur, first generation entrepreneurs, women entrepreneurs, conception and evaluation of ideas and their sources.

**UNIT - II**

**Indian industrial environment:** Competence, opportunities and challenges, entrepreneurship and economic growth, small scale industry in India, objectives, linkage among small, medium and heavy industries, types of enterprises, corporate social responsibility.

**UNIT - III**

**Business plan:** Introduction, elements of business plan and its salient features, business model canvas, technical analysis, profitability and financial analysis, marketing analysis, feasibility studies, executive summary, selectionof technology and collaborative interactions.

**UNIT - IV**

**Project management:** During construction phase, project organization, project planning and control usingCPM, PERT techniques, human aspects of project management, assessment of tax burden.

**UNIT - V**

**Behavioral aspects of entrepreneurs:** Personality, determinants, attributes and models, leadership concepts and models, values and attitudes, motivation aspects, time management: approaches of time management, their strengths and weaknesses. Time management matrix and the urgency addiction.

**Text Books:**

1. Vasant Desai, "Dynamics of Entrepreneurial Development and Management", Himalaya Publishing House, 1997.
2. Prasanna Chandra, "Project-Planning, Analysis, Selection, Implementation and Review", Tata Mcgraw-Hill Publishing Company Ltd, 1995.
3. S.S. Khanka, "Entrepreneurial Development", S. Chand & Co. Pvt. Ltd., New Delhi, 2015.

**Suggested Reading:**

1. Robert D. Hisrich, Michael P. Peters, "Entrepreneurship", 5th edition, Tata Mc Graw Hill Publishing Company. Ltd., 2005.
2. Stephen R. Covey and A. Roger Merrill, "First Things First", Simon and Schuster Publication, 1994.

**20ECO05**

**SYSTEMS AUTOMATION AND CONTROL**
**(Open Elective – III)**

| | |
|---|---|
| Instruction | 3 Hours per week |
| Duration of End Examination | 3 Hours |
| Semester End Examination | 60 Marks |
| Continuous Internal Evaluation | 40 Marks |
| Credits | 3 |

**Pre-requisite:** Knowledge about physical parameters in industry is required

**Course Objectives**: The objectives of this course are,
1. Learn the concepts industrial control systems.
2. Learn how to measure the physical parameters in industry.
3. Learn the applications of Robots in industry.

**Course Outcomes**: On Successful completion of this course, student will be able to,
1. Understand the features of various automatic and process control systems.
2. Define and analyze various measuring parameters in the industry.
3. Compare performance of various controllers (P, PD, PI, and PID).
4. Illustrate the role of digital computers in automation.
5. Develop various robot structures for different applications.

**UNIT - I**
**Introduction to Automatic Control Systems:** Purpose of Automatic Control, How an Industrial Control System is implemented, Introduction to Automatic Control theory.
**Sensors**: Sensor definition, Different types of Sensors: Motion, Position, Force, Level sensors, and Thermo couples.

**UNIT - II**
**Theory of Measurements:** Measurement goals and concepts, Scale factor, Linearity, accuracy, Range, Resolution, Precision and repeatability.
**Measurement Techniques and Hardware:** Typical Sensor outputs, Bridge measurements: General equation for bridge balance, Resistance balanced Wheatstone bridge, Variable voltage type measurements, Frequency type measurements.

**UNIT - III**
**Process Controllers:** What is a Controller, uses of Controllers, Open loop and closed loop Control, proportional, PD, PI, PID Controllers, Analog and Digital methods of Control.
**Controller Hardware:** Analog and Digital Controllers.

**UNIT - IV**
**Digital Computers as Process Controllers:** Use by Digital Computer for process control, Information required by the computer, Information required by the process, Computer Interface electronics, Digital Computer input-output, computer processing of data, Digital Process control computer design, Computer programming.
**Actuators:** Electro mechanical - Linear motion and rotary motion solenoids, DC motors, AC motors and Stepped motors.

**UNIT - V**
**Robots:** What are robots, Robots and process Control systems, Degrees of freedom, factories of the future, Delivery, Disposal and transport systems, Sensing elements, Robot Classifications and Applications. Trouble shooting System failures: Preliminary steps and other troubleshooting aids.

**Text Books:**
1. Ronald P. Hunter, "Automated process control systems – concepts and Hardware", 2/e, PHI, 1987.
2. Norman A. Anderson, "Instrumentation for process measurement and Control", 3/e, CRC Press, 2005.

**Suggested Reading:**
1. Kuo B. C, "Automatic Control Systems", 9th edition
2. A.K Sawhney, "A course on Electrical and Electronic Measurements and Instrumentation".

**20EEO03**

**ENERGY AUDITING**
**(Open Elective – III)**

| | |
|---|---|
| Instruction | 3 Hours per week |
| Duration of End Examination | 3 Hours |
| Semester End Examination | 60 Marks |
| Continuous Internal Evaluation | 40 Marks |
| Credits | 3 |

**Pre-requisites:** Students should have prior knowledge on different Electrical Energy Generation systems, measuring instruments and basics of power systems

**Course Objectives:** The objectives of this course are,

1. To know the concept of Energy auditing.
2. To understand the formulation of efficiency for various engineering systems.
3. To explore the different ways to design various technologies for efficient engineering systems.

**Course Outcomes:** After completion of this course, students will be able to,

1. Know the current energy scenario and various energy sources.
2. Understand the concepts of energy auditing.
3. Evaluate the performance of existing engineering systems.
4. Explore the methods of improving energy efficiency in different engineering systems.
5. Design different energy efficient appliances.

**UNIT - I**

**Basics of Energy and its various forms:** Overview of Engineering, elements Solar energy, electricity generation methods using solar energy, PV cell, elements of wind energy, electricity generation using wind energy, elements of Bio energy, Bio mass energy conservation, elements of Geothermal energy, sources of Geo thermal energy, sources of Chemical energy, fuel cells, Energy Scenario in India.

**UNIT - II**

**Energy Auditing-I:** Introduction, Need for energy audit, types of energy audit: Preliminary audit,General/mini Audit, Investment-grade/ Comprehensive audit. Major energy consuming equipment and systems, Energy audit team, energy Auditing methodology: preliminary and detailed. Process flow diagram, Energy Audit report format.

**UNIT - III**

**Energy Auditing-II: For buildings:** Energy Auditing Instruments, Energy Efficiency, Energy Auditing for buildings- stages in programs, surveying, measurements, and model analysis. Energy audit form of commercial buildings such as Hotel, checklist for Energy saving measures.

**UNIT - IV**

**Energy Efficient Technologies-I: Energy Efficient Technology in Mechanical Engineering:** Heating, ventilation, and air-conditioning; Evaporative coolers, Air conditioners -types such as Portable; Central AC, Window AC and Split AC.

**Energy Efficient Technology in Electrical Engineering**: Electricity billing, Power Factor Improvement-Regenerated Energy in Lifts and Escalators.

**UNIT-V**

**Energy Efficient Technologies-II: Energy Efficient Technology in Civil Engineering**: Green building-features- concept of Embodied energy -Building design-Green construction-Net Zero Energy Building - **Energy Efficient Technology in Chemical Engineering**: Green chemistry, - Battery Managementsystems – concept and salient features –topologies.

**Text Books:**

1. Umesh Rathore, 'energy management', Kataria publications, 2nd ediiton, 2014.
2. G.Hari hara Iyer : Green Building – Fundamentals , Notion Press .com2022.
3. Hargroves, K., Gockowiak, K., Wilson, K., Lawry, N., and Desha, C. (2014) An Overview of Energy Efficiency Opportunities in Mechanical/civil/electrical/chemical Engineering, The University of Adelaide and Queensland University of Technology.

**Suggested Reading:**

1. Success stories of Energy Conservation by BEE, New Delhi (www.bee-india.org).
2. Guide books for National Certification Examination for Energy Manager / Energy Auditors Book-1, General Aspects.

**20EGM01**

## INDIAN CONSTITUTION AND FUNDAMENTAL PRINCIPLES

| | |
|---|---|
| Instruction | 2 Hours per week |
| Duration of End Examination | 2 Hours |
| Semester End Examination | 50 Marks |
| Continuous Internal Evaluation | - |
| Credits | - |

**Course Objectives:** The main objectives of this course are

1. History of Indian Constitution and how it reflects the social, political and economic perspectives of the Indian society.
2. Growth of Indian opinion regarding modern Indian intellectual's constitutional role and entitlement to civil and economic rights as well as the emergence of nationhood in the early years of Indian nationalism.
3. Various Organs of Governance and Local Administration.

**Course Outcomes:** On Successful completion of this course, student will be able to,

1. Understand the making of the Indian Constitution and its features.
2. Identify the difference among Right To equality, Right To freedom and Right to Liberty.
3. Analyze the structuring of the Indian Union and differentiate the powers between Union and States.
4. Distinguish between the functioning of Lok Sabha and Rajya Sabha while appreciating the importance of Judiciary.
5. Differentiate between the functions underlying Municipalities, Panchayats and Co-operative Societies.

**UNIT - I**

**Constitution of India:** Constitutional history-Govt of India Act 1909, 1919 and 1935, Constitution making and salient features. Directive Principles of State Policy - Its importance and implementation.

**UNIT - II**

**Scheme of the Fundamental Rights & Duties:** The Fundamental Rights - To Equality, to certain Freedom under Article 19, to Life and Personal Liberty under Article 21. Fundamental Duties - the legal status.

**UNIT - III**

**Union Government and its Administration:** Structure of the Indian Union: Federalism, distribution of legislative and financial powers between the Union and the States.
Parliamentary form of government in India: Executive-President's role, power and position.

**UNIT - IV**

**Legislature and Judiciary:** Central Legislature-Powers and Functions of Lok Sabha and Rajya Sabha.
**Judiciary:** Supreme Court-Functions, Judicial Review and Judicial Activism.

**UNIT - V**

**Local Self Government:** District's Administration Head (Collector): Role and Importance. **Municipalities & Municipal Corporations:** Introduction, Chairperson/Mayor, Commissioner and Role of Elected Representatives. **Panchayati Raj:** Introduction, Zilla Panchayat, Chairperson, CEO, Elected Officials and their roles. **Block/Mandal level:** Organizational Hierarchy (Different departments). Village level: Role of Elected and Officials.

**Text Books:**

1. Ed Prof V Ravindra Sastry, "Indian Government & Politics", Telugu Akademy, 2nd edition, 2018.
2. "Indian Constitution at Work", NCERT, First edition 2006, Reprinted- January 2020.

**Suggested Reading:**

1. "The Constitution of India", 1950 (Bare Act), Government Publication.
2. Dr. S. N. Busi, Dr. B. R. Ambedkar, "Framing of Indian Constitution", 1st Edition, 2015.
3. M. P. Jain, "Indian Constitution Law", 7th Ed. Lexis Nexis, 2014.
4. D.D. Basu, "Introduction to the Constitution of India", Lexis Nexis, 2015.

**Online Resources:**

1. http://www.nptel.ac.in/courses/103107084 /Script.pdf

**20EGM02**

**INDIAN TRADITIONAL KNOWLEDGE**

| | |
|---|---|
| Instruction | 2 Hours per week |
| Duration of End Examination | 2 Hours |
| Semester End Examination | 50 Marks |
| Continuous Internal Evaluation | - |
| Credits | - |

**Pre-requisite:** Knowledge on Indian Culture.

**Course Objectives:**

1. To get a knowledge in Indian Culture.
2. To Know Indian Languages and Literature and the fine arts in India.
3. To explore the Science and Scientists of Medieval and Modern India.

**Course Outcomes:** After completion of this course, students will be able to:

1. Understand philosophy of Indian culture.
2. Distinguish the Indian languages and literature.
3. Learn the philosophy of ancient, medieval and modern India.
4. Acquire the information about the fine arts in India.
5. Know the contribution of scientists of different eras.

**UNIT - I**

**Culture and Civilization:** Culture, civilization and heritage, general characteristics of culture, importance of culture in human life, Cultural diversity, Aesthetics, Women seers, Indus culture, Indian cuisine, Martial arts.

**UNIT - II**

**Education System:** Education in ancient, medieval and modern India, aims of education, subjects, Languages, Science and Scientists of ancient, medieval and modern India.

**UNIT - III**

**Linguistic Wealth:** Indian Languages and Literature: the role of Sanskrit, Paleography, Significance of scriptures to current society, Indian semantics and lexicography, Bhakti literature, Darsanas.

**UNIT - IV**

**Art, Technology & Engineering:** Sculpture, Painting and Handicrafts, Indian Music, Dance Drama and Theatre, Introduction to Mayamatam, Iron and steel technology, Use of metals in medicinal preparations.

**UNIT - V**

**Science and Logic:** Helio-centic system, Sulbasutras, Katapayadi, Hindu calendar, 6 pramanas in Indian logic, Scientific method applied to therapeutics, Fallacies, Tarka – Induction &Deduction, Ayurvedic biology, Definition of health.

**Essential Readings:**


1. Kapil Kapoor, **Text and Interpretation: The Indian Tradition,** ISBN: 81246033375, 2005
2. Samskrita Bharati, **Science in Samskrit**, ISBN-13: 978-8187276333, 2007.
3. Satya Prakash, **Founders of sciences in Ancient Indi**a, Govindram Hasanand, ISBN-10: 8170770009, 1989.
4. Brajendranath Seal, **The Positive Sciences of the Ancient Hindus**, Motilal Banarasidass, ISBN-10: 8120809254, 1915.
5. Kancha Ilaiah, Turning the Pot, Tilling the Land: Dignity of Labour in Our Times.


**Suggested Readings:**


1. Swami Vivekananda, *Caste, Culture and Socialism*, Advaita Ashrama, Kolkata ISBN-9788175050280.
2. Swami Lokeswarananda, *Religion and Culture*, Advaita Ashrama, Kolkata ISBN-9788185843384.
3. Kapil Kapoor, *Language, Linguistics and Literature: The Indian Perspective*, ISBN-10: 8171880649, 1994.
4. Karan Singh, *A Treasury of Indian Wisdom: An Anthology of Spiritual Learn*,ISBN: 978-0143426158, 2016.
5. Swami Vivekananda, *The East and the West*, Advaita Ashrama, Kolkata 9788185301860.

6. Srivastava R.N., *Studies in Languages and Linguistics*, Kalinga Publications ISBN-13: 978-8185163475.
7. Subhash Kak and T.R.N. Rao, Computation in Ancient India, Mount Meru Publishing ISBN-1988207126.
8. R.N Misra, *Outlines of Indian Arts Architecture, Painting, Sculpture, Dance and Drama,* IIAS, Shimla & Aryan Books International, ISBN 8173055149.
9. S. Narain, *Examinations in ancient India*, Arya Book Depot, 1993.
10. M. Hiriyanna, Essentials of Indian Philosophy, Motilal Banarsidass Publishers, ISBN-13: 978-8120810990, 2014.
11. Ravi Prakash Arya, Engineering and Technology in Ancient India, Indian Foundation for Vedic Science, ISBN-10: 1947593072020.
12. Shashi Tharoor, The Hindu Way.
13. Amartya Sen, Argumentative Indian.

**SWAYAM/Nptel:**

1. History of Indian Science and Technology - https://onlinecourses.swayam2.ac.in/arp20_ap35/preview.
2. Introduction to Ancient Indian Technology – https://onlinecourses.nptel.ac.in/noc19_ae07/preview.
3. Indian Culture & Heritage - https://onlinecourses.swayam2.ac.in/nos21_sc11/preview.
4. Language and Society - https://nptel.ac.in/courses/109/106/109106091/
5. Science, Technology & Society - https://nptel.ac.in/courses/109/103/109103024/
6. Introduction to Indian Philosophy - https://nptel.ac.in/courses/109/106/109106059/
7. Introduction to Indian Art - An appreciation - https://onlinecourses.nptel.ac.in/noc20_hs09/preview.

**20CSC31**

**CRYPTOGRAPHY AND NETWORK SECURITY LAB**

| | |
|---|---|
| Instruction | 2 Hours per week |
| Duration of End Examination | 3 Hours |
| Semester End Examination | 50 Marks |
| Continuous Internal Evaluation | 50 Marks |
| Credits | 1 |

**Pre-requisites:** Data communication and computer networks.

**Course Objectives:** The objectives of this course are,

1. To provide practical understanding of cryptography and its application to network security.
2. To learn various approaches on encryption techniques, strengths of Traffic Confidentiality, Message Authentication Codes.
3. To familiarize with symmetric and asymmetric cryptography.
4. Able to understand the significant functionalities of secure communication.

**Course Outcomes:** On successful completion of the course, students will be able to,

1. Identify basic security attacks and services.
2. Design symmetric and asymmetric key algorithms for cryptography.
3. Create and use of Authentication functions.
4. Identify and investigate network security threat.
5. Analyze and design network security protocols.

**LIST OF EXPERIMENTS:**

1. Write a C program that contains a string (char pointer) with a value 'Hello world'. The program should XOR each character in this string with 0 and displays the result.
2. Write a C program that contains a string (char pointer) with a value 'Hello world'. The program should AND or and XOR each character in this string with 127 and display the result.
3. Write a Java program to perform encryption and decryption using the following algorithms
    a. Ceaser cipher
    b. Substitution cipher
    c. Hill Cipher
    d. Play fair Cipher
4. Write a C/JAVA program to implement the DES algorithm logic.
5. Write a C/JAVA program to implement the Blowfish algorithm logic.
6. Write a C/JAVA program to implement the Rijndael algorithm logic.
7. Write the RC4 logic in Java Using Java cryptography; encrypt the text "Hello world" using Blowfish. Create your own key using Java key tool.
8. Write a Java program to implement RSA algorithm.
9. Implement the Diffie-Hellman Key Exchange mechanism using HTML and JavaScript.
10. Calculate the message digest of a text using the SHA-1 algorithm in JAVA.
11. Calculate the message digest of a text using the MD5 algorithm in JAVA.
12. Implement Simple Columner Transposition technique and Advanced Columner Transposition technique.
13. Implement Euclidean Algorithm and Advanced Euclidean Algorithm.
14. Familiarize the cryptographic tools (opencv).

**Text Books:**

1. William Stallings, "Cryptography and Network Security: Principles and Practice" Pearson Education, 6th Edition.
2. Chris Brenton, "Mastering Network Security" Bk & Cd-Rom Edition 2017.

**Suggested Reading:**

1. J.W. Rittiaghouse and William M.Hancok "Cyber Security Operations Handbook" Elseviers.
2. Eric Chou, "Mastering Python Networking" 3rd Edition, 2020.
3. Jean-Philippe Aumasson "Serious Cryptography: A Practical Introduction to Modern Encryption", 2017.

**Online Resources:**

1. https://onlinecourses.nptel.ac.in/noc21_cs16/preview

**20CIE13**

**MALWARE ANALYSIS LAB**
**(Professional Elective-IV Lab)**

| | |
|---|---|
| Instruction | 2 Hours per week |
| Duration of End Examination | 3 Hours |
| Semester End Examination | 50 Marks |
| Continuous Internal Evaluation | 50 Marks |
| Credits | 1 |

**Pre-requisites**: Computer Networks.

**Course Objectives:** The objectives of this course are to

1. Understand the malware behavior and identify the infected files on the machines.
2. Identify indicators that could find the malware on the infected machines.
3. Analyze and explore the key analysis tools of the malware.

**Course Outcomes:** On Successful completion of the course, students will be able to

1. Create virtual environment to analyze malware.
2. Point out network signatures and host-based indicators for malware recognition on infected machines.
3. Use key analysis tools to detect and classify malware.
4. Understand malware tricks like obfuscation, anti-disassembly, anti-debugging, and anti-virtual machine techniques.
5. Inspect malware functionalities and commands.

**LIST OF EXPERIMENTS:**

1. Analyze the files and view the reports using VirusTotal.com.
   (Check the size, timestamp, MD5 and SHA256 fingerprints of the binary and note the information. Also check the sample in virus databases for antivirus definitions (e.g.: VirusTotal).
2. Collect the information about the malware without executing it?
3. Identify whether the file is packed or obfuscated and explore host or network based indicators that could be used to find malware on infected machines.
4. Examine the binary using static analysis methods and draw the findings & conclusions.
   Examine the following parts of the binary:
   - strings
   - import functions
   - export functions
   - sections/segments
   - resources if they exist
5. Analyze and classify the malware found in the files using tools IDA Pro, OllyDbg, and WinDbg.
6. Analyze and report malware behavior in terms of files, registry, network connections and Auto start.
7. Explore the functionality of the commands that are present within the malware.
8. Explore the key analysis tools PE Explorer and PEiD.

**Text Books:**

1. Michael Sikorski and Andrew Honig, “Practical Malware Analysis The Hands-On Guide to Dissecting Malicious Software”, February 2012, 800 pp. ISBN l-13: 9781593272906. No Starch Press.

**Suggested Reading:**

1. Dennis Andriesse, “Practical Binary Analysis Build Your Own Linux Tools for Binary Instrumentation, Analysis, and Disassembly” December 2018, 456 pp. ISBN-13:9781593279127. No Starch Press.
2. Joshua Saxe with Hillary Sanders, “Malware Data Science Attack Detection and Attribution”, September 2018, 272 pp. ISBN-13:978-1-59327-859-5 No Starch Press.

**Online Resources:**

1. https://www.jaiminton.com/Tutorials/PracticalMalwareAnalysis/#

**20CIE14**

**BUILDING SECURE AND RELIABLE SYSTEMS LAB**
**(Professional Elective-IV Lab)**

| | |
|---|---|
| Instruction | 2 Hours per week |
| Duration of End Examination | 3 Hours |
| Semester End Examination | 50 Marks |
| Continuous Internal Evaluation | 50 Marks |
| Credits | 1 |

**LIST OF EXPERIMENTS:**

1. Installation of Various Linux flavors (optionally using VirtualBox) : CentOS(LVM, without LVM), Ubuntu, Debian.
2. Git installation and configuration.
3. Local Development Environments.
4. Working with Remote Repositories.
5. Building Images with Packer/Docker.
6. Implementation of different tests including: Infrastructure testing, Production tests, Failover testing, Capacity Testing, Security and Compliance Testing.
7. Configuration of Infrastructure Resources using CFEngine/Chef/Puppet/Salt/RedHat Ansible.
8. Configuration of Apache/Nginx for concurrency.

**20CSE17**

**ENTERPRISE APPLICATION DEVELOPMENT LAB**
**(Professional Elective-IV Lab)**

| | |
|---|---|
| Instruction | 2 Hours per week |
| Duration of End Examination | 3 Hours |
| Semester End Examination | 50 Marks |
| Continuous Internal Evaluation | 50 Marks |
| Credits | 1 |

**Pre-requisites:** Internet and web technologies, OOPs, Database management systems.

**Course Objectives:** The objectives of this course are,

1. To acquire knowledge on MongoDB, ReactJS, Express, Node.js and Angular2 to develop web applications.
2. Ability to develop dynamic web content using web frameworks.
3. To understand the design and development process of a complete web application.

**Course Outcomes:** On Successful completion of the course, students will be able to,

1. Prepare database connections with application servers.
2. Design user interfaces using ReactJS.
3. Construct strong expertise on Express framework to develop responsive web applications.
4. Create server side applications using Node.js
5. Develop SPA using Angular 2.
6. Invent next culture-shifting web applications.

**LIST OF EXPERIMENTS:**

1. Installation, configuration and connection establishment of MongoDB.
2. CRUD operations on MongoDB.
3. Building and Deploying React App.
4. Demonstration of component intercommunication using ReactJS.
5. Create Express application.
6. Demonstration of authentication and authorization using Express.
7. Data access using Node.js
8. Create a form to edit the data using Angular2.
9. A case study on a single platform for all financial data for NSE India.

**Text Books:**

1. Amos Q. Haviv, MEAN Web Development, Second Edition, Packt Publications, November 2016.
2. Vasan Subramanian, “Pro MERN Stack, Full Stack Web App Development with Mongo, Express, React, and Node”, 2nd Edition, APress.

**Suggested Reading:**

1. Shelly Powers, “Learning Node: Moving to the Server-Side”, 2nd Edition, O’REILLY, 2016.
2. Simon D. Holmes and Clive Harber, “Getting MEAN with Mongo, Express, Angular, and Node”, Second Edition, Manning Publications, 2019.
3. Brad Dayley, “Node.js, MongoDB and Angular Web Development”, 2nd Edition, Addison-Wesley Professional, 2017.

**Online Resources:**

1. https://www.mongodbtutorial.org/mongodb-crud/
2. https://reactjs.org/tutorial/tutorial.html
3. https://www.javatpoint.com/expressjs-tutorial
4. https://www.javatpoint.com/nodejs-tutorial
5. https://angular-training-guide.rangle.io/

**20CSE30**

**DEEP LEARNING LAB**
**(Professional Elective – IV Lab)**

| | |
|---|---|
| Instruction | 2 Hours per week |
| Duration of End Examination | 3 Hours |
| Semester End Examination | 50 Marks |
| Continuous Internal Evaluation | 50 Marks |
| Credits | 1 |

**Pre-requisites:** Artificial Intelligence and Machine Learning.

**Course Objectives:** The objectives of this course are,

1. To understand basic concepts of Deep learning and their applications.
2. To evaluate Deep learning methods, models and algorithms.
3. To analyze CNN and RNN algorithms and their applications.

**Course Outcomes:** On successful completion of the course, students will be able to,

1. Implement various learning models.
2. Design and develop various Neural Network Architectures.
3. Analyze various Optimization and Regularizations techniques of deep learning.
4. Analyze various pretrained models using Convolution Neural Networks.
5. Ability to apply RNN techniques to solve different applications.
6. Evaluate the Performance of different models of Deep learning networks.

**LIST OF EXPERIMENTS:**

1. Implementation of Classification with Multilayer Perceptron using Scikit-learn with MNIST Dataset.
2. Understanding of Deep learning Packages Basics: Tensorflow, Keras, Theano and PyTorch.
3. Improve the performance of Deep Learning models with Hyper-Parameter Tuning.
4. Compare the Performance of various Optimization techniques of Momentum Based GD, Stochastic GD, Adam.
5. Implementation of Denoising autoencoders.
6. Compare the Performance of the Classification model using various Regularization Techniques.
7. Train a Deep learning model to classify a given image dataset using pre trained model of AlexNet, VGGNet and compare their performance.
8. Implementation of deep learning model using Guided Backpropagation.
9. Implementation of RNN for text generation.
10. Implementation of Encoder Decoder Models.

**Text Books:**

1. Goodfellow. I., Bengio. Y. and Courville. A., “Deep Learning “, MIT Press, 2016.
2. Giancarlo Zaccone, Md. RezaulKarim, Ahmed Menshawy "Deep Learning with TensorFlow: Explore neural networks with Python", Packt Publisher, 2017.
3. Josh Patterson, Adam Gibson "Deep Learning: A Practitioner's Approach", O'Reilly Media, 2017.
4. Huang, Shih-Chia, and Trung-Hieu Le. “Principles and labs for deep learning”. Academic Press, 2021.

**Online Resources:**

1. https://onlinecourses.nptel.ac.in/noc18_cs41/
2. https://onlinecourses.nptel.ac.in/noc22_cs22/
3. https://onlinecourses.nptel.ac.in/noc19_cs85/

**20CSE38**

**CLOUD COMPUTING LAB**
**(Professional Elective-IV Lab)**

| | |
|---|---|
| Instruction | 2 Hours per week |
| Duration of End Examination | 3 Hours |
| Semester End Examination | 50 Marks |
| Continuous Internal Evaluation | 50 Marks |
| Credits | 1 |

**Course Objectives:** The objectives of this course are to

1. Prepare the students for setting up cloud environment.
2. Expose students to virtual environment to manage resources.
3. Expertise students to manage resources and applications in cloud environment.

**Course Outcomes:** On successful completion of the course, students will be able to

1. Configure various virtualization tools such as VirtualBox/VMware Workstation.
2. Manage resources in virtual machines.
3. Design, implement and Deploy applications in PaaS environment.
4. Demonstrate Unix and Hadoop commands in VM.
5. Explore the features of Hadoop.
6. Install Hadoop single node cluster and run simple applications like WordCount.

**LIST OF EXPERIMENTS:**

1. Virtual Machine Creation using VirtualBox.
2. Virtual Block to VM – adding virtual block to VM.
3. Execution of C/Python program in VM.
4. VM Migration.
5. Hadoop Installation.
6. Creation of one Node Hadoop Cluster.
7. Unix commands in VM.
8. HDFS commands in VM.
9. Interactive API using Hadoop – WordCount using Hadoop.

**Text Books:**

1. Anthony T Velte, Toby J, Robert Elenpeter, “Cloud Computing – A Practical Approach”, McGra Hill, 2010.

**Online Resources:**

1. https://www.udemy.com/course/cloud-computing-lab-programs/

**20CIC10**

## TECHNICAL SEMINAR

| | |
|---|---|
| Instruction | 2 Hours per week |
| Duration of End Examination | - |
| Semester End Examination | - |
| Continuous Internal Evaluation | 50 Marks |
| Credits | 1 |

The goal of a seminar is to introduce students to critical reading, understanding, summarizing, explaining and preparing report on state of the art topics in a broad area of his/her specialization. Seminar topics may be chosen by the students with advice from the faculty members and the student shall read further relevant articles in the domain.

**The seminar must be clearly structured and the power point presentation shall include following aspects**:

1. Introduction to the topic.
2. Literature survey.
3. Consolidation of available information.
4. Summary and Conclusions.
5. References.

**Each student is required to**:

1. Submit a one page synopsis of the seminar talk for display on the notice board.
2. Deliver the seminar for a maximum duration of 30 minutes, where the presentation should be for 20 minutes in PowerPoint, followed by Question and Answers session for 10 minutes.
3. Submit the detailed report of the seminar in spiral bound in a précised format as suggested by the department.

**Course Outcomes:** At the end of the course, students will be able to:

1. Study and review research papers of new field/areas and summarize them.
2. Identify promising new directions of various cutting edge technologies in Computer Science and Engineering.
3. Impart skills to prepare detailed report describing the selected topic/area.
4. Acquire skills to write technical papers/articles for publication.
5. Effectively communicate by making an oral presentation before the evaluating committee.

Seminars are to be scheduled **from 3rd week to the last week of the semester** and any change in schedule shall be discouraged. For the award of sessional marks students are **judged by three (3) faculty members** and are based on oral and written presentations as well as their involvement in the discussions during the oral presentation.

Note: Topic of the seminar shall preferably be from any peer reviewed recent journal publications.

| Guidelines for awarding Marks | | |
|---|---|---|
| S. No. | Description | Max. Marks |
| 1 | Contents and Relevance | 10 |
| 2 | Presentation Skills | 10 |
| 3 | Preparation of Presentation slides | 05 |
| 4 | Question and Answers | 05 |
| 5 | Report in prescribed format | 20 |

**20CIC11**

**PROJECT PART - 1**

| | |
|---|---|
| Instruction | 4 Hours per week |
| Duration of End Examination | - |
| Semester End Examination | - |
| Continuous Internal Evaluation | 50 Marks |
| Credits | 2 |

The objective of 'Project Phase – I' is to enable the student take up an investigative study in the broad field of Computer Science and Engineering, either fully theoretical/practical or involving both theoretical and practical work to be assigned by the Department on an **individual basis or two/three students in a group**, under the guidance of a supervisor. This is expected to provide a good initiation for the student(s) towards R&D. The work shall include:

1. Survey and study of published literature on the assigned topic;
2. Working out a preliminary Approach to the Problem relating to the assigned topic;
3. Conducting preliminary Analysis/ Modelling / Simulation / Experiment / Design /Feasibility;
4. Preparing a Written Report on the Study conducted for Presentation to the Department;
5. Final Seminar, as oral Presentation before the Department Review Committee.

**Course Outcomes:** By the end of course, students will be able to:

1. Review the literature related to the problem area / selected topic.
2. Undertake problem identification, formulation and solution.
3. Prepare synopsis of the selected topic.
4. Gather the required data and Set up the environment for the implementation.
5. Conduct preliminary analysis/modelling/simulation experiment.
6. Communicate the work effectively in both oral and written forms.

| **Guidelines for awarding CIE (Max. Marks: 100)** | | |
|---|---|---|
| Evaluation by | Max. Marks | Evaluation Criteria / Parameter |
| Supervisor | 20 | Project Status / Review |
| | 5 | Report Submission |
| Department Review Committee (DRC) | 5 | Relevance of the Topic |
| | 5 | Presentation Slide Preparation |
| | 5 | Presentation |
| | 5 | Question and Answers |
| | 5 | Quality of Report |

**20CII03**

## INTERNSHIP-III

| | |
|---|---|
| Instruction | 5-6 weeks / 135 hours |
| Duration of End Examination | - |
| Semester End Examination | - |
| Continuous Internal Evaluation | 50 Marks |
| Credits | 3 |

# CHAITANYA BHARATHI INSTITUTE OF TECHNOLOGY(A)

## SCHEME OF INSTRUCTION AND EXAMINATION

## Model Curriculum(R-20) 2022-23

## B.E. (CSE - IOT & Cyber Security including Blockchain Technology)

**SEMESTER –VIII**

| S. No | Course Code | Title of the Course | Scheme of Instruction | | | Scheme of Examination | | | Credits |
|---|---|---|---|---|---|---|---|---|---|
| | | | Hours per Week | | | Duration of SEE in Hours | Maximum Marks | | |
| | | | L | T | P/D | | CIE | SEE | |
| **THEORY** | | | | | | | | | |
| 1 | | Professional Elective-V | 3 | - | - | 3 | 40 | 60 | 3 |
| 2 | 20EGM04 | Gender Sensitization | 2 | - | - | 2 | - | 50 | No Credits |
| 3 | 20CEM01 | Environmental Science | 2 | - | - | 2 | - | 50 | No Credits |
| **PRACTICAL** | | | | | | | | | |
| 4 | 20CIC12 | Project Part – 2 | 0 | 0 | 8 | - | 100 | 100 | 4 |
| **TOTAL** | | | **7** | **-** | **8** | - | **140** | **260** | **7** |

L: Lecture T: Tutorial D: Drawing P: Practical

CIE - Continuous Internal Evaluation SEE - Semester End Exam

| **Professional Elective-V** | |
|---|---|
| 20CIE15 | Cognitive IoT |
| 20CIE16 | Blockchain Security and Privacy |
| 20CIE17 | Blockchain Policy: Legal, Economic and Social Impact |
| 20CSE04 | Free and Open Source Technologies |
| 20CSE35 | Augmented Reality and Virtual Reality |

**20CIE15**

**COGNITIVE IOT**
**(Professional Elective-V)**

| | |
|---|---|
| Instruction | 3 Hours per week |
| Duration of End Examination | 3 Hours |
| Semester End Examination | 60 Marks |
| Continuous Internal Evaluation | 40 Marks |
| Credits | 3 |

**Course Objectives:** The objectives of this course are to

1. Emphasizing practical knowledge in cognitive IoT.
2. Impart the knowledge to log the sensor data and to perform data analytics using ML techniques.
3. Apply IoT data for business solution in various domains in secured manner.

**Course Outcomes:** On successful completion of the course, students will be able to

1. Integrate the aspects of human cognitive processes in the system design.
2. Comprehend underlying cognitive process that has many abstractions of a cognitive cycle.
3. Detect any failure of system components and re-configure itself which provide a graceful degradation through self-healing.
4. Accomplish knowledge about the application, system architecture, resources, system state and behavior.
5. Apply advanced techniques in cognitive IoT.
6. Analyze security issues in IoT applications.

**UNIT - I**

**Cognitive IoT –Introduction:** Cognitive IoT, Need for Cognitive IoT, Current and future trends of IoT.
**Cognition radio Enabled IoT**: Major functionalities and Challenges with IoT, IoT and CR Framework.

**UNIT - II:**

**Data Analytics of Cognitive IoT:** Data Analytics for IoT ,IoT Data sources, Data Processing, IoT technologies, Optimization techniques, Data analytics for IoT regression, Data analytics for IoT ANN classification, Data analytics for IoT modern DNNs.

**UNIT - III**

**Cloud and Edge computing in IoT**: Decentralized Computing, Cloud computing, Cloudlets and Fog computing, Cloud and edge computing for large scale IoT Applications.

**UNIT - IV**

**Introduction to GPU:** Introduction to GPU's, parallel programming for GPU, Parallel programming in CUDA, CNN Inference in GPU, CNN Training in GPU.
**FPGA for internet of things**: Benefits of FPGA, interfacing FPGAs with IoT based edge devices, IoT –FPGA based applications, Micro semi's SmarFusin2SoC FPGA.

**UNIT - V**

**IoT Enabling Technologies and devices:**
Big data, Digital twin, Analytic software, Edge devices.
**Security in Cognitive IoT:**
Security in Cognitive IoT, z, a hardware assisted approach for security, Architectural level overview for providing security, security threats, Recent trends.

**Text Books:**

1. Neeraj Kumar, Aaisha Makkar, Machine Learning in Cognitive IoT, Boca Raton, 1st Edition.
2. Mohammad Abdul Matin, "Towards Cognitive IoT Networks" Springer International Publishing, 1st editional 2020.
3. Tolga Soyata, "GPU Parallel Program Development Using CUDA", Boca Raton, Florida: CRC Press, 2018.

**Suggested Reading:**

1. Preeti Sharma, "FPGA Algorithms and applications for the Internaet of Things" IGI Global, 2020.

2. Arshdeep Bahga, Vijay Madisetti, “Internet of Things A Hans –on Approach”, Universities Press (India) Private Limited, 2014.

**Online Resources:**

1. https://www.microsemi.com/product-directory/soc-fpgas/1693-smartfusion
2. https://ieeexplore.ieee.org/document/9001747
3. https://ieeexplore.ieee.org/document/6785328
4. https://dspace.mit.edu/bitstream/handle/1721.1/126870/CognitiveFirewallFINAL.pdf?sequence=2&isAllowed=y
5. https://www.nec.co.nz/market-leadership/publications-media/what-are-iot-enabling-technologies/#:~:text=However%2C%20the%20major%20enabling%20technologies,protocols%2C%20and%20LTE%2DA.

**20CIE16**

## BLOCKCHAIN SECURITY AND PRIVACY
**(Professional Elective-V)**

| | |
|---|---|
| Instruction | 3 Hours per week |
| Duration of End Examination | 3 Hours |
| Semester End Examination | 60 Marks |
| Continuous Internal Evaluation | 40 Marks |
| Credits | 3 |

**Course Objectives:** The objectives of this course are to
1. Familiarize with cybersecurity challenges.
2. Understand the impact of blockchain on CIA Security triad.
3. Identify different types of attacks in distributed systems.
4. Apply blockchain based solutions for information security issues.
5. Understand common risks and specific risks associated with blockchain.

**Course Outcomes:** On successful completion of the course, students will be able to
1. Understand CIA Security triad in blockchain.
2. Understand identity, authentication and naming mechanisms and their challenges.
3. Identify different types of DDoS attacks.
4. Apply blockchain based solutions for information security.
5. Understand the common and specific risks in blockchain technology.

**UNIT – I**

**Introduction: Cybersecurity challenges:** Ransomware, DDoS Attacks, Data Breaches, Insider Threats, Security ecosystem, Blockchain & Distributed Ledger Technology (DLT), Blockchain Architecture. **Blockchain on the CIA Security Triad**- Confidentiality, Integrity, Availability, Security of Transactions in Bitcoin and User Privacy in Bitcoin.

**UNIT – II**

**PKI based identity with blockchain:** PKI components, Architecture, Certificate life cycle, Key management, Challenges of the existing PKI model and Blockchain Solutions.
**Two-Factor Authentication with Blockchain:** Evolution of user authentication, 2FA Working and Challenges, Blockchain for 2FA: Solution architecture.

**UNIT – III**

**Blockchain-Based DNS Security Platform: DNS components:** Namespace, Name servers, Resolver, DNS Structure and Hierarchy: Root name server, Current TLD structure, Registries, registrars, and registrants, DNS records, Challenges with current DNS, Blockchain-based DNS solution: X.509 PKI replacement,MITM-proof DNS infrastructure.

**UNIT – IV**

**Blockchain-Based DDoS Protection:** DDoS attacks definition, Types of DDoS attacks. **Attacks targeting network resources:** User datagram protocol (UDP) flood, ICMP flood, IGMP flood, Amplification attacks. **Attacks targeting server resources:** TCP SYN Flood, TCP RST attack, Secure sockets layer (SSL)-based attack, Encrypted HTTP attacks.
**Attacks targeting application resources**: DNS flooding, regular expression DoS attacks. Hash collision DoS attacks, Challenges with current DDoS solutions and Blockchain based solutions.

**UNIT – V**

**Blockchain Privacy and Security Issues:** Common Risks: Ransomware and Crypto-Lockers, Cryptojacking, ICO Scams and Ponzi Schemes, Specific Risks: Smart contract vulnerabilities, Realtime Attacks-51% vulnerability, double spending and collusion, Selfish Mining attack, Eclipse attack, DAO Hack, Parity Hack, Enhancing Privacy and Security in Blockchain.

**Text Books:**

1. Rajneesh Gupta, Hands-on Cybersecurity with Blockchain. Implement DDoS Protection, PKI-based Identity, 2FA and DNS Security using Blockchain, Packt Publishing, 2018.
2. Ghassan Karame, Elli Androulaki, Bitcoin and Blockchain Security, Artech Publisher, 2017.

**Suggested Reading:**

1. Richard Ma, Jan Gorzny, Edward Zulkoski, Kacper Bak, Olga V. Mack, Fundamentals of Smart Contract Security, Momentum Press, 2019.
2. Kevin Werbach, the Blockchain and the New Architecture of Trust, the MIT Press, 2018.

**Online Resources:**

1. https://www.leewayhertz.com/smart-contracts-security/
2. https://ethereum-contract-security-techniques-and-tips.readthedocs.io/en/latest/
3. https://www.ibm.com/topics/blockchain-security
4. https://www.hindawi.com/journals/wcmc/2022/4079781/
5. https://dl.acm.org/doi/10.1145/3316481

**20CIE17**

**BLOCKCHAIN POLICY: LEGAL, ECONOMIC AND SOCIAL IMPACT**
**(Professional Elective-V)**

| | |
|---|---|
| Instruction | 3 Hours per week |
| Duration of End Examination | 3 Hours |
| Semester End Examination | 60 Marks |
| Continuous Internal Evaluation | 40 Marks |
| Credits | 3 |

**Course Objectives:** The objectives of this course are to

1. Understands the key essentials of policy making and areas of policy governance.
2. Understand the legal issues in cryptocurrencies.
3. Comprehend regulation mechanisms for digital assets and blockchain applications.
4. Understand and analyze incentivisation mechanisms and markets for digital assets.
5. Understand the impact of blockchain on the society through case studies.

**Course Outcomes:** On successful completion of the course, students will be able to

1. Understand the key essentials of policy making and areas of policy governance and nation-led blockchain policies worldwide.
2. Understand the legal issues and the need for regulations in blockchain applications.
3. Comprehend regulation mechanisms for digital assets and blockchain applications.
4. Analyze the primary and secondary markets for digital assets.
5. Understand the impact of blockchain adoption on the society in different sectors.

**UNIT – I**

**Blockchain Policy:** Introduction, DLT Technology, Standards: Blockchain Interoperability, Governance, Essentials of Policy, Key areas of Policy governance, Nation-led approaches to enable blockchain policy - Examples, Blockchain Technology adoption policies in India.

**UNIT – II**

**Legal Impact: Bitcoin Blockchain Legal issues, Tokens in Smart Contracts, Smart Contracts as private law, Regulation of digital assets:** International Adoption, Howey Test, Case Study: Ripple, Central Bank digital currencies, **Regulating Blockchain Applications:** Financial Regulation, Consumer Protection, Privacy, Digital Content Regulation, Taxation, Antitrust**, Blockchain and Copyright Infringement.**

**UNIT – III**

**Economic Impact-I**: Mining and Pooling, Incentive compatible reward function, Bankruptcy situations, Reward functions based on bankruptcy rules, **Corporate Finance of tokens:** Protocol Associated tokens, tokens as contracts.

**UNIT – IV**

**Economic Impact-II:** Markets for digital assets and Security Tokens: Trading and Finding Liquidity, Developing the Primary Markets, Bringing tokens to market, developing secondary market, Settlement and clearing, Settlement Risk, Stock Exchange and DLTs.

**UNIT – V**

**Social Impact: DeFI and Digital Adoption, Financial and Public Sector Case Studies:** Agriculture, Health, Financial Inclusion, Land Rights, Philanthropy Aid, Environment and Climate Change, Education and Human Rights.

**Text Books:**

1. Baxter Hines, Digital Finance- Security Tokens and Unlocking the Real Potential of Blockchain, Wiley Publication, 2020.
2. Antonio Fernández Anta, Chryssis Georgiou, Maurice Herlihy, Maria Potop-Butucaru, Principles of Blockchain Systems, Morgan & Claypool Publishers, 2021.

**Suggested Reading:**

1. Darius Szostek, Blockchain and the Law, Nomos Publication, 2019.

2. Primavera De Filippi, Aaron Wright, Blockchain and the Law: The Rule of Code, Harvard University Press, 2018.
3. Yassine Maleh, Blockchain for Cybersecurity and Privacy, CRC Press 2020.
4. Massimo Ragnedda (Editor), Giuseppe Destefanis (Editor), Blockchain and Web 3.0: Social, Economic, and Technological Challenges, Routledge Studies in Science, Technology and Society, 2019.

**Online Resources:**

1. https://www.pwc.com/m1/en/publications/documents/establishing-blockchain-policy-pwc.pdf
2. https://www.lexology.com/library/detail.aspx?g=e2ccba98-930b-454d-8687-f402db0296f5
3. https://itif.org/publications/2019/04/30/policymakers-guide-blockchain
4. https://www.gsb.stanford.edu/sites/gsb/files/publication-pdf/study-blockchain-impact-moving-beyond-hype.pdf
5. https://www.meity.gov.in/writereaddata/files/National_BCT_Strategy.pdf

**20CSE04**

**FREE AND OPEN SOURCE TECHNOLOGIES**
**(Professional Elective – V)**

| | |
|---|---|
| Instruction | 3 Hours per week |
| Duration of End Examination | 3 Hours |
| Semester End Examination | 60 Marks |
| Continuous Internal Evaluation | 40 Marks |
| Credits | 3 |

**Pre-requisites:** Programming for problem solving, Object Oriented Programming.

**Course Objectives:** The objectives of this course are,

1. To familiarize the students with Open Source Technologies.
2. To expose students with OSS Projects, Advantages of Open Source.
3. To make the students understand the principles, methodologies, policies, licensing procedures and ethics of FOSS.

**Course Outcomes:** On Successful completion of this course, student will be able to,

1. Identify various FOSS tools, platforms, licensing procedures and development models, ethics.
2. Describe various FOSS projects, development models and project management.
3. Adapt to the usage of FOSS tools and technologies.
4. Distinguish between Proprietary and Open Source tools, development methods.
5. Practice Open Source principles, ethics, and models and to evaluate various Open Source projects like Linux, Apache, GIT, etc.

**UNIT - I**

**Introduction to Open Source**: Open Source, need and principles of OSS, Open Source Standards, Requirements for Software, OSS success, Free Software, Examples, Free Vs. Proprietary Software, Public Domain software, Historyof free software, Proprietary Vs Open Source, uses and advantages of Free and Open Source Software.

**UNIT - II**

**Principles and Open Source Methodology**: Open Source Initiatives, Open Standards Principles, Methodologies, Software freedom, Open Source Software Development, Licenses, Copyright vs. Copy left, Patents, zero marginal cost, income-generation Opportunities, Internationalization.

**UNIT - III**

**Case Studies**: Apache, BSD, Linux, Mozilla Firefox, Wikipedia, GIT, GNU CC, LibreOffice.

**UNIT - IV**

**Open Source Project**: Starting and Maintaining an Open Source Project, Open Source Hardware, Open Source Design, OpenSource Teaching (OST), Open Source Media.
How to create your own Licenses, Important FOSS Licenses (Apache, BSD, GPL and LGPL).

**UNIT - V**

**Open Source Ethics**: Open Source Government, Ethics of Open Source, Social and Financial Impact of Open Source Technology, Shared Software, Shared Source, Open Source as a Business Strategy.

**Text Books:**

1. Kailash Vadera, Bhavyesh Gandhi "Open Source Technology", University Science Press, 1st Edition, 2009.
2. Fadi P. Deek and James A. M. McHugh, "Open Source Technology and Policy", Cambridge University Press.

**Suggested Reading:**

1. Wale Soyinka, "Linux Administration- A beginner's Guide", Tata McGraw Hills.
2. Andrew M. St. Laurent, "Understanding Open Source and Free Software Licensing", O'Reilly Media.
3. Dan Woods, Gautam Guliani, "Open Source for the Enterprise", O'Reilly Media.
4. Bernard Golden, "Succeeding with Open Source", Addison-Wesley Professional.

5. Clay Shirky and Michael Cusumano, “Perspectives on Free and Open Source Software”, MIT press.

**Online Resources:**

1. https://fossee.in/
2. https://opensource.com
3. https://www.gnu.org/

**20CSE35**

**AUGMENTED REALITY AND VIRTUAL REALITY**
**(Professional Elective – V)**

| | |
|---|---|
| Instruction | 3 Hours per week |
| Duration of End Examination | 3 Hours |
| Semester End Examination | 60 Marks |
| Continuous Internal Evaluation | 40 Marks |
| Credits | 3 |

**Pre-requisites:** Programming for problem solving, Internet and web technologies, Machine Learning, Deep Learning.

**Course Objectives:** The objectives of this course are,

1. Explore the history of spatial computing and design interactions.
2. Understand the fundamental principles describing how hardware, computer vision algorithms functions.
3. Learn Virtual reality animation and 3D Art optimization.
4. Demonstrate Virtual reality.
5. Develop visualization tools.

**Course Outcomes:** On successful completion of the course, students will be able to,

1. Explain how the humans interact with computers.
2. Understand the design and implementation of the technologies for AR and VR systems.
3. Apply technical and creative approaches to make successful applications and experiences.
4. Design audio and video interaction paradigms.
5. Understand AR and VR best practices.
6. Apply VR/MR/AR in various fields in industry.

**UNIT - I**

**How Humans interact with Computers**: Introduction, modalities through the ages, types of common HCI modalities, new modalities, the current state of modalities for spatial computing devices, current controllers for immersive computing systems, hand tracking and hand pose recognition.

**Designing for Senses:** Envisioning a future, sensory technology explained, sensory design, five sensory principles, Adobe's AR story.

**UNIT - II**

**Virtual Reality for Art:** A more natural way of making 3D art, VR for animation.

**3D art optimization:** Introduction, draw calls, using VR tools for creating 3D art, acquiring 3D models vs making them from scratch.

**How augmented reality works:** a brief history of AR, how and why to select an AR platform, mapping, platforms, other development considerations, the AR cloud.

**UNIT - III**

**Virtual reality and augmented reality:** cross platform theory, The role of game engines, understanding 3D graphics, portability lessons from video game design, simplifying the controller input.

**Virtual reality toolkit:** open source framework for the community.

**UNIT - IV**

**Virtual Reality and Augmented Reality Development Best Practices:** Handling Locomotion in VR and AR, Effective Use of Audio in VR and AR, Common Interactions Paradigms.

**Character AI and Behaviors:** Introduction, behaviors, current practice: Reactive AI, more intelligence in the system, Deliberative AI, machine learning.

**UNIT - V**

**Use Cases in Embodied Reality**

**The virtual and augmented reality health technology ecosystem:** VR/AR health technology application design, case studies.

**Key Principles of AR and VR for Sports**

Virtual Reality Enterprise Training Use Cases and Ideal Training Scenarios.

**Text Books:**

1. Erin Pangilinan, Steve Lukas and Vasanth Mohan, “Creating Augmented & Virtual Realities: Theory and Practice for Next-Generation Spatial Computing”, 1st edition, O’REILLY, 2019.
2. Steve Aukstakalnis, “Practical Augmented Reality:A Guide to the Technologies, Applications, and Human Factors for AR and VR”, Pearson Education, 2017.
3. Schmalstieg and Hollerer, “Augmented Reality: Principles & Practice”, Pearson Education, 2016.
4. Paul Mealy, “Virtual & Augmented Reality”, John Wiley & Sons, 2018.

**Suggested Reading:**

1. Greengard, Samuel, "Virtual Reality", MIT Press, 2019
2. Robert Scoble & Shel Israel, "The Fourth Transformation: How Augmented Reality & Artificial Intelligence Will Change Everything", Patrick Brewster Press, 1st Edition, 2016.
3. Tony Parisi, "Learning Virtual Reality: Developing Immersive Experiences and Applications for Desktop, Web, and Mobile", O’Reilly Media; 1st Edition, 2015.
4. Tony Parisi, "Programming 3D Applications with HTML5 and WebGL: 3D Animation and Visualization for Web Pages", O'Reilly Media; 1 Edition, 2014.
5. Jos Dirksen, "Learning Three.js: The JavaScript 3D Library for WebGL", 2nd Revised Edition, Packt Publishing, 2015.
6. Jos Dirksen, "Learning Three.js : programming 3D animations and visualizations for the web with HTML5 and WebGL, 3rd Edition, 2018

**20EGMO4**

**GENDER SENSITIZATION**

| | |
|---|---|
| Instruction | 2 Hours per week |
| Duration of End Examination | 2 Hours |
| Semester End Examination | 50 Marks |
| Continuous Internal Evaluation | - |
| Credits | - |

**Course Objectives:** The objectives of this course are,

1. Sensibility regarding issues of gender in contemporary India.
2. A critical perspective on the socialization of men and women.
3. Popular debates on the politics and economics of work while helping them reflect critically on gender violence.

**Course Outcomes:** On Successful completion of this course, student will be able to,

1. Understand the difference between "Sex" and "Gender" and be able to explain socially constructed theories of identity.
2. Recognize shifting definitions of "Man" and "Women" in relation to evolving notions of "Masculinity" and "Femininity".
3. Appreciate women's contributions to society historically, culturally and politically.
4. Analyze the contemporary system of privilege and oppressions, with special attention to the ways gender intersects with race, class, sexuality, ethnicity, ability, religion, and nationality.
5. Demonstrate an understanding of personal life, the workplace, the community and active civic engagement through classroom learning.

**UNIT – I**
**Understanding Gender:**
**Gender:** Why Should We Study It? (*Towards a World of Equals*: Unit -1)
**Socialization:** Making Women, Making Men (*Towards a World of Equals*: Unit -2)
Introduction. Preparing for Womanhood. Growing up Male. First lessons in Caste. Different Masculinities.

**UNIT – II**
**Gender and Biology:**
**Missing Women:** Sex Selection and Its Consequences (*Towards a World of Equals*: Unit -4)
Declining Sex Ratio. Demographic Consequences.
**Gender Spectrum:** Beyond the Binary (*Towards a World of Equals*: Unit -10)
Two or Many? Struggles with Discrimination.

**UNIT – III**
**Gender and Labour:**
**Housework:** the Invisible Labour (*Towards a World of Equals*: Unit -3)
"My Mother doesn't Work." "Share the Load."
**Women's Work**: Its Politics and Economics (*Towards a World of Equals*: Unit -7)
Fact and Fiction. Unrecognized and Unaccounted work. Additional Reading: Wages and Conditions of Work.

**UNIT - IV**
**Issues of Violence**
**Sexual Harassment:** Say No! (*Towards a World of Equals*: Unit -6)
Sexual Harassment, not Eve-teasing- Coping with Everyday Harassment- Further Reading: "*Chupulu".*
**Domestic Violence:** Speaking Out (*Towards a World of Equals*: Unit -8)
Is Home a Safe Place? -When Women Unite [Film]. Rebuilding Lives. Additional Reading: New Forums for Justice.
Thinking about Sexual Violence (*Towards a World of Equals*: Unit -11)
Blaming the Victim-"I Fought for my Life…." - Additional Reading: The Caste Face of Violence.

**UNIT – V**
**Gender: Co - Existence**
**Just Relationships:** Being Together as Equals (*Towards a World of Equals*: Unit -12)
Mary Kom and Onler. Love and Acid just do not Mix. Love Letters. Mothers and Fathers.

Additional Reading: Rosa Parks-The Brave Heart.

**Text Books:**

1. Suneetha, Uma Bhrugubanda, DuggiralaVasanta, Rama Melkote,VasudhaNagaraj, AsmaRasheed, GoguShyamala, DeepaSreenivas and Susie Tharu "Towards a World of Equals: A Bilingual Textbook on Gender" published by Telugu Akademi, Hyderabad, Telangana State, 2015.

**Suggested Reading:**

1. Menon, Nivedita. Seeing like a Feminist. New Delhi: Zubaan-Penguin Books, 2012.
2. Abdulali Sohaila. "I Fought For My Life…and Won." Available online at: http://www.thealternative.in/lifestyle/i-fought-for-my-lifeand-won-sohaila-abdulal/

**Online Resources:**

1. https://aifs.gov.au/publications/gender-equality-and-violence-against-women/introduction
2. https://theconversation.com/achieving-gender-equality-in-india

**20CEM01**

## ENVIRONMENTAL SCIENCE

| | |
|---|---|
| Instruction | 2 Hours per week |
| Duration of End Examination | 2 Hours |
| Semester End Examination | 50 Marks |
| Continuous Internal Evaluation | - |
| Credits | - |

**Course Objectives:** The objectives of this course are,

1. Identify environmental problems arising due to over utilization of natural resources and understand the importance of use of renewable energy sources.
2. Become aware about the importance of eco system and interlinking of food chain.
3. Identify the importance of biodiversity in maintaining ecological balance.
4. Learn about various attributes of pollution management and waste management practices.
5. Contribute for capacity building of nation for arresting and/or managing environmental disasters.

**Course Outcomes:** On Successful completion of this course, student will be able to,

1. Identify the natural resources and realise the importance of water, food, forest, mineral, energy, land resources and affects of over utilization.
2. Understand the concept of ecosystems and realise the importance of interlinking of food chains.
3. Contribute for the conservation of bio-diversity.
4. Suggest suitable remedial measure for the problems of environmental pollution and contribute for the framing of legislation for protection of environment.
5. Follow the environmental ethics and contribute to the mitigation and management of environmental disasters.

**UNIT - I**

**Environmental Studies:** Definition, Scope and importance, need for public awareness.

**Natural resources:** Use and over utilization of Natural Resources - Water resources, Food resources, Forest resources, Mineral resources, Energy resources, Land resources.

**UNIT – II**

**Ecosystems:** Concept of an ecosystem, structure and function of an ecosystem, role of producers, consumers and decomposers, energy flow in an ecosystem, food chains, food webs, ecological pyramids, Nutrient cycling, Bio-geo chemical cycles, Terrestrial and Aquatic ecosystems.

**UNIT – III**

**Biodiversity:** Genetic, species and ecosystem biodiversity, Bio-geographical classification of India, India as a Mega diversity nation. Values of biodiversity, hot-spots of biodiversity, threats to biodiversity, endangered and endemic species of India, methods of conservation of biodiversity.

**UNIT – IV**

**Environmental Pollution:** Cause, effects and control measures of air pollution, water pollution, marine pollution, soil pollution, noise pollution and Solid waste management, nuclear hazards.

**Environmental Legislations:** Environment protection Act, Air, Water, Forest & Wild life Acts, issues involved in enforcement of environmental legislation, responsibilities of state and central pollution control boards.

**UNIT – V**

**Social Issues and the Environment:** Water conservation methods: Rain water harvesting and watershed management, Environmental ethics, Sustainable development and Climate change: Global warming, Ozone layer depletion, forest fires, and Contemporary issues.

**Text Books:**

1. Y. Anjaneyulu, “Introduction to Environmental Science”, B S Publications, 2004.
2. Suresh K. Dhameja, “Environmental Studies”, S. K. Kataria& Sons, 2009.

**Suggested Reading:**

1. C. S. Rao,” Environmental Pollution Control Engineering”, Wiley, 1991.
2. S. S. Dara, “A Text Book of Environmental Chemistry &Pollution Control”, S. Chand Limited, 2006

**20CIC12**

## PROJECT PART – 2

| | |
|---|---|
| Instruction | 8 Hours per week |
| Duration of End Examination | - |
| Semester End Examination | 100 Marks |
| Continuous Internal Evaluation | 100 Marks |
| Credits | 4 |

The objective of 'Project: Part Phase - 2' is to enable the student extend further the investigative study taken up, either fully theoretical/practical or involving both theoretical and practical work, under the guidance of a Supervisor from the Department alone or jointly with a Supervisor drawn from R&D laboratory/Industry. This is expected to provide a good training for the student(s) in R&D work and technical leadership. The assignment to normally include:

1. In depth study of the topic assigned;
2. Review and finalization of the Approach to the Problem relating to the assigned topic;
3. Preparing an Action Plan for conducting the investigation, including team work;
4. Detailed Analysis/Modelling/Simulation/Design/Problem Solving/Experiment as needed;
5. Final development of product/process, testing, results, conclusions and future directions;
6. Preparing a paper for Conference presentation/ Publication in Journals, if possible;
7. Preparing a Dissertation in the standard format for being evaluated by the Department.
8. Final Seminar presentation before Department Review Committee.

**Course Outcomes:** On Successful completion of this course, student will be able to,

1. Demonstrate a sound technical knowledge of their selected topic.
2. Design engineering solutions to complex problems utilizing a systematic approach.
3. Conduct investigations by using research-based knowledge and methods to provide valid conclusions.
4. Create/select/use modern tools for the modelling, prediction and understanding the limitation of complex engineering solutions.
5. Communicate with engineers and the community at large in written and oral forms.
6. Demonstrate the knowledge, skills and attitudes of a professional engineer.

| **Guidelines for awarding CIE (Max. Marks: 100)** | | |
|---|---|---|
| Evaluation by | Max. Marks | Evaluation Criteria / Parameter |
| Department Review Committee (DRC) | 10 | Review 1 |
| | 15 | Review 2 |
| | 25 | Report Submission |
| Supervisor | 10 | Regularity and Punctuality |
| | 10 | Work Progress |
| | 10 | Quality of the work which may lead to Publication |
| | 10 | Report Preparation |
| | 10 | Analytical/ Programming/Experimentation Skills |

| **Guidelines for awarding SEE (Max. Marks: 100)** | | |
|---|---|---|
| Evaluation by | Max. Marks | Evaluation Criteria/Parameter |
| External and Internal Examiners together | 20 | Power Point Presentation |
| | 40 | Thesis Evaluation |
| | 20 | Quality of the Project<br>• Innovation,<br>• Applications,<br>• Live Research Projects,<br>• Scope for further study,<br>• Applications to Society |
| | 20 | Viva-Vice |