Shri Vile Parle Kelavani Mandal's

# Dwarkadas J. Sanghvi College of Engineering

*(Autonomous College Affiliated to the University of Mumbai)*

## Course Structure and Syllabus

## of

## Final Year Engineering

## in

## Computer Engineering

Prepared by:- Board of Studies in Computer Engineering

Recommended by:- Academic Council of D. J. Sanghvi College of Engineering

Approved by:- Governing Body of D. J. Sanghvi College of Engineering

*Revision: 2 (2022)*

*With effect from the Academic Year: 2025-2026*

Shri Vile Parle Kelavani Mandal's
DWARKADAS J. SANGHVI COLLEGE OF ENGINEERING
(Autonomous College Affiliated to the University of Mumbai)
NAAC Accredited with "A" Grade (CGPA : 3.18)

**Scheme for Fourth Year B.Tech. Program in Computer Engineering : Semester VII (Autonomous)**
**(Academic Year 2025-2026)**

**Semester VII**

| Sr | Course Code | Course | Teaching Scheme | | | | Semester End Examination (A) | | | | | | Continuous Assessment (B) | | | | Aggregate (A+B) | Credits earned | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | Theory (hrs.) | Practical (hrs.) | Tutorial (hrs.) | Credits | Duration (Hrs) | Theory | Oral | Pract | Oral & Pract | End Sem Exam Total | Theory | Termwork | | CA Total | | | |
| 1 | DJS22CEC701 | Natural Language Processing | 3 | -- | -- | 3 | 2 | 65 | -- | -- | -- | 65 | 35 | -- | -- | 35 | 100 | 3 | 4 |
| | DJS22CEL701 | Natural Language Processing Laboratory | -- | 2 | -- | 1 | 2 | -- | 25 | -- | -- | 25 | -- | 10 | 25 | 25 | 50 | 1 | |
| 2 | DJS22CEC702 | Internet of Everything | 3 | -- | -- | 3 | 2 | 65 | -- | -- | -- | 65 | 35 | -- | -- | 35 | 100 | 3 | 4 |
| | DJS22CEL702 | Internet of Everything Laboratory | -- | 2 | -- | 1 | 2 | -- | 25 | -- | -- | 25 | -- | 10 | 25 | 25 | 50 | 1 | |
| 3@ | DJS22CEC7011 | Deep Learning | 3 | -- | -- | 3 | 2 | 65 | -- | -- | -- | 65 | 35 | -- | -- | 35 | 100 | 3 | 4 |
| | DJS22CEL7011 | Deep Learning Laboratory | -- | 2 | -- | 1 | 2 | -- | 25 | -- | -- | 25 | -- | 10 | 25 | 25 | 50 | 1 | |
| | DJS22CEC7012 | Software Architecture | 3 | -- | -- | 3 | 2 | 65 | -- | -- | -- | 65 | 35 | -- | -- | 35 | 100 | 3 | |
| | DJS22CEL7012 | Software Architecture Laboratory | -- | 2 | -- | 1 | 2 | -- | 25 | -- | -- | 25 | -- | 10 | 25 | 25 | 50 | 1 | |
| | DJS22CEC7013 | Predictive Modeling | 3 | -- | -- | 3 | 2 | 65 | -- | -- | -- | 65 | 35 | -- | -- | 35 | 100 | 3 | |
| | DJS22CEL7013 | Predictive Modeling Laboratory | -- | 2 | -- | 1 | 2 | -- | 25 | -- | -- | 25 | -- | 10 | 25 | 25 | 50 | 1 | |
| | DJS22CEC7014 | Software Testing and Quality Assuarance | 3 | -- | -- | 3 | 2 | 65 | -- | -- | -- | 65 | 35 | -- | -- | 35 | 100 | 3 | |
| | DJS22CEL7014 | Software Testing and Quality Assuarance Laboraotry | -- | 2 | -- | 1 | 2 | -- | 25 | -- | -- | 25 | -- | 10 | 25 | 25 | 50 | 1 | |
| 4 | DJS22CEL703 | Big Data and Cloud Infrastructure Laboratory | -- | 4 | -- | 2 | 2 | -- | 50 | -- | -- | 50 | -- | 10 | 50 | 50 | 100 | 2 | 2 |
| 5# | DJS22ILO7011 | Product Lifecycle Management (PLM) | 3 | -- | -- | 3 | 2 | 65 | -- | -- | -- | 65 | 35 | -- | -- | 35 | 100 | 3 | 3 |
| | DJS22ILO7012 | Management Information System (MIS) | 3 | -- | -- | 3 | 2 | 65 | -- | -- | -- | 65 | 35 | -- | -- | 35 | 100 | 3 | |
| | DJS22ILO7013 | Operations Research (OR) | 3 | -- | -- | 3 | 2 | 65 | -- | -- | -- | 65 | 35 | -- | -- | 35 | 100 | 3 | |
| | DJS22ILO7014 | Cyber Security and Laws (CSL) | 3 | -- | -- | 3 | 2 | 65 | -- | -- | -- | 65 | 35 | -- | -- | 35 | 100 | 3 | |
| | DJS22ILO7015 | Personal Finance Management (PFM) | 3 | -- | -- | 3 | 2 | 65 | -- | -- | -- | 65 | 35 | -- | -- | 35 | 100 | 3 | |
| | DJS22ILO7016 | Energy Audit and Management (EAM) | 3 | -- | -- | 3 | 2 | 65 | -- | -- | -- | 65 | 35 | -- | -- | 35 | 100 | 3 | |
| | DJS22ILO7017 | Disaster Management and Mitigation Measures (DMM) | 3 | -- | -- | 3 | 2 | 65 | -- | -- | -- | 65 | 35 | -- | -- | 35 | 100 | 3 | |
| | DJS22ILO7018 | Science of Wellbeing (SW) | 3 | -- | -- | 3 | 2 | 65 | -- | -- | -- | 65 | 35 | -- | -- | 35 | 100 | 3 | |
| | DJS22ILO7019 | Research Methodology (RM) | 3 | -- | -- | 3 | 2 | 65 | -- | -- | -- | 65 | 35 | -- | -- | 35 | 100 | 3 | |
| | DJS22ILO7020 | Public Systems and Policies (PSP) | 3 | -- | -- | 3 | 2 | 65 | -- | -- | -- | 65 | 35 | -- | -- | 35 | 100 | 3 | |
| 6 | DJS22CEP703 | Project Stage-I | -- | 4 | -- | 2 | 2 | -- | 50 | -- | -- | 50 | -- | 10 | 50 | 50 | 100 | 2 | 2 |
| | | **Total** | **12** | **14** | **0** | **19** | **12** | **260** | **175** | -- | -- | **435** | **140** | **40** | **175** | **315** | **750** | **19** | **19** |

@ Any 1 Elective Course

# Any 1 Institute Professional Elective

**Prepared by:**

**Name and Signatures (with date)**

**Checked By** **HoD**

**Name and Signatures (with date)** **Department of Computer Engineering** **Vice-Principal** **Principal**

Shri Vile Parle Kelavani Mandal's
DWARKADAS J. SANGHVI COLLEGE OF ENGINEERING
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**Scheme for Fourth Year B.Tech. Program in Computer Engineering : Semester VIII (Autonomous)**
**(Academic Year 2025-2026)**

**Semester VIII**

| Sr | Course Code | Course | Teaching Scheme | | | | Semester End Examination (A) | | | | | | Continuous Assessment (B) | | | | Aggregate (A+B) | Credits earned | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | Theory (hrs.) | Practical (hrs.) | Tutorial (hrs.) | Credits | Duration (Hrs) | Theory | Oral | Pract | Oral & Pract | End Sem Exam Total | Theory | Termwork | | CA Total | | | |
| 1 | DJS22CEC801 | Web Intelligence | 3 | -- | -- | 3 | 2 | 65 | -- | -- | -- | 65 | 35 | -- | -- | 35 | 100 | 3 | 4 |
| | DJS22CEL801 | Web Intelligence Laboratory | -- | 2 | -- | 1 | 2 | -- | 25 | -- | -- | 25 | -- | 10 | 25 | 25 | 50 | 1 | |
| 2 | DJS22CEC802 | Digital Signal Processing and Applications | 3 | -- | -- | 3 | 2 | 65 | -- | -- | -- | 65 | 35 | -- | -- | 35 | 100 | 3 | 4 |
| | DJS22CEL802 | Digital Signal Processing and Applications Laboratory | -- | 2 | -- | 1 | 2 | -- | 25 | -- | -- | 25 | -- | 10 | 25 | 25 | 50 | 1 | |
| 3@ | DJS22CEC8011 | Block Chain Technology | 3 | -- | -- | 3 | 2 | 65 | -- | -- | -- | 65 | 35 | -- | -- | 35 | 100 | 3 | 4 |
| | DJS22CEL8011 | Block Chain Technology Laboratory | -- | 2 | -- | 1 | 2 | -- | 25 | -- | -- | 25 | -- | 10 | 25 | 25 | 50 | 1 | |
| | DJS22CEC8012 | Social Network Analysis | 3 | -- | -- | 3 | 2 | 65 | -- | -- | -- | 65 | 35 | -- | -- | 35 | 100 | 3 | |
| | DJS22CEL8012 | Social Network Analysis Laboratory | -- | 2 | -- | 1 | 2 | -- | 25 | -- | -- | 25 | -- | 10 | 25 | 25 | 50 | 1 | |
| | DJS22CEC8013 | Design UI/UX | 3 | -- | -- | 3 | 2 | 65 | -- | -- | -- | 65 | 35 | -- | -- | 35 | 100 | 3 | |
| | DJS22CEL8013 | Design UI/UX Laboratory | -- | 2 | -- | 1 | 2 | -- | 25 | -- | -- | 25 | -- | 10 | 25 | 25 | 50 | 1 | |
| | DJS22CEC8014 | Ethical Hacking & Digital Forensics | 3 | -- | -- | 3 | 2 | 65 | -- | -- | -- | 65 | 35 | -- | -- | 35 | 100 | 3 | |
| | DJS22CEL8014 | Ethical Hacking & Digital Forensics Laboratory | -- | 2 | -- | 1 | 2 | -- | 25 | -- | -- | 25 | -- | 10 | 25 | 25 | 50 | 1 | |
| 4# | DJS22ILO8021 | Project Management (PM) | 3 | -- | -- | 3 | 2 | 65 | -- | -- | -- | 65 | 35 | -- | -- | 35 | 100 | 3 | 3 |
| | DJS22ILO8022 | Entrepreneurship Development and Management (EDM) | 3 | -- | -- | 3 | 2 | 65 | -- | -- | -- | 65 | 35 | -- | -- | 35 | 100 | 3 | |
| | DJS22ILO8023 | Corporate Social Responsibility (CSR) | 3 | -- | -- | 3 | 2 | 65 | -- | -- | -- | 65 | 35 | -- | -- | 35 | 100 | 3 | |
| | DJS22ILO8024 | Human Resource Management (HRM) | 3 | -- | -- | 3 | 2 | 65 | -- | -- | -- | 65 | 35 | -- | -- | 35 | 100 | 3 | |
| | DJS22ILO8025 | Corporate Finance Management (CFM) | 3 | -- | -- | 3 | 2 | 65 | -- | -- | -- | 65 | 35 | -- | -- | 35 | 100 | 3 | |
| | DJS22ILO8026 | Logistics and Supply Chain Management (LSCM) | 3 | -- | -- | 3 | 2 | 65 | -- | -- | -- | 65 | 35 | -- | -- | 35 | 100 | 3 | |
| | DJS22ILO8027 | IPR and Patenting (IPR) | 3 | -- | -- | 3 | 2 | 65 | -- | -- | -- | 65 | 35 | -- | -- | 35 | 100 | 3 | |
| | DJS22ILO8028 | Digital Marketing Management (DMM) | 3 | -- | -- | 3 | 2 | 65 | -- | -- | -- | 65 | 35 | -- | -- | 35 | 100 | 3 | |
| | DJS22ILO8029 | Environmental Management (EM) | 3 | -- | -- | 3 | 2 | 65 | -- | -- | -- | 65 | 35 | -- | -- | 35 | 100 | 3 | |
| | DJS22ILO8030 | Labour and Corporate Law (LCL) | 3 | -- | -- | 3 | 2 | 65 | -- | -- | -- | 65 | 35 | -- | -- | 35 | 100 | 3 | |
| 5 | DJS22CEP803 | Project Stage-II | -- | 10 | -- | 5 | 2 | -- | 100 | -- | -- | 100 | -- | 10 | 100 | 100 | 200 | 5 | 5 |
| 6 | DJS22A4 | Disaster Management and Preparedness | 2 | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | | -- | -- | -- | -- | -- |
| | | **Total** | **14** | **16** | **0** | **20** | **16** | **260** | **175** | **0** | **0** | **435** | **140** | **80** | **175** | **315** | **750** | **20** | **20** |

@ Any 1 Elective Course

# Any 1 Institute Professional Elective

**Prepared by:**

**Name and Signatures (with date)**

**Checked By** **HoD** **Vice-Principal** **Principal**

**Name and Signatures (with date)** **Department of Computer Engineering**

***Continuous Assessment (A):***

| Course | Assessment Tools | Marks | Time (hrs.) |
|---|---|---|---|
| Theory | a. One Term test (based on 40 % syllabus) | 20 | 1 |
| | b. Second Term test (next 40 % syllabus) / presentation / assignment / course project / group discussion / any other. | 15 | 1 |
| | Total marks (a + b) | 35 | -- |
| Audit course | Performance in the assignments / quiz / power point presentation / poster presentation / group project / any other tool. | -- | As applicable |
| Laboratory | Performance in the laboratory and documentation. | As per the scheme | |
| Tutorial | Performance in each tutorial & / assignment. | | |

The final certification and acceptance of term work will be subject to satisfactory performance upon fulfilling minimum passing criteria in the term work / completion of audit course.

***Semester End Assessment (B):***

| Course | Assessment Tools | Marks | Time (hrs.) |
|---|---|---|---|
| Theory | Written paper based on the entire syllabus. | 65 | 2 |
| Oral | Questions based on the entire syllabus. | 25 | As applicable |
| Practical | Performance of the practical assigned during the examination and the output / results obtained. | 25 | 2 |
| Oral & Practical | Project based courses - Performance of the practical assigned during the examination and the output / results obtained.<br>Based on the practical performed during the examination and on the entire syllabus. | As per the scheme | 2 |

Prepared by Checked by Head of the Department Principal

| Program: Computer Engineering | Final Year B.Tech. | Semester: VII |
|---|---|---|
| Course: Natural Language Processing (DJS22CEC701) | | |
| Course: Natural Language Processing Laboratory (DJS22CEL701) | | |

**Pre-requisite:** Finite Automata, Machine Learning, Probability Mathematics

**Course Objectives:**

1. Understand the theoretical foundations and basic principles of Natural Language Processing.
2. Apply preprocessing techniques, syntactic and semantic analysis to process and analyze text data.
3. Explore statistical and machine learning methods for solving NLP tasks such as classification, tagging, and translation.
4. Design and implement NLP applications using modern tools and frameworks with consideration of ethical issues.

**Outcomes:** On successful completion of course, learner will be able to:

1. Understand stages of NLP and apply morphological analysis techniques on any real world text.
2. Apply appropriate techniques such as tokenization, POS tagging and syntactic parsing to real-world text.
3. Apply feature extraction, word sense disambiguation and similarity for semantic analysis of text.
4. Apply pragmatics and discourse segmentation to understand structure and context of text.
5. Analyze advanced language models for various NLP applications.

| Natural Language Processing (DJS22CEC701) | | |
|---|---|---|
| **Unit** | **Description** | **Duration** |
| **1** | **Introduction:**<br>History Of NLP, Generic NLP System, Levels Of NLP, Knowledge in Speech and Language Processing, Ambiguity in Natural Language, Challenges Of NLP, Applications of NLP | 03 |
| **2** | **Word Level Analysis:**<br>Regular Expression, Finite Automata, Finite State Transducers (FST), Morphology Analysis: Survey of English Morphology, Inflectional Morphology & Derivational Morphology, Lemmatization, Morphological Parsing With FST, Lexicon Free FST Porter Stemmer, Word and Sentence Tokenization, Detection and Correction of Errors, Minimum Edit Distance with Backtracing. | 08 |

| | | |
|---|---|---|
| | N – Grams, Unigrams/Bigrams Language Models, Corpora, Computing the Probability of Word Sequence, Training and Testing.<br><br>Perplexity And Entropy: Smoothing and Backup, Zipf's Law, Add One Smoothing, Witten-Bell Discounting, Good Turing Discounting, Back Off Methods, Class Based Models, Google N-Gram Release. | |
| **3** | **Syntax Analysis:**<br><br>Part-Of-Speech Tagging (POS) - Open and Closed Words. Tag Set for English (Penn Treebank), Rule Based POS Tagging, Transformation Based Tagging, Stochastic POS Tagging and Issues –Multiple Tags & Words, Unknown Words.<br><br>Hidden Markov Model (HMM), Maximum Entropy, And Conditional Random Field (CRF).<br><br>Context-Free Grammars, Grammar rules for English, Treebanks, Normal Forms for grammar<br><br>Parsing with CFG: Top-down parsing, Bottom-up parsing, Basic top-down parser,<br><br>Problems with the Basic Top-down Parser: Left Recursion, Ambiguity<br><br>Earley parser, Probabilistic CFG, Probabilistic CYK | 08 |
| **4** | **Semantic Analysis:**<br><br>Lexical Semantics, Attachment for Fragment of English- Sentences, Noun Phrases, Verb Phrases, Prepositional Phrases, Relations Among Lexemes & Their Senses: Homonymy, Polysemy, Synonymy, Hyponymy, WordNet,<br><br>**Feature Extraction and Word Embeddings:**<br><br>Vector semantics, Traditional Word Embedding: TF-IDF<br><br>Static Word Embedding: Word2Vec - Continuous Bag of Words (CBOW), Skip-gram, GloVe<br><br>Word Sense Disambiguation: WSD using Indirect approaches: selectional restriction-based disambiguation, selectional association-based disambiguation, WSD using Direct approaches: Supervised, Unsupervised, Bootstrapping methods, Dictionary based: Lesk algorithm; Thesaurus based: Walker's Algorithm; Word Sense Similarity using Thesaurus and Distributional methods. | 06 |
| **5** | **Pragmatics & Discourse Segmentation:**<br><br>Introduction to Discourse, Cohesion and Coherence in Discourse, Discourse connectives, Reference Resolution, Reference Phenomena, Features for | 06 |

| | | |
|---|---|---|
| | Pronominal Anaphora Resolution, Anaphora Resolution: Hobbs algorithm, Centering algorithm, Log-linear model, Co-reference resolution, Evaluation of Co-reference resolution. | |
| **6** | **Large Language models and NLP applications:**<br><br>**Introduction to Large Language models:**<br><br>Types of LLMs: Auto-regressive language models – GPT3; Transformer-based models – BERT, RoBERTa (Robustly Optimized BERT Pretraining Approach); Encoder-decoder models – MarianMT (Marian Neural Machine Translation), T5; Pre-trained and fine-tuned models – ELECTRA; Multilingual models – XLM (Cross-lingual Language Model)<br><br>**NLP applications:**<br><br>Machine Translation, Information Retrieval, Question Answers System, Categorization, Summarization, Sentiment Analysis, Named Entity Recognition. | 05 |

**Books Recommended:**

**Textbook:**

1. Speech and Language Processing, 2nd Edition, Jurafsky and Martin, Prentice Hall; (January 26, 2000), ISBN: 0130950696
2. Tanmoy Chakraborty, Introduction to Large Language Models, Generative AI for Text. Wiley, 25th Dec 2024
3. Denis Rothman, Transformers for Natural Language Processing, Packt Publishing, 2nd Edition, 2022

**Reference Books:**

1. Jurafsky, D., & Martin, J. H. (2025). Speech and Language Processing: An Introduction to Natural Language Processing, Computational Linguistics, and Speech Recognition with Language Models (3rd ed., draft), Self-published
2. Manning and Schutze, "Statistical Natural Language Processing", MIT Press; 1st edition (June 18, 1999), ISBN: 0262133601
3. James Allen. Natural Language Understanding. The Benajmins/Cummings Publishing Company Inc. 1994. ISBN 0-8053-0334-0.
4. Tom Mitchell. Machine Learning. McGraw Hill, 1997. ISBN 0070428077

5. Cover, T. M. and J. A. Thomas: Elements of Information Theory. Wiley. 1991. ISBN 0-471-06259-6.
6. Charniak, E.: Statistical Language Learning. The MIT Press. 1996. ISBN 0-262-53141-0.
7. Jelinek, F.: Statistical Methods for Speech Recognition. The MIT Press. 1998. ISBN 0-262-10066-5.
8. Sinan Ozdemir. Quick Start Guide to Large Language Models: Strategies and Best Practices for Using ChatGPT and Other LLMs. Addison-Wesely Professional; 1st Edition 2023

***Suggested List of Experiments:***

| **Natural Language Processing Laboratory (DJS22CEL701)** | |
|---|---|
| **Sr. No.** | **Suggested Practical** |
| 1 | Study of recent NLP applications |
| 2 | Performing Preprocessing steps in NLP |
| 3 | Performing Word-level analysis using bi-gram and tri-gram models. |
| 4 | Performing POS tagging using HMM. |
| 5 | Implementing parse trees from a given sentence and corpus. |
| 6 | Performing Morphological analysis to identify morphemes for regional language. |
| 7 | Word Sense Disambiguation: Identify the word senses using "synset" in NLTK |
| 8 | Implement Word2Vec, GloVe |
| 9 | Any application of NLP : Spell Check, Autocorrect, plagiarism detection, sentiment analysis, sarcasm detection or text analytics in any domain |

Prepared by Checked by Head of the Department Principal

| Program: Computer Engineering | Final Year B.Tech. | Semester: VII |
|---|---|---|
| Course: Internet of Everything (DJS22CEC702) | | |
| Course: Internet of Everything Laboratory (DJS22CEL702) | | |

**Pre-requisite:** Basics of python programming, Computer Network

**Course Objectives:**

1. Understand the core concepts of the Internet of Things and explore the associated challenges.
2. Explore the design and functionality of IoT/IoE devices, their system architecture, and connectivity technologies.
3. Analyze the importance of data in IoT, including structured/unstructured data and cloud integration for analytics.
4. Gain knowledge of sensors, actuators, Arduino, and Raspberry Pi for developing IoT-based solutions.
5. Study various IoT communication and routing protocols essential for data transfer in IoT environments.
6. Develop skills to relate the IoT technologies for practical IoT applications.

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

1. Describe the fundamentals, evolution, and ecosystem of IoT and differentiate between IoT, IoE, and M2M.
2. Demonstrate an understanding of IoT devices, software, system architecture, and communication models.
3. Analyze the importance of data in IoT, including structured/unstructured data and cloud integration for analytics.
4. Apply knowledge of sensors, actuators, Arduino and Raspberry Pi for developing IoT-based solutions.
5. Identify and explain various IoT communication and routing protocols for efficient data transfer.
6. Analyze and evaluate IoT applications across different sectors through case studies and propose suitable solutions.

| Internet of Everything (DJS22CEC702) | | |
|---|---|---|
| **Unit** | **Description** | **Duration** |
| **1** | **Internet Evolution**<br>Introduction – Overview of IoT, IoT Evolution, Characteristics of IoT, IoT Stack, Application areas of IoT, IoT Challenges.<br>M2M Technology, Understanding IoE-IoE Pyramids, IoT 2.0. IoE Benefits, Disambiguation of IoT vs IoE<br>vs M2M vs others. | 06 |

| | | |
|---|---|---|
| **2** | **IoE Devices**<br>Introduction – IoT Devices, IoT Software, IoT Device Management Platform and Software, IoT System Architecture, IoT connectivity technologies, Physical design of IoT, Logical design of IoT- IoT Communication model, IoT Levels and Deployment Templates. | 06 |
| **3** | **Pillars of IoE**<br>Internet of everything Devices –Introduction, common devices, connecting devices, sensors, RFID in Internet of Things.<br>Data as IoE Piller-Introduction, structured and unstructured data, cloud data, virtualization, data center, big data integration, IoT analytics: from data collection to deployment and operationalization. | 06 |
| **4** | **Elements of IoT**<br>Introduction to Sensors, Actuators, Transducers and their types.<br>Arduino- Pin configuration and architecture, Device and platform features, Concept of digital and analog ports, Familiarizing with Arduino Interfacing Board and its types.<br>Raspberry Pi - Introduction, Comparison of various Rpi Models, Pin Description of Raspberry Pi, On-board components of Rpi. | 08 |
| **5** | **IoT Communication Protocols**<br>IoT Protocols- MQTT, XMPP, DDS, AMQP, COAP, REST, IPv6, 6LoWPAN.<br>IoT Routing Protocols, Data-centric and Flat-Architecture Protocols, Flooding, Gossiping, Sensor Protocols for Information via Negotiation (SPIN), SPIN PP, SPIN EC (Energy Conserve), SPIN BC (Broadcast),SPIN RL(Reliable), LEACH Protocol. | 08 |
| **6** | **IoT Case Studies**<br>IoT Case Studies based on Home Automation, Cities, Environment, Transportation, Retail, Logistics, Agriculture, Industry, Healthcare. | 05 |

**Text Books:**

Dr. Prateek Jain and Dr. Archana Sharma, "Transitioning to Internet of Everything (IoE) Key Technology Application and Recent Trends", BFC Publications, 2024.

Arshdeep Bahga and Vijay Madisetti, "Internet of Things: A Hands-On Approach", 1st Edition, Universities Press, 2016.

**Reference Book:**

Hang Song, "Internet of Everything: Key Technologies, Practical Applications and Security of IoT", World Scientific, Tsinghua University Press, 2023.

**Online Resources:**

**Coursera**

Introduction to Internet of Things by Prof. Rajbabu Velmurugan

https://www.coursera.org/learn/introduction-to-internet-of-things

**NPTEL**

Introduction To Internet of Things By Prof. Sudip Misra, IIT Kharagpur

https://onlinecourses.nptel.ac.in/noc22_cs53/preview

***Suggested List of Experiments:***

| **Internet of Everything Laboratory (DJS22CEL702)** | |
|---|---|
| **Sr. No.** | **Suggested Practical** |
| 1 | Interfacing with LED |
| 2 | Traffic Simulation |
| 3 | Interfacing with IR/PIR Sensor |
| 4 | Interfacing with LDR Sensor |
| 5 | Interfacing with Ultrasonic Sensor |
| 6 | Interfacing with Smoke Sensor |
| 7 | Interfacing with 7 Segment Display |
| 8 | Interfacing with DHT11 Sensor |
| 9 | Interfacing with Servo Motor |
| 10 | Interfacing with Soil Moisture Sensor |

Prepared by Checked by Head of the Department Principal

| Program: Computer Engineering | Final Year B.Tech. | Semester: VII |
|---|---|---|
| Course: Deep Learning (DJS22CEC7011) | | |
| Course: Deep Learning Laboratory (DJS22CEL7011) | | |

**Pre-requisite:** Artificial Intelligence, Machine Learning

**Course Objective:**

1. To understand Hyper parameter Tuning.
2. To explore Deep Learning Techniques with different learning strategies.
3. To design Deep Learning Models for real time applications.

**Course Outcomes (CO): On successful completion of course, learner will be able to:**

1. Understand and Apply Hyper parameters Tuning.
2. Create and interpret deep learning Models.
3. Investigate suitable deep learning models for various applications.

| Deep Learning (DJS22CEC7011) | | |
|---|---|---|
| **Unit** | **Description** | **Duration** |
| **1** | **Introduction to Deep Learning:**<br>Overview of Neural Network, Deep learning and human brain, Why is Deep Learning taking off?, Deep Learning applications<br>Overview of Tools: Torch, TensorFlow, Keras | 04 |
| **2** | **Convolutional Neural Network:**<br>Introduction to CNNs, Kernel filter, Principles behind CNNs, Multiple Filters, CNN applications<br>**ConvNet Architectures**<br>Discussions on famous convnet architectures: AlexNet, VGG, GoogLeNet, ResNet | 09 |
| **3** | **Hyperparameter Tuning, Batch Normalization**<br>Tuning Process, Using an Appropriate Scale to pick Hyperparameters, Hyperparameters Tuning in Practice: Pandas vs. Caviar, Normalizing Activations in a Network, Fitting Batch Norm into a Neural Network, why does Batch Norm work, Batch Norm at Test Time | 05 |

| | | |
|---|---|---|
| **4** | **Sequential models:**<br>Introduction to Sequence Models and RNNs, Recurrent Neural Network Model, Backpropagation Through Time, Different Types of RNNs: Unfolded RNNs, Seq2Seq RNNs, Long Short-Term Memory (LSTM), Bidirectional RNN, Vanishing Gradients with RNNs, Gated Recurrent Unit (GRU), RNN applications, Sequence models and attention mechanism, Attention over Images, Hierarchical Attention | 10 |
| **5** | **Adversarial Networks**<br>Introduction to adversarial Networks, Auto encoders (standard, denoising, contractive, etc.), Variational Auto encoders, Generative Adversarial Networks, Diffusion Models: Basics of Diffusion models, Advantages of over GANs, Popular Diffusion tools: Stable Diffusion, DALL-E, Midjourney, Applications of Adversarial Networks | 10 |
| **6** | **Deep Learning Case Studies:** Image Processing, Natural Language Processing, Speech Recognition, Video Analytics | 04 |

**Books Recommended:**

**Text Book**

1. Goodfellow, I., Bengio,Y., and Courville, A., Deep Learning, MIT Press, 2016.
2. Umberto Michelucci, Advanced Applied Deep Learning: Convolutional Neural Networks and Object Detection, 2019.
3. Michael Nielsen (Goodreads Author), "Neural Networks and Deep Learning",2015
4. TensorFlow 1.x Deep Learning Cookbook, Gulli and Kapoor, Packt, 2017.

**Reference Books**

1. Yegnanarayana, B., Artificial Neural Networks PHI Learning Pvt. Ltd, 2009.
2. Satish Kumar, Neural Networks: A Classroom Approach, Tata McGraw-Hill Education, 2004.
3. Neural Networks: A Systematic Introduction, Raúl Rojas, 1996.
4. David Foster, Generative Deep Learning: Teaching Machines to Paint, Write, Compose, and Play O"Relly, 2019.
5. Maxim Lapan, Deep Reinforcement Learning HandsOn: Apply modern RL methods, with deep Q-networks, value iteration, policy gradients, TRPO, AlphaGo Zero and more, Packt 2018.
6. Santanu Pattanaya K, Pro Deep Learning with TensorFlow A Mathematical Approach to Advanced Artificial Intelligence in Python, APress, 2017.

**Online Resources**

1. NPTEL:
   Deep Learning, By Prof. Prabir Kumar Biswas, IIT Kharagpur
   https://onlinecourses.nptel.ac.in/noc22_cs22/preview
2. Coursera:
   Deep Learning Specialization, By DeepLearning.AI
   https://www.coursera.org/specializations/deep-learning#courses

***Suggested List of Experiments:***

| **Deep Learning Laboratory (DJS22CEL7011)** | |
|---|---|
| **Sr. No.** | **Suggested Practical** |
| 1 | Building own Neural Network from scratch. |
| 2 | To implement EBPTA algorithm. |
| 3 | Understanding ANN using Pytorch/Tensor Flow. |
| 4 | Visualizing Convolutional Neural Network using Pytorch/Tensor Flow. |
| 5 | Object detection using RNN using Pytorch/Tensor Flow. |
| 6 | Students are supposed to complete any one mini project not limited to following list of projects.<br>1. Sequence Prediction<br>2. Object Detection<br>3. Traffic Sign Classification<br>4. Automatic Music Generation<br>5. Music Genre Classification<br>6. Text Summarizer<br>7. Gender and Age Detection Using Voice<br>8. Chatbot Using Deep Learning<br>9. Neural Style Transfer<br>10. Face Aging<br>11. Driver Drowsiness Detection<br>12. Language Translator<br>13. Image Reconstruction |

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| Program: Computer Engineering | Final Year B.Tech. | Semester: VII |
|---|---|---|
| Course: Software Architecture (DJS22CEC7012) | | |
| Course: Software Architecture Laboratory (DJS22CEL7012) | | |

**Pre-requisite:** Object Oriented Concepts, Software Engineering

**Course Objectives:** To learn and use the Software Architecture with modern tools and techniques.

**Outcomes:** students will be able to:
1. Specify and evaluate software architectures.
2. Select and use appropriate architectural styles.
3. Select and use appropriate software design patterns.
4. Understand and perform a design review with agile project architecture.

**Detailed Syllabus: (unit wise)**

| Unit | Description | Duration |
|---|---|---|
| 1 | **Basic Concepts:**<br>Concepts of Software Architecture, Models, Processes, Stakeholders<br>**Designing Architectures:**<br>The Design Process, Architectural Conception.<br>Refined Experience in Action: Styles and Architectural Patterns, Architectural Conception in Absence of Experience. | 05 |
| 2 | **Connectors:**<br>Connectors in Action: A Motivating Example, Connector Foundations, Connector Roles, Connector Types and Their Variation Dimensions, Example Connectors. | 06 |
| 3 | **Modeling:**<br>Modeling Concepts, Ambiguity, Accuracy, and Precision,<br>Complex Modeling: Mixed Content and Multiple Views, Evaluating Modeling Techniques, Specific Modeling Techniques. | 04 |
| 4 | **Analysis:**<br>Analysis Goals, Scope of Analysis, Architectural Concern being Analyzed, Level of Formality of Architectural Models, Type of Analysis, Analysis Techniques. | 08 |
| 5 | **Implementation and Deployment**<br>Concepts, Existing Frameworks, Software Architecture and Deployment, Software Architecture and Mobility.<br>**Conventional Architectural styles:**<br>Pipes and Filters, Event- based, Implicit Invocation, Layered systems, Repositories, Interpreters, Process control. | 08 |

| | | |
|---|---|---|
| **6** | **Agile methodology software architecture:** Fundamentals of Agile Architecting: Object Orientation Achieving the Vision, Shortcomings of the Models, DCI as a new Paradigm, DCI and Architecture Refactoring Software Architecture: Code Refactoring, Refactoring to Patterns Managing Software Architecture in Agile Projects. | **07** |
| **7** | **Analyzing Architectures:** The ATAM, The CBAM, The World Wide Web. **Moving from one System to Many:** Software Product Lines, CelsiusTech (Case Study), J2EE/EJB (Case Study), Service-Oriented Architecture (SOA) (Case Study). | **04** |

**Books Recommended:**

***Text Books:***

1. Software Architecture: Foundations, Theory, and Practiceî by Richard N. Taylor, Nenad Medvidovic, Eric Dashofy , ISBN: 978-0-470-16774-8
2. M. Shaw: Software Architecture Perspectives on an Emerging Discipline, Prentice- Hall.
3. Len Bass, Paul Clements, Rick Kazman: Software Architecture in Practice, Pearson.
4. Agile Software Architecture by Muhammad Ali Babar, Alan W. Brown, Ivan Mistrik,Publisher(s): Morgan Kaufmann, ISBN: 9780124078857

***Reference Books:***

1. Pattern Oriented Software Architectureî by Frank Buchnan etal, Wiley India.
2. The Art of Software Architectureî by Stephen T. Albin

***Suggested List of Experiments:***

| Sr. No. | Title of Experiments |
|---|---|
| 1. | Modeling using xADL |
| 2. | Visualization using xADL 2.0 |
| 3. | Integrate software components using a middleware |
| 4. | Use middleware to implement connectors |
| 5. | Wrapper to connect two applications with different architectures |
| 6. | Creating and analyzing web service |
| 7. | Domain specific architecture development. |
| 8. | Case Study on Agile Methodology Architecture |
| 9. | Case Study on Service-Oriented Architecture (SOA) |

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| Program: Computer Engineering | Final Year B.Tech. | Semester: VII |
|---|---|---|
| **Course: Predictive Modelling (DJS22CEC7013)** | | |
| **Course: Predictive Modelling Laboratory (DJS22CEL7013)** | | |

**Prerequisite:** Data Mining, Python programming

**Objectives:**

1. To learn, how to develop models to predict categorical and continuous outcomes.

2. To advice on when and how to use each model. Also learn how to combine two or more models to improve prediction and use the predictive analytics to aid in decision making.

**Outcomes:** On completion of the course, learner will be able to:

1. Understand the process of formulating business objectives, data selection/collection, preparation and process to successfully design, build, evaluate and implement predictive models for various business applications.
2. Apply regression, neural network, decision tree in predictive modeling.
3. Model assessment and compare the underlying predictive modeling techniques.

| **Predictive Modelling (DJS22CEC7013)** | | |
|---|---|---|
| **Unit** | **Description** | **Hours** |
| **1** | Introduction: Identifying the business problem, Designing the model, Preparing the data, Selecting features, How to choose a model, Interpreting the output, Sharing the output. | 5 |
| **2** | Working with Data: Understanding and Preparing the Data, Retrieving data from different sources, Visualizing the data and finding the relationship among the data variables, Handling the missing data, Applying distributions and summary statistics. Applying Segmentation, Sampling, Outlier analysis, Aggregating the data. | 5 |
| **3** | Prediction Methods and Models: Mathematical Methods, Distance Methods, Logic Methods, Modern heuristic Methods, Additional considerations, Evaluation of Models, Hybrid Systems for prediction, CRISP-Data Mining, Applying to Marketing Campaigns, Manufacturing, Investment Strategies, Emergency Response Services, Credit Card Fraud Developing and Using Models: Model selection for data, Model development, Model evaluation and validation, comparing and combining models, Deploying Model, Assessing Model Performance, Updating a model. | 8 |
| **4** | Building Decision Tree model to predict Response and Risk Overview of Decision tree and development of decision tree, cultivating decision trees, optimizing the complexity of decision trees, understanding additional diagnostic tools. | 6 |

| | | |
|---|---|---|
| **5** | Predictive Modeling with Neural Networks and Regression: Introduction to neural network models, Neural Network model to predict loss frequency in Auto Insurance, Comparison of alternative built in architectures of the Neural Network node. Regression: Regression using exploratory data analysis, producing correlations, understanding the concepts of multiple regression, building and interpreting models, describing all regression techniques, exploring stepwise selection techniques, Logistic regression for predictive response to a mail Campaign, Regression for a continuous target. | 10 |
| **6** | Comparing and combination of different Models: Introduction, Models for Binary targets, Models for Ordinal Targets, Comparison of all three accidents risk models, Boosting and combining predictive models, comparing the models. | 5 |

**Books Recommended:**

**Text Books:**

1. "Applied Predictive Analytics: Principles and Techniques for the Professional Data Analyst" by Dean Abbott.
2. “Adaptive Business Intelligence”, Zbigniew Michalewicz, Martin Schmidt, Matthew Michalewicz, Constantin Chiriac Springer Publication
3. Applied Analytics Using SAS Enterprise Miner

**Reference Books:**

1. Predictive Modeling with SAS Enterprise Miner: Practical Solutions for Business Applications, Second Edition
2. Predictive Modeling Applications in Actuarial Science: Volume 2, Case Studies in Insurance (International Series on Actuarial Science). by Edward W. Frees (Editor), Glenn Meyers (Editor), Richard A. Derrig (Editor), By Cambridge press.
3. “Machine Learning, A probabilistic perspective”, Kevin P Murphy, IGHT Press Aug 2012.
4. Predictive & Advanced Analytics (IBM ICE Publication)

**Online Resources**

1. Coursera:
Regression Modeling Fundamentals
https://www.coursera.org/learn/regression-modeling-sas

2. Coursera:
“Predictive Modeling with Logistic Regression using SAS”
https://www.coursera.org/learn/sas-predictive-modeling-using-logistic-regression

**Suggested List of Experiments:**

| **Predictive Modelling Laboratory (DJS22CEL7013)** | |
|---|---|
| **Sr. No.** | **Suggested Practical** |
| **1** | Case Study: Identify types of data, Data cleansing and interpreting the data from data visualization |
| **2** | Relationship between attributes: Covariance, Correlation Coefficient, Chi Square, Measure of Distribution (Skewness and Kurtosis), Box and Whisker Plot (Box Plot and its parts. Using Box Plots to compare distribution) and other statistical graphs. |
| **3** | Applying statistical distributions and outlier analysis on data to summarize the data. |
| **4** | Applications of Time Series in financial markets to find Moving Averages, Trend, Cyclical and Seasonal analysis. |
| **5** | Case study to demonstrate and build a Decision tree. |
| **6** | Demonstration of Predictive Modelling using Regression. |
| **7** | Demonstration of Predictive modelling using Neural Network. |
| **8** | Mini Project |

Any other practical covering the syllabus topics and subtopics can be conducted.

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| Program: Computer Engineering | Final Year B.Tech. | Semester: VII |
|---|---|---|
| **Course: Software Testing and Quality Assurance (DJS22CEC7014)** | | |
| **Course: Software Testing and Quality Assurance Laboratory (DJS22CEL7014)** | | |

**Pre-requisite: Software Engineering**

**Course Objectives:** This course equips the students with a solid understanding of:

1. Practices that support the production of quality software
2. Software testing techniques and quality models
3. Life-cycle models for requirements, defects, test cases, and test results
4. Process models for units, integration, system, and acceptance testing

**Outcomes:** On successful completion of course, learner will be able to:

1. Use various Software testing techniques to produce quality software.
2. Identify Learn Life-cycle models for requirements.
3. Design process models for units, integration, system, and acceptance testing
4. Identify various Quality Models.

| Software Testing and Quality Assurance (DJS22CEC7014) | | |
|---|---|---|
| **Unit** | **Description** | **Duration** |
| **1** | **Introduction:** Software Quality, Role of testing, verification and validation, objectives and issues of testing, testing activities and levels, Sources of Information for Test Case Selection, Introduction to Testing techniques, Introduction to Testing strategies, Test Planning and Design, Monitoring and Measuring Test Execution, Test Tools and Automation, Test Team Organization and Management. | **04** |
| **2** | **System testing techniques and strategies:**<br>**Unit Testing:** Concept of Unit Testing, Static Unit Testing**,** Defect Prevention, Dynamic Unit Testing**,** Mutation Testing**,** Debugging**,** Unit Testing in eXtreme Programming.<br>**System Integration Testing:** Concept of Integration Testing, Different Types of Interfaces and Interface Errors, Granularity of System Integration Testing, System Integration Techniques, Software and Hardware Integration, Test Plan for System Integration, Off-the-Shelf Component Integration, Off- the-Shelf Component Testing, Built-in Testing.<br>**Acceptance Testing:** Types of Acceptance Testing, Acceptance Criteria, Selection of Acceptance Criteria, Acceptance Test Plan, Acceptance Test Execution, Acceptance Test Report, Acceptance Testing in eXtreme Programming. | **08** |

| | | |
|---|---|---|
| **3** | **Control Flow Testing:** Outline of Control Flow Testing, Control Flow Graph, Paths in a Control Flow Graph, Path Selection Criteria, All-Path Coverage Criterion, Statement Coverage Criterion, Branch Coverage Criterion, Predicate Coverage Criterion, Generating Test Input, Examples of Test Data Selection.<br>**Data Flow Testing:** Data Flow Anomaly, Overview of Dynamic Data Flow Testing, Data Flow Graph, Data Flow Terms, Data Flow Testing Criteria, Comparison of Data Flow Test Selection Criteria, Feasible Paths and Test Selection Criteria, Comparison of Testing Techniques. | **10** |
| **4** | **System Test Categories:** Basic Tests, Functionality Tests, Robustness Tests, Interoperability Tests, Performance Tests, Scalability Tests, Stress Tests, Load and Stability Tests, Reliability Tests, Regression Tests, Documentation Tests. **System Test Execution:** Preparedness to Start System Testing, Metrics for Tracking System Test, Metrics for Monitoring Test Execution, Beta Testing, First Customer Shipment, System Test Report, Product Sustaining, Measuring Test Effectiveness.<br>**Functional Testing:** Equivalence Class Partitioning, Boundary Value Analysis, Decision Tables, Random Testing, Error Guessing, Category Partition.<br>**System Test Design:** Test Design Factors**,** Requirement Identification, Characteristics of Testable Requirements, Test Design Preparedness Metrics, Test Case Design Effectiveness. | **10** |
| **5** | **System Test Planning and Automation:** Structure of a System Test Plan, Introduction and Feature Description, Assumptions, Test Approach, Test Suite Structure, Test Environment, Test Execution Strategy, Test Effort Estimation, Scheduling and Test Milestones, System Test Automation, Evaluation and Selection of Test Automation Tools, Test Selection Guidelines for Automation, Characteristics of Automated Test Cases, Structure of an Automated Test Case, Test Automation Infrastructure | **06** |
| **6** | **Software Quality:** Five Views of Software Quality, McCall‟s Quality Factors and Criteria, Quality Factors Quality Criteria, Relationship between Quality Factors and Criteria, Quality Metrics, ISO 9126 Quality Characteristics, ISO 9000:2000 Software Quality Standard ISO 9000:2000 Fundamentals, ISO 9001:2000 Requirements | **04** |

**Books Recommended:**

***Text books:***

1. “Software Testing and Quality Assurance: Theory and Practice”, Sagar Naik, University of Waterloo, Piyu Tripathy, Wiley, 2008.

2. Roger Pressman, ―SoftwareEngineering: A Practitioners Approach", McGraw-Hill Publications,2011

***Reference Books:***

1. "Effective methods for Software Testing "William Perry, Wiley.
2. "Software Testing - A Craftsman"s Approach", Paul C. Jorgensen, CRC Press, 1995.
3. "The Art of Creative Destruction", Rajnikant Puranik, SPD.
4. "Software Testing", Srinivasan Desikan and Gopalaswamy Ramesh – Pearson Education 2006.
5. "Introducing to Software Testing", Louis Tamres, Addison Wesley Publications, First Edition.
6. "The Art of Software Testing", Glenford J. Myers, John Wiley & Sons, 1979.
7. "Testing Object-Oriented Systems: Models Patterns and Tools", Robert V. Binder, Addison Wesley, 2000.
8. "Software Testing Techniques", Boris Beizer, 2nd Edition, Van Nostrand Reinhold, 1990.
9. "Software Quality Assurance", Daniel Galin, Pearson Education.

***Suggested List of Experiments:***

| **Software Testing and Quality Assurance Laboratory (DJS22CEL7014)** | |
|---|---|
| **Sr. No.** | **Title of Experiments** |
| 1. | Prepare a test case verification document for a given scenario |
| 2. | Detailed Test Plan in IEEE format for given case study |
| 3. | White Box Testing on Units/Modules of Income Tax Calculator |
| 4. | Black Box Testing on Units/Modules of Income Tax Calculator |
| 6. | To design test cases for given problem statement based on Decision Table Testing method |
| 7. | Study of Automation Software Testing with JUnit |
| 8. | To study software Automation Testing with JMeter |
| 9. | To study software Automation Testing tool WinRunner for Setting Up the GUI Map |
| 10. | To study software Automation Testing tool WinRunner for Checking GUI Objects |
| 11. | To study software Automation Testing tool WinRunner Creating Data-Driven Tests |

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| Program: Computer Engineering | Final Year B.Tech. | Semester: VII |
|---|---|---|
| **Course: Big Data and Cloud Infrastructure Laboratory (DJS22CEL703)** | | |

**Prerequisite:** Foundations of Data Analysis, Database Management System, Python Laboratory, Java and Scala Laboratory.

**Course Objectives**:

1. Equip students with hands-on experience in designing, deploying, and managing cloud-based infrastructure using industry-standard tools and platforms.
2. Enable students to implement and configure distributed data processing systems including Hadoop, Spark, and streaming solutions for handling large-scale datasets.
3. Train students to create complete data processing workflows from ingestion to storage, processing, analysis, and visualization in cloud environments.
4. Apply infrastructure-as-code methodologies and implement robust security measures for cloud-based big data applications.

**Course Outcomes:**

1. Successfully architect and implement scalable cloud infrastructure for big data applications using services from major cloud providers.
2. Apply distributed computing frameworks to efficiently analyze and transform large datasets using both batch and real-time processing techniques.
3. Create automated provisioning, deployment, and scaling solutions for complex big data systems using infrastructure-as-code tools.
4. Configure comprehensive security controls and monitoring solutions for big data applications while optimizing performance and resource utilization.

| **Big Data and Cloud Infrastructure Laboratory (DJS22CEL703)** | | |
|---|---|---|
| **Unit** | **Description** | **Hours** |
| 1 | **Cloud Fundamentals and Storage**<br>• Introduction to big data concepts and cloud computing platforms<br>• Setting up cloud environments (AWS/Azure/GCP)<br>• Working with cloud storage solutions (S3/Blob Storage/GCS)<br>• Data transfer protocols and management techniques<br>• Storage optimization, security, and access control<br>• Cost Management: cost monitoring tools and budgeting strategies | 04 |
| **2** | **Virtualization and Container Orchestration**<br>• Virtual machine deployment and management | 04 |

| | | |
|---|---|---|
| | • Docker containerization for big data applications<br>• Container orchestration fundamentals<br>• HDFS architecture and implementation<br>• Basic MapReduce paradigm and applications | |
| **3** | **Distributed Processing Frameworks**<br>• Advanced Hadoop ecosystem components<br>• YARN resource management<br>• Apache Spark architecture and programming<br>• RDD operations and Spark SQL<br>• Stream processing with Kafka/Kinesis and Spark Streaming<br>• Building end-to-end data pipelines | 06 |
| **4** | **Cloud-Based Data Management**<br>• NoSQL database deployment (MongoDB, Cassandra)<br>• Data modeling for distributed environments<br>• Cloud data warehousing solutions<br>• ETL processes in cloud environments<br>• Analytics and visualization platforms | 04 |
| **5** | **Advanced Cloud Technologies**<br>• Machine learning on distributed systems<br>• Model training and deployment at scale<br>• Infrastructure as Code with Terraform<br>• Configuration management with Ansible<br>• CI/CD pipelines for infrastructure and applications | 04 |
| **6** | **Security, Monitoring, and Project Implementation**<br>• Identity and access management in cloud environments<br>• Network security configuration<br>• Monitoring and logging solutions<br>• Performance optimization techniques | 04 |

Perform at least 10 experiments from the given list.

- Configure cloud provider accounts and create resource groups.
- Implement data storage strategies using object storage.
- Create Docker images for Hadoop and Spark environments.
- Implement container orchestration for distributed applications.
- Configure and operate HDFS clusters.
- Develop MapReduce applications for data processing.
- Process structured and unstructured data using Spark RDDs.

- Implement SparkSQL for complex data transformations.
- Deploy and configure MongoDB and Cassandra clusters.
- Implement CRUD operations and analyze performance.
- Design and implement ETL workflows.
- Preprocess large datasets for ML using distributed computing.
- Train ML models on cloud infrastructure.
- Develop Terraform scripts for infrastructure provisioning.
- Implement Ansible playbooks for configuration management.
- Configure identity and access management policies.
- Implement network security controls and encryption.
- Implement data pipelines across multiple services.

**Textbooks:**

1. **"Hadoop: The Definitive Guide"** by Tom White, 4th Edition, 2015, O'Reilly Media, ISBN: 978-1491901632
2. **"Learning Spark: Lightning-Fast Data Analytics"** by Jules Damji, Brooke Wenig, Tathagata Das, and Denny Lee, 2nd Edition, 2020, O'Reilly Media, ISBN: 978-1492050049
3. **"Data Science on AWS"** by Chris Fregly and Antje Barth, 1st Edition, 2021, O'Reilly Media, ISBN: 978-1492079385
4. **"Designing Data-Intensive Applications"** by Martin Kleppmann, 1st Edition, 2017, O'Reilly Media, ISBN: 978-1449373320
5. **"Cloud Native DevOps with Kubernetes"** by John Arundel and Justin Domingus, 1st Edition, 2019, O'Reilly Media, ISBN: 978-1492040767

**Reference Books:**

1. **"Cloud Computing Black Book"** by Kailash Jayaswal, Jagannath Kallakurchi, Donald J. Houde, Dr. Deven Shah, 1st Edition, 2014, Dreamtech Press, ISBN: 9789351194187
2. **"Cloud Computing: A Practical Approach for Learning and Implementation"**, A. Srinivasan, J. Suresh, Pearson, 2014, ISBN: 9788131776513
3. **"Infrastructure as Code: Managing Servers in the Cloud"** by Kief Morris, 2nd Edition, 2020, O'Reilly Media, ISBN: 978-1098114671
4. **"Kafka: The Definitive Guide"** by Neha Narkhede, Gwen Shapira, and Todd Palino, 2nd Edition, 2021, O'Reilly Media, ISBN: 978-1492043089
5. **"NoSQL Distilled: A Brief Guide to the Emerging World of Polyglot Persistence"** by Pramod J. Sadalage and Martin Fowler, 1st Edition, 2012, Addison-Wesley Professional, ISBN: 978-0321826626
6. **"Docker: Up & Running"** by Sean P. Kane and Karl Matthias, 3rd Edition, 2022, O'Reilly Media, ISBN: 978-1098131821
7. **"Terraform: Up & Running"** by Yevgeniy Brikman, 3rd Edition, 2022, O'Reilly Media, ISBN: 978-1098116743

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| **Program: Final Year (Common for All Programs)** | **Semester: VII** |
|---|---|
| **Course: Product Life Cycle Management** | **Course Code: DJS22ILO7011** |

**Pre-requisite:** Knowledge of basic concepts of Management.

**Objectives:**

1. To familiarize the students with the need, benefits and components of PLM
2. To acquaint students with Product Data Management & PLM strategies
3. To give insights into new product development program and guidelines for designing and developing a product
4. To familiarize the students with Virtual Product Development

**Outcomes:** On completion of the course, learner will be able to:

1. Gain knowledge about phases of PLM, PLM strategies and methodology for PLM feasibility study and PDM implementation.
2. Illustrate various approaches and techniques for designing and developing products.
3. Apply product engineering guidelines / thumb rules in designing products for moulding, machining, sheet metal working etc.
4. Acquire knowledge in applying virtual product development tools for components, machining and manufacturing plant

**Detailed Syllabus (Unit wise)**

| Unit | Description | Duration in Hours |
|---|---|---|
| 1 | **Introduction to Product Lifecycle Management (PLM):** Product Lifecycle Management (PLM), Need for PLM, Product Lifecycle Phases, Opportunities of Globalization, Pre-PLM Environment, PLM Paradigm, Importance & Benefits of PLM, Widespread Impact of PLM, Focus and Application, A PLM Project, Starting the PLM Initiative, PLM Applications<br>**PLM Strategies:** Industrial strategies, Strategy elements, its identification, selection and implementation, Developing PLM Vision and PLM Strategy, Change management for PLM | 09 |
| 2 | **Product Design:** Product Design and Development Process, Engineering Design, Organization and Decomposition in Product Design, Typologies of Design Process Models, Reference Model, Product Design in the Context of the Product Development Process, Relation with the Development Process Planning Phase, Relation with the Post design Planning Phase, Methodological Evolution in Product Design, Concurrent Engineering, Characteristic Features of Concurrent Engineering, Concurrent Engineering and Life Cycle Approach, New Product Development (NPD) and Strategies, Product Configuration and Variant Management, The Design for X System, Objective Properties<br>and Design for X Tools, Choice of Design for X Tools and Their Use in the Design Process | 08 |
| 3 | **Product Data Management (PDM):** Product and Product Data, PDM systems and importance, Components of PDM, Reason for implementing a PDM system, financial justification of PDM, barriers to PDM implementation<br>**Virtual Product Development Tools:** For components, machines, and manufacturing plants, 3D CAD systems and realistic rendering techniques, Digital mock-up, Model building, Model analysis, Modelling and simulations in Product Design, Examples/Case studies | 08 |

| | | |
|---|---|---|
| **4** | **Integration of Environmental Aspects in Product Design:** Sustainable Development Design for Environment, Need for Life Cycle Environmental Strategies, Useful Life Extension Strategies, End-of-Life Strategies, Introduction of Environmental Strategies into the Design Process, Life Cycle Environmental Strategies and Considerations for Product Design. | 07 |
| **5** | **Life Cycle Assessment and Life Cycle Cost Analysis:** Properties, and Framework of Life Cycle Assessment, Phases of LCA in ISO Standards, Fields of Application and Limitations of Life Cycle Assessment, Cost Analysis and the Life Cycle Approach, General Framework for LCCA, Evolution of Models for Product Life Cycle Cost Analysis | 07 |
| | **Total** | 39 |

**Books Recommended:**

*Text books:*

1. Product Lifecycle Management: Paradigm for 21st Century Product Realization, John Stark, Springer-Verlag, 2004.
2. Product Design for the environment-A life cycle approach, Fabio Giudice, Guido La Rosa, Antonino Risitano, Taylor & Francis 2006.

*Reference Books:*

1. Product Life Cycle Management‖, Saaksvuori Antti, Immonen Anselmie, Springer, Dreamtech.
2. Product Lifecycle Management: Driving the next generation of lean thinking, Michael Grieve, Tata McGraw Hill, 2006.
3. Product Life-Cycle Management: Geometric Variations, François Villeneuve, Luc Mathieu, Max Giordano, Wiley, 2010.

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| **Program: Final Year (Common for All Programs)** | **Semester: VII** |
|---|---|
| **Course: Management Information System** | **Course Code: DJS22ILO7012** |

**Objectives:**

1. The course is blend of Management and Technical field.
2. Discuss the roles played by information technology in today's business and define various technology architectures on which information systems are built
3. Define and analyze typical functional information systems and identify how they meet the needsof the firm to deliver efficiency and competitive advantage
4. Identify the basic steps in systems development

**Outcomes:** Learner will be able to…

1. Explain how information systems Transform Business
2. Identify the impact information systems have on an organization
3. Describe IT infrastructure and its components and its current trends
4. Understand the principal tools and technologies for accessing information from databases to improve business performance and decision making
5. Identify the types of systems used for enterprise-wide knowledge management and how they provide value for businesses.

| **Detailed Syllabus (Unit wise)** | | |
|---|---|---|
| **Unit** | **Description** | **Duration in Hours** |
| **1** | **Foundation Concepts:** Information Systems in Business, Functional Area Information System**,** The Components of Information Systems**,** Impact of IT on organizations and society, Organizational Strategy, Information systems for strategic advantage. | 03 |
| **2** | **Information Technologies:** Hardware and Software<br>**Computer Systems:** End User and Enterprise Computing<br>**Computer Peripherals:** Input, Output, and Storage Technologies<br>**Application Software:** End User Applications<br>**System Software:** Computer System Management<br>**Data Resource Management:** Technical Foundations of Database Management, Managing Data Resources, Big data, Data warehouse and Data Marts**,** Knowledge Management<br>**Networks:** The Networked Enterprise (Wired and wireless), Pervasive computing, Cloud Computing models | 07 |
| **3** | **MIS Tools and applications for Decision making:** ERP and ERP support of Business Process Reengineering,<br>**Business intelligence (BI):** Managers and Decision Making, BI for Data analysis and Visualization<br>**Artificial Intelligence Technologies in Business** | 08 |
| **4** | **Security and Ethical Challenges:** Security, Ethical, and Societal Challenges of IT Security Management of Information Technology | 06 |
| **5** | **Social Computing (SC):** Web 2.0 and 3.0, SC in business-shopping, Marketing, Operational and Analytic CRM, E-business and E-commerce – B2B B2C, Mobile commerce. | 07 |

| | | |
|---|---|---|
| **6** | **Information System within Organization:** Acquiring Information Systems and Applications: Various System development life cycle models.<br>**Enterprise and Global Management of Information Technology:** Managing Information Technology, Managing Global IT. | 08 |
| | **Total** | 39 |

**Books Recommended:**

*Reference Books:*

1. Management Information Systems, 11th edition by James A O'Brien, George M., Ramesh Behl.
2. Kelly Rainer, Brad Prince, Management Information Systems, Wiley.
3. K.C. Laudon and J.P. Laudon, Management Information Systems: Managing the Digital Firm, 10th Ed., Prentice Hall, 2007.
4. D. Boddy, A. Boonstra, Managing Information Systems: Strategy and Organization, Prentice Hall, 2008

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| **Program: Final Year (Common for All Programs)** | **Semester: VII** |
|---|---|
| **Course: Operations Research** | **Course Code: DJS22ILO7013** |

**Pre-requisites:** Basic Knowledge of Algebra, Probability and Statistics.

**Objectives:**

1. To formulate a real-world decision problem as a mathematical programming model.
2. To learn the mathematical tools that are employed to solve mathematical programming models.

**Outcomes:** On completion of the course, learner will be able to:

1. Convert a real-world problem in to a Linear Programming Problem and analyse the solution obtained using Simplex method or other algorithms.
2. Identify real-world problems as Transportation Problem and Assignment Problem and Solve the decision problem by choosing appropriate algorithm.
3. Identify the decision situations which vary with time and analyse them using principle of dynamic programming to real life situations.
4. Explain reasons of formation of queues, classify various queuing systems and apply parameters defined for various queuing systems for decision making in real life situations.
5. Understand the concept of decision making in situation of competition and recommend strategies in case of two-person zero sum games.
6. Describe concept of simulation and apply Monte Carlo Simulation technique to systems such as inventory, queuing and recommend solutions for them.
7. Understand need for right replacement policy and determine optimal replacement age.

| **Detailed Syllabus (Unit wise)** | | |
|---|---|---|
| **Unit** | **Description** | **Duration in Hours** |
| **1** | **Introduction to Operations Research:** Concept of decision making. Definition of OR. Formulation of decision problem as OR model, Concept of Optimization,<br>**Linear Programming Problem:** Mathematical Formulation. Finding optimal solution - Graphical method, Simplex Method, Big M-method, Two Phase Method.<br>Duality, Primal – Dual construction, Symmetric and Asymmetric Dual.<br>Dual Simplex Method. | 10 |
| **2** | **Assignment Problems:** Mathematical Formulation, Finding optimal solution - Hungarian Method<br>**Transportation problem:** Mathematical Formulation, Finding initial basic feasible solution – Northwest corner rule, row minima, column minima, least cost method and Vogel's approximation method.<br>Optimality test: the stepping stone method and MODI method.<br>Improving the solution. | 08 |
| **3** | **Dynamic Programming**: Bellman's Principle of optimality - Applications of dynamic programming- Employment smoothening problem, capital budgeting problem, shortest path problem, cargo loading problem | 05 |

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|---|---|---|
| **4** | **Queuing Models:** Characteristics of queuing models.<br>Single Channel – Single and multi phase servers, Poisson arrivals, exponential service time - with infinite population and finite population models – with infinite and finite capacity.<br>Multichannel – Single phase server - Poisson arrivals, exponential service time with infinite population.<br>**Game Theory:** Introduction. Minimax & Maximin Criterion and optimal strategy. Solution of games with saddle points, rectangular games without saddle points - 2 x 2 games, dominance principle.<br>Approximate methods - Iterative method, m x 2 & 2 x n games -Graphical method and method of sub-games.<br>Expressing game as LPP. | 10 |
| **5** | **Simulation:** Definition. Types of simulation models. Monte Carlo simulation technique. Applications of simulation - Inventory and Queuing problems. Simulation Languages.<br>**Replacement Models:** Replacement of items that deteriorate with time - when money value is not counted and counted, Replacement of items that fail suddenly – individual and group replacement policy. | 06 |
| | **Total** | 39 |

**Books Recommended:**

*Text books:*

1. Operations Research, Sharma J. K., Trinity Press
2. Operations Research, Gupta P. K., Hira D. S., S. Chand Limited

*Reference Books:*

1. Operations Research - An Introduction; Taha, H.A.; Prentice Hall
2. Operations Research: Principles and Practice; Ravindran, A, Phillips, D. T and Solberg, J. J.; John Willey and Sons
3. Introduction to Operations Research; Hiller, F. S. and Liebermann, G. J.; Tata McGraw Hill
4. Operations Research Principles and Practice; Pradeep Prabhakar Pai; Oxford University Press
5. Operations Research, R. Panneerselvam, PHI Publications.
6. Operations Research, A. M. Natarajan, P. Balasubramani, A. Tamilarasi, Pearson Education.
7. Operations Research; Kanti Swarup, P. K. Gupta and Man Mohan; Sultan Chand & Sons

Prepared by Checked by Head of the Department Principal

| **Program: Final Year (Common for All Programs)** | **Semester: VII** |
|---|---|
| **Course: Cyber Security and Laws** | **Course Code: DJS22ILO7014** |

**Objectives:**

1. To understand and identify different types cybercrime and cyber offences.
2. To recognized Indian IT Act 2008 and its latest amendments
3. To learn various types of security standards compliances

**Outcomes:** On completion of the course, learner will be able to:

1. Understand the different types of cybercrime and security issues E Business.
2. Analyses different types of cyber threats and techniques for security management.
3. Explore the legal requirements and standards for cyber security in various countries to regulate cyberspace.
4. Impart the knowledge of Information Technology Act and legal frame work of right to privacy, data security and data protection.

| **Detailed Syllabus (Unit wise)** | | |
|---|---|---|
| **Unit** | **Description** | **Duration in Hours** |
| **1** | **Introduction to Cybercrime**:<br>Cyber Crime, Cyber Law, Cyber Security, History of Cyber Crime, Hacking, Data Theft, Cyber Terrorism, Virus & Worm's, Email Bombing, Pornography, online gambling, Forgery, Web Defacements, Web Jacking, Illegal online Selling, Cyber Defamation, Software Piracy, Electronics/ Digital Signature, Phishing, Password Cracking, Key loggers and Spywares, Steganography, DoS and DDoS attacks, SQL Injection, Buffer Over Flow,, Phishing Identity Theft (ID Theft) ,How criminal plan the attacks, Social Engineering, Cyber stalking . | 10 |
| **2** | **Cyber Threats Analysis**<br>Knowledge of Dynamic and Deliberate Targeting<br>Knowledge of Indications and Warning<br>Knowledge of Internal Tactics to Anticipate and/or, Emulate Threat Capabilities and Actions<br>Knowledge of Key Cyber Threat Actors and their EquitiesKnowledge of Specific Target Identifiers and Their Usage | 06 |
| **3** | **Electronic Business and legal issues**<br>Evolution and development in Ecommerce, Policy Frameworks for Secure Electronic Business, paper vs paper less contracts, E-Commerce models- B2B, B2C, E security. E-Payment Mechanism; Payment through card system, E-Cheque, E-Cash, E-Payment Threats & Protections, Security for E-Commerce. | 06 |
| **4** | **Indian IT Act**<br>Cyber Crime and Criminal Justice, Penalties, Adjudication and Appeals Under the IT Act, 2000, IT Act. 2008 and its Amendments<br>**Security aspect in cyber Law**<br>The Contract Aspects in Cyber Law , The Security Aspect of Cyber Law, The Intellectual Property Aspect in Cyber Law ,The Evidence Aspect in Cyber Law ,The Criminal Aspect in Cyber Law. | 08 |

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| **5** | **Security Industries Standard Compliances**<br>IT Security v/s IT Compliance, Cyber Security Standards, critical security controls for cyber security, GRC (Governance, Risk Management, and Compliance), SOX, GLBA, HIPAA, ISO/IEC 27001, NIST Cyber Security Framework (CSF), PCI-DSS.<br>OWASP Top Ten Project, GDPR (General Data Protection Regulation), NIST (National Institute of Standards and Technology), CIS Controls (Center for Internet Security Controls) | 09 |
| | **Total** | 39 |

**Books Recommended:**

*Reference Books and Material:*

1. Nina Godbole, Sunit Belapure, Cyber Security, Wiley India, New Delhi
2. The Indian Cyber Law by Suresh T. Vishwanathan; Bharat Law House New Delhi
3. The Information Technology Act, 2000; Bare Act- Professional Book Publishers, New Delhi.
4. E-Commerce Security and Privacy", Anup K. Ghosh, Springer Science and Business Media, 2012
5. Izzat Alsmadi , The NICE Cyber Security Framework Cyber Security Intelligence and Analytics, Springer
6. Cyber Law & Cyber Crimes, Advocate Prashant Mali; Snow White Publications, Mumbai
7. Nina Godbole, Information Systems Security, Wiley India, New Delhi
8. Kennetch J. Knapp, Cyber Security &Global Information Assurance Information Science Publishing.
9. William Stallings, Cryptography and Network Security, Pearson Publication
10. Websites for more information is available on : The Information Technology ACT, 2008- TIFR : https://www.tifrh.res.in
11. Website for more information, A Compliance Primer for IT professional: https://www.sans.org/reading-room/whitepapers/compliance/compliance-primer-professionals-33538

Prepared by Checked by Head of the Department Principal

| **Program: Final Year (Common for All Programs)** | **Semester: VII** |
|---|---|
| **Course: Personal Finance Management** | **Course Code: DJS22ILO7015** |

**Pre-requisites:** Basic Knowledge of Algebra, Probability and Statistics.

**Objectives:**

1. To create awareness and educate consumers on access to financial services.
2. To make the students understand the basic concepts, definitions and terms related to direct taxation.
3. To help the students compute the Goods and Service Tax (GST) payable by a supplier after considering the eligible input tax credit.
4. To familarise the students with microfinance for accelerating the expansion of local microbusinesses.

**Outcomes:** On completion of the course, learner will be able to:

1. Use a framework for financial planning to understand the overall role finances play in his/her personal life.
2. Compute income from salaries, house property, business/profession, capital gains and income from other sources.
3. Compute the amount of CGST, SGST and IGST payable after considering the eligible input tax credit.
4. Understand how Microfinance can help in financial inclusion.

| **Detailed Syllabus (Unit wise)** | | |
|---|---|---|
| **Unit** | **Description** | **Duration in Hours** |
| **01** | **Overview of Indian Financial System:** Characteristics, Components and Functions of Financial System. Financial Instruments and Financial Markets, Financial inclusion.<br>**Introduction to Personal Finance**<br>Person Financial Planning in Action, Money Management Skills, Taxes in Your Financial Plan, Savings and Payment Services.<br>Consumer Credit: Advantages, Disadvantages, Sources and Costs. | 07 |
| **02** | **Personal Financial Management**<br>**Loans:** Home, Car, Education, Personal, Loan against property and Jewel loan.<br>**Insurance:** Types of Insurance – ULIP and Term; Health and Disability Income Insurance, Life Insurance.<br>**Investment:** Investing Basics and Evaluating Bonds, Investing in Stocks and Investing in Mutual Funds, Planning for the Future. | 07 |
| **03** | **Income Tax**<br>**Income Tax Act Basics**- Introduction to Income Tax Act, 1961<br>**Heads of Income and Computation of Total Income and Tax Liability-** Heads of Income and Computation of Total Income under various heads, Clubbing Provisions, Set off and Carry forward of Losses, Deductions, Assessment of Income and tax liability of different persons.<br>**Tax Management, Administrative Procedures and ICDS -** TDS, TCS and Advance Tax Administrative Procedures, ICDS. | 07 |

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|---|---|---|
| **04** | **Goods and Services Tax**<br>GST Constitutional framework of Indirect Taxes before GST (Taxation Powers of Union & State Government); Concept of VAT: Meaning, Variants and Methods; Major Defects in the structure of Indirect Taxes prior to GST; Rationale for GST; Structure of GST (SGST, CGST, UTGST & IGST); GST Council, GST Network, State Compensation Mechanism, Registration.<br>**Levy and Collection of GST**<br>Taxable event- "Supply" of Goods and Services; Place of Supply: Within state, Interstate, Import and Export; Time of supply: Valuation for GST- Valuation rules, taxability of reimbursement of expenses; Exemption from GST: Small supplies and Composition Scheme: Classification of Goods and Services | 09 |
| **05** | **Introduction to Micro – finance**<br>Micro-Finance: Definitions, Scope & Assumptions, Types of Microfinance, Customers of Micro-finance, Credit Delivery Methodologies, SHG concept, origin, Formation & Operation of Self Help Groups (SHGs).<br>**Models in Microfinance -** Joint Liability Groups (JLG), SHG Bank Linkage Model and GRAMEEN Model: Achievements & Challenges,<br>**Institutional Mechanism**<br>Current Challenges for Microfinance, Microfinance Institutions (MFIs): Constraints & Governance Issues, Institutional Structure of Microfinance in India :NGO-MFIs, NBFC-MFIs, Co-operatives, Banks, Microfinance Networks and Associations; Demand & Supply of Microfinance Services in India, Impact assessment and social assessments of MFIs. | 09 |
| | **Total** | 39 |

**Books Recommended:**

*Reference Books:*

1. Banking and Financial Sector Reforms in India , by Asha Singh, M.S. Gupta, Serials Publication.
2. Indian Banking Sector: Essays and Issues (1st) , by M.S. Gupta & J.B. Singh, Serials Publication.
3. Basics Of Banking & Finance , by K.M. Bhattacharya O.P. Agarwal , Himalaya Publishing House
4. Agricultural Finance And Management, by S. Subba Reddy , P. Raghu Ram .
5. The Indian Financial System And Development , by Dr.Vasant Desai, Himalaya Publishing House; Fourth Edition
6. Income Tax Management , Simple Way of Tax Management, Tax Planning and Tax Saving , By Sanjay Kumar Satapathy
7. Direct Tax System Income Tax by Dr. R. K. Jain, SBPD Publications.
8. Simplified Approach to GST Goods and Services Tax, By S K Mishra , Educreation Publishing.
9. Introduction To Microfinance , By Todd A Watkins , World Scientific Publishing Company

Prepared by Checked by Head of the Department Principal

| **Program: Final Year (Common for All Programs)** | **Semester: VII** |
|---|---|
| **Course: Energy Audit and Management** | **Course Code: DJS22ILO7016** |

**Objectives:**

1. To understand the importance of energy security for sustainable development and the fundamentals of energy conservation.
2. To identify and describe the basic principles and methodologies adopted in energy audit of a utility
3. To introduce performance evaluation criteria of various electrical and thermal installations to facilitate the energy management.
4. To relate the data collected during performance evaluation of systems for identification of energy saving opportunities.

**Outcomes:** On completion of the course, learner will be able to:

1. To identify and describe present state of energy security and its importance.
2. To identify and describe the basic principles and methodologies adopted in energy audit of a utility.
3. To describe the energy performance evaluation of some common electrical installations and identify the energy saving opportunities.
4. To describe the energy performance evaluation of some common thermal installations and identify the energy saving opportunities.
5. To analyze the data collected during performance evaluation and recommend energy saving measures.

| **Detailed Syllabus (Unit wise)** | | |
|---|---|---|
| **Unit** | **Description** | **Duration in Hours** |
| **01** | **Energy Scenario:** Present Energy Scenario, Energy Pricing, Energy Sector Reforms, Energy Security, Energy Conservation and its Importance, Energy Conservation Act-2001 and its Features. Basics of Energy and its various forms, Material and Energy balance. | 05 |
| **02** | **Energy Audit:** Definition, Energy audit- need, Types of energy audit, Energy management (audit) approach-understanding energy costs, Bench marking, Energy performance, matching energy use to requirement, Maximizing system efficiencies, Optimizing the input energy requirements, Fuel and energy substitution. Elements of monitoring & targeting, Energy audit instruments. Technical and economic feasibility, Classification of energy conservation measures. Safety considerations during energy audit.<br>**Financial analysis techniques:** Simple payback period, NPV, Return on investment (ROI) Internal rate of return (IRR). | 09 |
| **03** | **Energy Management and Energy Conservation in Electrical System:** Electricity billing, Electrical load management and maximum demand Control; Power factor improvement, Energy efficient equipments and appliances, star ratings. Energy efficiency measures in lighting system, lighting control: Occupancy sensors, daylight integration, and use of intelligent controllers. Energy conservation opportunities in water pumps, compressor, fan and blower. industrial drives, induction motors, motor retrofitting, soft starters, variable speed drives. | 10 |

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|---|---|---|
| **04** | **Energy Management and Energy Conservation in Thermal Systems:** Review of different thermal loads; Energy conservation opportunities in: Steam distribution system, Steam leakages, Steam trapping, Condensate and flash steam recovery system. Waste heat recovery, use of insulation- types and application. Energy conservation opportunities in: Boiler system. Refrigeration system and HVAC system. | 09 |
| **05** | **Energy conservation in Buildings**: Energy Conservation Building Codes (ECBC):Green Building, LEED rating, Application of Non-Conventional and Renewable Energy Sources, Energy sources and energy management in electric vehicles. | 06 |
| | **Total** | 39 |

**Books Recommended:**

*Reference Books:*

1. Handbook of Electrical Installation Practice, Geofry Stokes, Blackwell Science.
2. Designing with light: Lighting Handbook, By Anil Valia, Lighting System.
3. Energy Management Handbook, By W.C. Turner, John Wiley and Sons.
4. Handbook on Energy Audits and Management, edited by A. K. Tyagi, Tata Energy Research Institute (TERI).
5. Energy Management Principles, C.B. Smith, Pergamon Press.
6. Energy Conservation Guidebook, Dale R. Patrick, S. Fardo, Ray E. Richardson, Fairmont Press.
7. Handbook of Energy Audits, Albert Thumann, W. J. Younger, T. Niehus, CRC Press.
8. *www.energymanagertraining.com*
9. *www.bee-india.nic.in*

Prepared by Checked by Head of the Department Principal

| Program: Final Year (Common for All Programs) | Semester: VII |
|---|---|
| Course: Disaster Management and Mitigation Measures | Course Code: DJS22ILO7017 |

**Objectives:**

1. To provide basic understanding hazards, disaster and various types and categories of disaster occurring around the world.
2. To identify extent and damaging capacity of a disaster.
3. To study and understand the means of losses and methods to overcome /minimize it.
4. To understand roles and responsibilities of individual and various organization during and after disaster.
5. To appreciate the significance of GIS, GPS in the field of disaster management.
6. To understand the emergency government response structures before, during and after disaster.

**Outcomes:** On completion of the course, learner will be able to:

1. Know natural as well as manmade disaster and their extent and possible effects on the economy.
2. Know the institutional framework and organization structure in India for disaster management and get acquainted with government policies, acts and various emergency laws.
3. Get to know the simple dos and don'ts in such extreme events and build skills to respond accordingly.
4. Understand the importance of disaster prevention and various mitigation measure with the exposure to disasters hotspots across the globe.

| Detailed Syllabus (Unit wise) | | |
|---|---|---|
| **Unit** | **Description** | **Duration in Hours** |
| 1 | **General Information about Disaster:**<br>Brief concept of Hazards, definition and types of Disasters – Natural, Man-made, and hybrid, Groups of Disasters- Natural and Technological, global Scenario, Significance of studying various aspects of disasters, effects of disasters, India's vulnerability to disasters, Impact of disaster on National development.<br>Study of Natural disasters:<br>Flood, drought, cloud burst, Earthquake, Landslides, Avalanches, Volcanic eruptions, Mudflow, Cyclone, Storm, Storm Surge, climate change, global warming, sea level rise, ozone depletion etc.<br>Study of Human/Technology Induced Disasters:<br>Chemical, Industrial and Nuclear disasters, Internally displaced persons, road and train accidents Fire Hazards, terrorism, militancy, Role of growing population and subsequent industrialization, urbanization and changing lifestyle of human beings in frequent occurrences of manmade disasters. | 09 |
| 2 | **Disaster Management:**<br>Brief Introduction, Disaster management cycle, Evolution of Disaster and Disaster management in India, Disaster management acts, policies and guidelines, laws of emergencies etc.<br>Prior, During and Post disaster management activities:<br>(Preparedness, strengthening emergency centers, Logistics, optimum resource management, emergency response and relief, Training, Public awareness, Research, Reconstruction of essential services and livelihood restoration. | 08 |

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|---|---|---|
| **3** | **Institutional framework and Mechanism for disaster management in India:**<br>Institutions in India for dealing with various disasters, Organizational structure, functions and responsibilities of National Institute of Disaster Management (NIDM) and National disaster management authority (NDMA) in India, roles and responsibilities of central and state government during and after disaster, NGO's involved in disasters and their task, Jobs carried out by armed forces.<br>Financial Relief During disaster (State, National and International Disaster Assistance) | 07 |
| **4** | **Disaster risk reduction and Mitigation Measures:**<br>Need of disaster prevention and mitigation, mitigation guiding principles, challenging areas, structural and non-structural measures for disaster risk reduction.<br>Mitigation measures for flood, earthquake, cyclone monitoring, air quality, water quality, climate change, land use, winter storms and aquatic biology etc.<br>Use of information management, GIS, GPS and remote sensing Mitigation measure.<br>Do's and don'ts in case of disasters and effective implementation of relief aids. | 08 |
| **5** | **Case studies on disaster (National /International):**<br>Case study discussion of Hiroshima – Nagasaki (Japan), India – Tsunami (2004) , Bhopal gas tragedy, Kerala and Uttarakhand flood disaster, Cyclone Phailin (2013), Fukushima Daiichi nuclear disaster (2011), 26th July 2005 Mumbai flood, Chernobyl meltdown and so on.<br>(Discuss case studies on disaster with respect to reason for the disaster, incidents, effects of disaster, present scenario and safety measures taken) | 07 |
| | **Total** | 39 |

**Books Recommended:**

*Reference Books and Reports:*

1. Disaster Management, by Harsh K.Gupta, Universities Press Publications (2003).
2. Disaster Management: An Appraisal of Institutional Mechanisms in India, by O.S.Dagur, published by Centre for land warfare studies, New Delhi, 2011.
3. Introduction to International Disaster Management, by Damon Copolla, Butterworth Heinemann Elsevier Publications (2015).
4. Disaster Management Handbook, by Jack Pinkowski, CRC Press, Taylor and Francis group (2008).
5. Disaster management & rehabilitation, by Rajdeep Dasgupta, Mittal Publications, New Delhi (2007).
6. Natural Hazards and Disaster Management, Vulnerability and Mitigation, by R B Singh, Rawat Publications (2006).
7. Concepts and Techniques of GIS, by C.P.Lo Albert, K.W. Yonng, Prentice Hall (India) Publications (2006).
8. Risk management of natural disasters, by Claudia G. Flores Gonzales, KIT Scientific Publishing (2010).
9. Disaster Management – a disaster manger's handbook, by W. Nick Carter, Asian Development Bank (2008).
10. Disaster Management in India, by R. K. Srivastava, Ministry of Home Affairs, GoI, New Delhi (2011)
11. The Chernobyl Disaster: Legacy and Impact on the Future of Nuclear Energy, by Wil Mara, Marshall Cavendish Corporation, New York, 2011.
12. The Fukushima 2011 Disaster, by Ronald Eisler, Taylor & Francis, Florida, 2013.

(Learners are expected to refer reports published at national and international level and updated information available on authentic web sites)

Prepared by Checked by Head of the Department Principal

| **Program: Final Year (Common for All Programs)** | **Semester: VII** |
|---|---|
| **Course: Science of Well-being** | **Course Code: DJS22ILO7018** |

**Objectives:**

1. To create consciousness about importance of holistic health and physical as well as mental well-being.
2. To make learners aware of the concepts of Happiness, Gratitude, Self-Compassion, Empathy etc.
3. To introduce the learners to the means of mental and physical well-being, ill effects of mal-practices like alcoholism, smoking etc.
4. To equip the learners to manage and cope up with stress in their daily living.

**Outcomes:** Upon Completion of the course, the learner should be able to:

1. Describe concepts of holistic health and well-being, differentiate between its true meaning and misconceptions and understand the benefits of well-being.
2. Recognize meaning of happiness, practice gratitude and self-compassion and analyze incidents from one's own life.
3. Understand the causes and effects of stress, identify reasons for stress in one's own surrounding and self.
4. Recognize the importance of physical health and fitness, assess their life style and come up with limitations or effectiveness.
5. Inspect one's own coping mechanism, assess its effectiveness, develop and strategize for betterment and execute it.

| **Detailed Syllabus (Unit wise)** | | |
|---|---|---|
| **Unit** | **Description** | **Duration in Hours** |
| **1** | **Health and well-being:** The concept of health, dimensions of health, the notion of well-being, various facets of well-being, relation between health and well-being.<br>Concept of holistic health, its principles and importance, concept and benefits of holistic care, misconceptions about holistic health approach, the application of a true holistic approach to our well-being. | 06 |
| **2** | **Concepts of happiness:**<br>Happiness: what is it and how do we measure it? Philosophical perspectives on happiness, Happiness: Nature or Nurture? Happiness in the modern world: impediments and accelerators, Narrow vs. Broad Band Approaches to Happiness, Benefits of Happiness, Self-Compassion and Gratitude. Misconceptions of happiness. | 08 |
| **3** | **Stress and mental health/well-being**: Nature and concept of stress, meaning and definitions of stress, types of stress, meaning of stressors, types of stressors, symptoms of stress, effects of stress, different models of stress.<br>Sources of stress and how does stress cause illness, various sources of stress, delineate between external and internal sources of stress, differentiate between continuous and discrete stressors, the effects of these stressors on health and well-being, diversity of stressors and their health consequences, relation between stress and illness from different perspectives association between stress related physiological mechanisms and different illnesses. | 09 |

| | | |
|---|---|---|
| **4** | **Physical Well-being / Health management:** concept of health behaviours, dimensions of health behaviours. Health enhancing behaviors: Exercise and Weight control, application and importance of these health enhancing behaviours. Health protective behaviors and illness management: concept of illness management, effectiveness of illness management. Concept of Nutrition, Role of Nutrition, Components of Nutrition, concept of Malnutrition, Health compromising behaviours: Alcoholism, Smoking and its effects on health. | 08 |
| **5** | **Dealing with Difficult Times / Coping mechanisms:** The concept of chronic stress, Health and safety risks of chronic stress, Forms and Treatment of chronic stress, Coping with Acute and Chronic stress, theories of the stress-illness link, role of stress in mental disorders.<br>Concept of coping, Ways of coping and stress management, basic knowledge about stress management, various techniques of stress management, stress management programs.<br>Mental strengths and virtues, Hope, Optimism, Resilience – concept, pathways and models, Meditation and Self-introspection. | 08 |
| | **Total** | 39 |

**Books Recommended:**

*Textbooks:*

1. The Science of well-being by Felicia Huppert, Nick Baylis, Barry Keverne; Oxford University Press
2. Health and Well-Being: Emerging Trends by S. Ojha, U. Rani Srivastava, Shobhna Joshi, Global Vision Publishing House
3. Positive psychology: The scientific and practical explorations of human strengths by Shane J. Lopez, Jennifer Teramoto Pedrotti, Charles Richard Snyder; Sage Publications.

*Reference Books:*

1. The pursuit of happiness and the realization of sympathy: Cultural patterns of self, social relations, and well-being by Kitayama, S., & Markus, H. R, Culture and subjective well-being, The MIT Press.
2. Man Adapting by Dubos, R; New Haven: Yale University Press.
3. Happiness a history by McMahon D. M., Atlantic Monthly Press.
4. Well-being: The foundations of hedonic psychology by D. Kahneman & E. Diener & N. Schwarz, New York: Russell Sage
5. Selye H. The Stress of Life. New York; McGraw-Hill; 1984.

Prepared by Checked by Head of the Department Principal

| Program: Final Year Mechanical Engineering | Semester: VII |
|---|---|
| Course: Research Methodology | Course Code: DJS22ILO7019 |

**Pre-requisites:** Basic Knowledge of Probability and Statistics.

**Objectives:**

1. To understand Research and Research Process
2. To acquaint learners with identifying problems for research and develop research strategies
3. To familiarize learners with the techniques of data collection, analysis of data and interpretation

**Outcomes:** On completion of the course, learner will be able to:

1. Prepare a preliminary research design for projects in their subject matter areas
2. Accurately collect, analyze and report data
3. Present complex data or situations clearly
4. Review and analyze research findings
5. Write report about findings of research carried out.

| Detailed Syllabus (Unit wise) | | |
|---|---|---|
| **Unit** | **Description** | **Duration in Hours** |
| **1** | **Basic Research Concepts**<br>Meaning of research, Objectives of research, Types of research, Significance of research Research process | 07 |
| **2** | **Research Methodology:**<br>Identification of research problem, Literature review, Formulation of hypothesis, Formulation of Research design. | 09 |
| **3** | **Research and Sample Design:**<br>Meaning of research and sample design, Need of research design, Features of good research design, Important concepts, Different research designs, Types of sampling designs | 09 |
| **4** | **Data Collection and Data Analysis:**<br>Types of data, Methods for collecting data: Experiments and surveys, Collection of primary and secondary data, Hypothesis testing and interpretation of Data | 09 |
| **5** | **Interpretation and Report Writing:**<br>Interpretation and drawing conclusions on the research, Preparation of the report, Ethical Issues | 05 |
| | **Total** | 39 |

**Books Recommended:**

*Reference Books:*

1. Dawson, Catherine, 2002, Practical Research Methods, New Delhi, UBS Publishers Distributors.
2. Kothari, C.R.,1985, Research Methodology-Methods and Techniques, New Delhi, Wiley Eastern Limited.
3. Kumar, Ranjit, 2005, Research Methodology-A Step-by-Step Guide for Beginners, (2nd Edition), Singapore, Pearson Education

Prepared by Checked by Head of the Department Principal

| Program: Final Year (Common for All Programs) | Semester: VII |
|---|---|
| Course: Public Systems and Policies | Course Code: DJS22ILO7020 |

**Pre-requisites:** Basic Knowledge of Social science and Current affairs

**Objectives:**

1. To analyze the transformations in public systems with emphasis on current initiatives and emerging challenges in the field.
2. To understand public systems in a fast-changing environment in the global context.
3. To provide an in-depth understanding of the ills prevailing in the society and aids to identify the solutions for them.
4. To explain public policy and its operations with special focus on policy relating to Government finance.
5. To analyze and evaluate the impact of the public policy on firms and economy at large.

**Outcomes:** On completion of the course, learner will be able to:

1. Understand the importance of public systems in a fast-changing environment in the global context.
2. Analyze the transformations in public systems with emphasis on current initiatives and emerging challenges in the field.
3. Explain public policy and its operations with special focus on policy relating to Government finance.
4. Make policies and know about the happenings in the world, in the nation and those in their locality.
5. Analyze and evaluate the impact of the public policy on firms and economy at large and work under various fields as policymakers.

| Detailed Syllabus (Unit wise) | | |
|---|---|---|
| **Unit** | **Description** | **Duration in Hours** |
| **1** | **Introduction and Overview of Public Systems:** Ideology of Public Systems; Mechanistic and Organic view of Society and Individuals, The Legal Framework; Federal Government; State and Local Governments, Government growth; The size of Government. | 09 |
| **2** | **Public Sector in the Economics Accounts:** Public Sector in the circular flow; Public Sector in the National Income Accounts. | 06 |
| **3** | **Public Choice and Fiscal Politics:** Direct Democracy; Representative Democracy; The Allocation Function; The Distribution Function; The Stabilization Function; Coordination of Budget Functions; The Leviathan Hypothesis. | 07 |
| **4** | **Introduction and Overview of Public Policy:** Markets and Government; Social goods and Market failure, Public expenditure and its evaluation; Cost Benefit Analysis, Public policy and Externalities, Taxation Policy and its impact, Income distribution, redistribution and social security issues Fiscal & Budgetary Policy, Fiscal Federalism in India. | 11 |
| **5** | **Case Studies in Expenditure Policy: Public Services**<br>A) National Defense B) Highways C) Outdoor Recreation D) Education | 06 |
| | **Total** | 39 |

**Books Recommended:**

***Reference Books:***

1. Introduction to Public Policy by Charles Wheelan, W.W. Norton & Company.
2. Understanding Public Policy by Thomas R. Dye, Prentice Hall.
3. Public Policy-Making: An Introduction by Anderson J.E., Boston, Houghton.
4. Public Administration by Avasthi & Maheshwari, Lakshminarayan Agarwal, Agra.
5. New Horizons of Public Administration by Bhattacharya, Mohit, Jawahar Publishers, New Delhi.
6. Public Administration and Public Affairs by Henry, Nicholas, Prentice Hall of India, New Delhi.
7. Public Finance 10th Edition by Harvey S Rosen and Ted Gayer, McGraw-Hill Education, 2013.
8. Public Finance in Theory and Practice by Musgrave and Musgrave.

Prepared by Checked by Head of the Department Principal

| Program: Computer Engineering | Final Year B.Tech. | Semester: VII |
|---|---|---|
| Course: Project Stage-I (DJS22CEP703) | | |

**Course Objectives:**

The Project work enables students to develop further skills and knowledge gained during the program by applying them to the analysis of a specific problem or issue, via a substantial piece of work carried out over an extended period. For students to demonstrate proficiency in the design of a research project, application of appropriate research methods, collection and analysis of data and presentation of results.

**Guidelines:**

**1. Project Topic:**

- To proceed with the project work it is very important to select a right topic. Project can be undertaken on any subject addressing the programme. Research and development projects on problems of practical and theoretical interest should be encouraged.
- Project work must be carried out by the group of at least two students and maximum three and must be original.
- Students can certainly take ideas from anywhere, but be sure that they should evolve them in the unique way to suit their project requirements.
- The project work can be undertaken in a research institute or organization/company/any business establishment.
- Student must consult internal guide along with external guide (if any) in selection of topic.
- Head of department and senior staff in the department will take decision regarding selection of projects.
- Student has to submit weekly progress report to the internal guide and whereas internal guide has to keep track on the progress of the project and also has to maintain attendance report. This progress report can be used for awarding term work marks.
- In case of industry projects, visit by internal guide will be preferred.

**2. Project Report Format:**

At the end of semester, a project report should preferably contain at least following details: -

- Abstract
- Introduction
- Literature Survey
  - Survey Existing system
  - Limitation Existing system or research gap
  - Problem Statement and Objective
  - Scope
- Proposed System
  - Analysis/Framework/ Algorithm

- Details of Hardware & Software o
- Design details
- Methodology (your approach to solve the problem)

- Implementation Plan for next semester
- Conclusion
- References

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| Program: Computer Engineering | Final Year B.Tech. | Semester: VIII |
|---|---|---|
| Course: Web Intelligence (DJS22CEC801) | | |
| Course: Web Intelligence Laboratory (DJS22CEL801) | | |

**Pre-requisite: Statistics, Machine Learning, Data**

**Mining Course Objectives:**

1. To gain a background in Web mining techniques
2. To extract knowledge from the social web for web analytics
3. To enable students to solve complex real-world problems for sentiment analysis and Recommendation systems.

**Outcomes:** On successful completion of course, learner will be able to:

1. Interpret the terminologies and perspectives of Web Mining.
2. Perform social network analysis to identify communities and network properties in social media sites.
3. Extract and Integrate information from the web for real-world scenarios.
4. Design new solutions to opinion extraction and sentiment classification problems
5. Provide solutions to the emerging problems with social media using Recommendation systems

| Detailed Syllabus: (DJS22CEC801) | | |
|---|---|---|
| **Unit** | **Description** | **Duration** |
| 1 | **Introduction**<br>Introduction: World Wide Web, History of the Web and the Internet, what is Data Mining? What is Web Mining? Introduction to Association Rule Mining, Supervised Learning & Unsupervised Learning. Information Retrieval and Web Search: Basic Concepts of Information Retrieval, Information Retrieval Models, Relevance Feedback, Evaluation Measures, Text and Web Page Pre-Processing, Inverted Index and Its Compression, Latent Semantic Indexing, Web Search, Meta-Search: Combining Multiple Rankings, Web Spamming. | 4 |
| 2 | **Social Network Analysis**<br>Social Network Analysis: Introduction, Co-Citation and Bibliographic Coupling, Page Rank, HITS Algorithm, Community Discovery.<br>Web Crawling: A Basic Crawler Algorithm, Implementation Issues, Universal Crawlers, Focused Crawlers, Topical Crawlers, Evaluation, Crawler Ethics and Conflicts. | 8 |

| | | |
|---|---|---|
| 3 | **Structured Data Extraction**<br>Structured Data Extraction: Wrapper Generation, Preliminaries, Wrapper Induction, Instance-Based Wrapper Learning, Automatic Wrapper Generation: Problems, String Matching and Tree Matching, Building DOM Trees, Extraction Based on a Single List Page, Extraction Based on Multiple Pages. | 7 |
| 4 | **Information Integration**<br>Information Integration: Introduction to Schema Matching, Pre-Processing for Schema Matching, Schema -Level Matching, Domain and Instance-Level Matching, Combining Similarities, Integration of Web Query Interfaces, Constructing a Unified Global Query Interface. | 7 |
| 5 | **Opinion Mining and Sentiment Analysis**<br>The Problem of Opinion Mining, Document Sentiment Classification, Sentence Subjectivity and Sentiment Classification, Opinion Lexicon Expansion, Aspect-Based Opinion Mining, Opinion Search and Retrieval, Opinion Spam Detection. | 7 |
| 6 | **Web Usage Mining**<br>Web Usage Mining: Data Collection and Pre-Processing, Data Modeling for Web Usage Mining, Discovery and Analysis of Web Usage Patterns, Recommender Systems and Collaborative Filtering, Query Log Mining, Computational Advertising. | 6 |

**Books Recommended:**

1. Web Data Exploring Hyperlinks, Contents, and Usage, Bing Liu, Springer, Second Edition
2. Priti Srinivas Sajja, Rajendra Akerkar, "Intelligent Technologies for Web Applications" CRC Press, Publisher: Taylor & Francis, 3rd Edition, 2019.
3. Rajendra Akerkar, Pawan Lingras, "Building an Intelligent Web Theory and Practice" Jones & Bartlett Learning, 2nd Edition, 2010
4. Avinash Kaushik "Web Analytics: An Hour a Day", Publisher: Sybex, 2007

**Reference books:**

1. Data Mining: Concepts and Techniques, Second Edition Jiawei Han, Micheline Kamber (Elsevier Publications)
2. Web Mining: Applications and Techniques by Anthony Scime
3. Mining the Web: Discovering Knowledge from Hypertext Data by Soumen Chakrabarti

**Coursera Courses Recommended:**

Introduction to Social Media Analytics | Coursera

***Suggested List of Experiments:***

| Sr. No. | Title of Experiments |
|---|---|
| 1 | Latent Semantic Indexing |
| 2 | Page rank estimation |
| 3 | Design a crawler to gather web information |
| 4 | Implement a wrapper induction technique to gather data from the web |
| 5 | Use linguistic techniques for schema matching |
| 6 | Perform Opinion spam detection |
| 7 | Using Google Analytics, perform Audience Analysis, Acquisition Analysis, Behaviour Analysis, Conversion Analysis |
| 8 | Mini Project |

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| Program: Computer Engineering | Final Year B.Tech. | Semester: VIII |
|---|---|---|
| **Course: Digital Signal Processing and Applications (DJS22CEC802)** | | |
| **Course: Digital Signal Processing and Applications Laboratory (DJS22CEL802)** | | |

**Prerequisite:** Engineering Mathematics-III, Engineering Mathematics- IV

**Objectives:**

1. To understand the fundamental concepts of signal processing and applications.
2. To develop a thorough understanding of DFT and FFT and their applications.
3. To apply image enhancement techniques.
4. To apply image segmentation techniques

**Outcomes:** On completion of the course, learner will be able to:

1. Understand concept of digital signal processing and applications
2. Classify and analyze discrete time signals and systems
3. Apply the efficient computing algorithms of DFT and FFT in finding the response of the system.
4. Use the enhancement techniques for digital Image Processing
5. Apply digital image processing techniques for edge detection

| Digital Signal Processing and Applications (DJS22CEC802) | | |
|---|---|---|
| **Unit** | **Description** | **Hours** |
| **1** | Discrete-Time Signal and Discrete-Time System:<br>1.1 Introduction to Digital Signal Processing, Sampling and Reconstruction, Standard DT Signals, Concept of Digital Frequency, Representation of DT signal using Standard DT Signals, Signal Manipulations (shifting, reversal, scaling, addition, multiplication).<br>1.2 Classification of Discrete-Time Signals, Classification of Discrete Systems<br>1.3 Linear Convolution formulation for 1-D and 2-D signal (without mathematical proof), Circular Convolution (without mathematical proof), Linear convolution using Circular Convolution. Auto and Cross Correlation formula evaluation, LTI system, Concept of Impulse Response and Step Response, Output of DT system using Time Domain Linear Convolution. | 10 |
| **2** | Discrete Fourier Transform<br>2.1 Introduction to DTFT, Relation between DFT and DTFT, DFT of DT signal, Inverse DFT. | 10 |

| | | |
|---|---|---|
| | 2.2 Properties of the DFT: Scaling and Linearity, Symmetry for real valued signal, Periodicity, Time Shift and Frequency Shift, Time Reversal, Convolution Property and Parsevals Energy Theorem.<br>Fast Fourier Transform<br>2.3 Fast Fourier Transform: Need of FFT, Radix-2 DIT-FFT algorithm<br>2.4 Flow graph for N=4 and 8 using Radix-2 DIT-FFT, Inverse FFT algorithm, Comparison of complex and real, multiplication and additions of DFT and FFT<br>2.5 Introduction to Wavelet Transform: Basic concepts of Continuous and Discrete Wavelet Transform (CWT & DWT). Multi-resolution Decomposition: Concept and use in signal processing | |
| **3** | DSP Algorithms:<br>3.1 Fast Circular Convolution Algorithm, Fast Linear Convolution Algorithm.<br>3.2 Linear FIR filtering using Overlap Add Algorithm and Overlap Save Algorithm and implementation using FFT<br>DSP Application:<br>3.3 Audio and speech processing, statistical signal processing, digital image processing, data compression, video coding | 04 |
| **4** | Digital Image Fundamentals:<br>4.1 Introduction to Digital Image, Digital Image Processing System, Sampling and Quantization<br>4.2 Representation of Digital Image, Connectivity, Image File Formats: BMP, TIFF and JPEG | 04 |
| **5** | Spatial Domain Filtering:<br>5.1 Basic Image Processing Operations: Negative, Thresholding, Bit-plane slicing, Histogram generation, Intensity transformation: contrast stretching, histogram equalization<br>5.2 Smoothing filters, sharpening filters, gradient and Laplacian<br>5.3 Frequency Domain Filtering<br>2D Fourier Transform, Discrete Cosine Transform, Discrete Wavelet Transform | 09 |
| **6** | Image Segmentation<br>Boundary detection-based techniques, Point, line detection, Edge detection, Edge linking, local processing, regional processing, Hough transform, Thresholding, Iterative thresholding, Otsu's method, moving averages, Multivariable thresholding, Region based segmentation | 07 |

**Books Recommended:**

**Text Books:**

1. John G. Proakis, Dimitris and G.Manolakis, Digital Signal Processing: Principles, Algorithms, and Applications‘ 4th Edition 2007, Pearson Education.

2. A. Anand Kumar, Digital Signal Processing‘, PHI Learning Pvt. Ltd., 2nd edition , 2015.

3. Rafel C. Gonzalez and Richard E. Woods, _Digital Image Processing‘, Pearson Education Asia,4th Edition, 2018,

4. S. Sridhar, Digital Image Processing‘, Oxford University Press, Second Edition, 2016.

**Reference Books:**

1. Sanjit Mitra, Digital Signal Processing: A Computer Based Approach‘, TataMcGraw Hill, 3rd Edition.2007

2. S. Salivahanan, A. Vallavaraj, and C. Gnanapriya, Digital Signal Processing‘ Tata McGraw Hill Publication 1st Edition , 2010.

3. S. Jayaraman, E. Esakkirajan and T. Veerkumar, Digital Image Processing‘ TataMcGraw Hill Education Private Ltd, 2009.

4. Anil K. Jain, Fundamentals and Digital Image Processing‘, Prentice Hall of India Private Ltd, 3rd Edition.,2008

**Online Resources**

1. NPTEL

Digital Image Processing, By Prof. Prabir Kumar Biswas, IIT Kharagpur

https://nptel.ac.in/courses/117/105/117105135/

| **Digital Signal Processing and Applications Laboratory (DJS22CEC802)** | |
|---|---|
| **Sr. No.** | **Title of Experiments** |
| 1 | Sampling and Reconstruction |
| 2 | To perform Discrete Correlation and convolution |
| 3 | To perform Discrete Fourier Transform |
| 4 | To perform Fast Fourier Transform |
| 5 | Implementation of Image negative, Gray level Slicing and Thresholding |
| 6 | Implementation of Contrast Stretching, Dynamic range compression & Bit plane Slicing |

| | |
|---|---|
| 7. | Implementation of Histogram Processing |
| 8. | Apply DFT, DCT and DWT transforms on the image |
| 9. | Implementation of Image smoothing/ Image sharpening |
| 10. | Implementation of Edge detection using Sobel and Prewitt masks |
| 11. | Suggested Mini Projects based on content of the syllabus. (Group of 2-3 students) [Real life Applications/problems].<br>• License plate recognition<br>• Face Emotion recognition<br>• Face recognition<br>• Cancer detection<br>• Object detection<br>• Pedestrian detection<br>• Lane detection<br>• Blind assistance systems<br>• Face Mask Detection<br>• ECG signals analysis<br>• Speech Pitch Detection<br>• Audio Steganography<br>• Audio Fingerprinting<br>• Beat Tracking<br>• Audio source separation |

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| Program: Computer Engineering | Final Year B.Tech. | Semester: VIII |
|---|---|---|
| **Course: Blockchain Technology (DJS22CEC8011)** | | |
| **Course: Blockchain Technology Laboratory (DJS22CEL8011)** | | |

**Prerequisite:** Knowledge of Information Security, Network Fundamentals, Distributed Computing

**Objectives:**

1. To understand emerging abstract models for Blockchain Technology and its relevance with cryptography.
2. To identify major research challenges and technical gaps existing between theory and practice in crypto currency domain.
3. To provide conceptual understanding of the function of Blockchain as a method of securing distributed ledgers, how consensus on their contents is achieved, and the new applications that they enable.
4. To apply hyperledger Fabric and Ethereum platform to implement the Blockchain Application.

**Outcomes:** On completion of the course, learner will be able to:

1. Acquire basic knowledge of Blockchain technology and Analyze various algorithms used in Blockchain.
2. Introduce cryptocurrency and various regulations.
3. Aware of privacy and security issues and applications in Blockchain.
4. Design and understand various applications using Blockchain and Distributed Foundation and case studies.

| **Blockchain Technology (DJS22CEC8011)** | | |
|---|---|---|
| **Unit** | **Description** | **Hours** |
| **1** | **Distributed Computing Foundations and the Emergence of Blockchain Technology:**<br>Introduction to Distributed Systems, Challenges in Distributed Record Keeping<br>Fault Tolerance: Crash vs Byzantine Failures<br>The Byzantine Generals Problem and Consensus<br>Scalability of Consensus Algorithms, Nakamoto Consensus and the Genesis of Blockchain,<br>Core Technologies in Blockchain: Hash Pointers & Merkle Trees, Consensus Mechanisms (PoW, PoS), Byzantine Fault Tolerance, Digital Cash and Cryptographic Security<br>Atomic Broadcast and Blockchain Consistency. | 07 |

| | | |
|---|---|---|
| **2** | **Basic Crypto primitives and Blockchain 1.0:**<br>Cryptographic Building Blocks: Hash Functions: Pre-image resistance, Puzzle-friendliness, Collision Resistance, Public Key Cryptography and Digital Signatures, Verifiable Random Functions, Zero-Knowledge Proofs (Intro and Relevance in Privacy),<br>**Bitcoin and Blockchain 1.0**: Overview of Bitcoin Blockchain, Challenges in Bitcoin: Scalability, Energy, Transaction Throughput, Solutions and Workarounds (SegWit, Lightning Network, etc.),<br>**Consensus Mechanisms**: Proof of Work: How and Why it Works, Proof of Stake and Other Alternatives, Trade-offs: Security, Scalability, Decentralization,<br>Bitcoin Scripting: Basics of Bitcoin Script, Use Cases: Multi-sig, Time locks, Escrow, Limitations and Future Extensions | 07 |
| **3** | **Blockchain 2.0:**<br>Ethereum and Smart Contracts, The Turing Completeness of Smart Contract Languages and verification challenges, using smart contracts to enforce legal contracts, comparing Bitcoin scripting vs. Ethereum Smart Contracts. | 07 |
| **4** | **Blockchain 3.0:**<br>Hyperledger fabric, the plug and play platform and mechanisms in permissioned blockchain. The Linux Foundation's Hyperledger Fabric and Microsoft Azure's Blockchain as a Service. | 07 |
| **5** | **Privacy, Security Issues in Blockchain:**<br>Pseudo-anonymity vs. anonymity, Zcash and Zk-SNARKS for anonymity preservation, attacks on Blockchains such as Sybil attacks, selfish mining, 51% attacks advent of algorand, and Sharding based consensus algorithms to prevent these attacks. | 07 |
| **6** | **Blockchain Applications and DiFi Foundations:**<br>Applications of Blockchain in Healthcare, Automotive, Government, Insurance, Media and Entertainment. Distributed Ledger Technology: Governance and Regulations, Applications in Governance, Global Perspectives, Case Study:– Estonian block chains transform paying, trading, and signing. DiFi Foundations, Role of quantum computing in crypto ecosystem. a key ingredient for Distributed Finance.<br>Introduction to Web 3.0: Decentralized web concepts, protocols, and impact<br>Tokenization: Types of tokens (fungible, non-fungible) | 07 |

**Text books:**

1. Josh Thompson, - Blockchain: The Blockchain for Beginnings, Guild to Blockchain Technology and Blockchain Programming, Create Space Independent Publishing Platform, 2017.
2. S. Shukla, M. Dhawan, S. Sharma, S. Venkatesan, -Blockchain Technology: Cryptocurrency and Applications, Oxford University Press, 2019.

**Reference Books:**

1. Dr. Gavin Wood -ETHEREUM: A Secure Decentralized Transaction Ledger, Yellow paper.2014.
2. Antony Lewis, Basics of Bitcoins and Blockchain, Mango Publishing, 2018.

**Suggested List of Experiments:**

| **Block Chain Technology (DJS22CEL8011)** | |
|---|---|
| **Sr. No.** | **Suggested Practical** |
| **1** | Program to demonstrate how to use SHA-256 Hash function in Blockchain. |
| **2** | Program to create n blocks in Blockchain and perform traversal function. |
| **3** | Program to implement PoW/ PoS Algorithm in Blockchain. |
| **4** | Program to create a Merkle Tree in Blockchain. |
| **5** | Program to demonstrate Features of the Digital Wallet. |
| **6** | Program to deploy a Smart Contract to Blockchain using Remix IDE. |
| **7** | Program to demonstrate how to identify 51% attacks on a Blockchain. |
| **8** | Program to demonstrate the concept of forking. |
| **9** | Program to create a Decentralized Blind Auction Smart Contract on the Ethereum Blockchain. |
| **10** | Program to demonstrate Healthcare/ Finance Application using Hyperledger Fabric. |

Any other practical covering the syllabus topics and subtopics can be conducted.

Prepared by Checked by Head of the Department Principal

| Program: Computer Engineering | Final Year B.Tech. | Semester: VIII |
|---|---|---|
| **Course: Social Network Analysis (DJS22CEC8012)** | | |
| **Course: Social Network Analysis Laboratory (DJS22CEL8012)** | | |

**Prerequisite:** Discrete Mathematics

**Objectives:**

1. To introduce students to the fundamental concepts of social networks and graph theory,
2. To Design graph-based models for representing social data and apply network analysis techniques to reason about social relationships and interactions.
3. To familiarize students with ontological modeling, knowledge representation, and reasoning in social networks.
4. To develop practical skills in applying algorithms and visualization techniques to study network dynamics, information diffusion, and community evolution in real-world social networks.

**Outcomes:** On completion of the course, learner will be able to:

1. Understand and explain the foundational concepts of social networks, including their structure, evolution, and applications using graph theory.
2. Construct ontological models and perform reasoning over social data to support semantic web applications.
3. Evaluate dynamic behaviors such as cascades and community evolution in large-scale social networks.
4. Extract, analyze, and visualize web-based social network data using matrix, graph-based, and hybrid visualization techniques.

| Social Network Analysis (DJS22CEC8012) | | |
|---|---|---|
| **Unit** | **Description** | **Hours** |
| **1** | **Introduction to Social Networks:** Introduction, History of social network analysis, Development of Social Network Analysis, measures in network analysis, Social Networks vs. Link Analysis, The Power of Informal Networks, The Power of Social Networks, Applications of Social Networks in Real Life. | 05 |
| **2** | **Basics of Graph Theory and Structure:** Choice of Representation, Degree of a Vertex, Degree Distribution, Average Degree of a Graph, Complete Graph, Regular Graph, Bipartite Graph, Graph Representation, Edge Attributes, Path, Cycle, Path Length, Distance, Average Path Length, Connectedness of Graphs, Clustering Coefficient, Average Clustering Coefficient, Algorithms, First Set of Experiments—Degree Distributions, Second Set of Experiments—Connected Components, Third Set of Experiments—Number of Breadth First Searches, Rank Exponent R, Out-Degree | 08 |

| | | |
|---|---|---|
| | Exponent O, Hop Plot Exponent H, Eigen Exponent E, Permutation Model, Random Graphs with Prescribed Degree Sequences. | |
| **3** | **Knowledge Representation, Modelling and aggregating:** Introduction to semantic Web, Ontologies and their role in the Semantic Web, Ontology languages for the Semantic Web, State-of-the-art in network data representation, Ontological representation of social individuals, Ontological representation of social relationships, Aggregating and reasoning with social network data, Building Semantic Web applications with social network features. | 06 |
| **4** | **Cascading in Social Networks**: Decision Based Models of Cascade: Collective Action, Cascade Capacity, Co-existence of Behaviours, Cascade Capacity with Bilinguality, Probabilistic Models of Cascade, Branching Process, Basic Reproductive Number, SIR Epidemic Model, SIS Epidemic Model, SIRS Epidemic Model, Transient Contact Network, Cascading in Twitter. | 06 |
| **5** | **Extracting and Analyzing Web Social Networks:** Extracting Evolution of Web Community from a Series of Web Archive: Types of Changes, Evolution Metrics, Web Archives and Graphs, Evolution of Web Community Charts, Temporal Analysis on Semantic Graph using Three-Way Tensor Decomposition: Background, Algorithms, Examples of Formed Community, Analysis of Communities and Their Evolutions in Dynamic Networks: Motivation, Problem Formulation, Algorithm, Community Discovery Examples, Socio-Sense: A System for Analyzing the Societal Behavior from Web Archive: System Overview, Web Structural Analysis, Web Temporal Analysis, Consumer Behavior Analysis. | 08 |
| **6** | **Visualizing Social Networks:** Introduction, A Taxonomy of Visualizations: Structural Visualization , The value of network layout in visualization, Node-link diagrams, Matrix Oriented Techniques, Hybrid Techniques, Semantic and Temporal Visualization: Ontology-based visualization, Temporal Visualization, Statistical Visualization, The Convergence of Visualization, Interaction and Analytics: Visualization and Analysis, Visualization and Interaction, Structural and Semantic Filtering with Ontologies, Centrality-based Visual Discovery and Exploration. | 06 |

**Book Recommended:**

**Text books:**

1. Maksim Tsvetovat and Alexander Kouznetsov, “Social Network Analysis for Startups”, O’Reilly, 2011.
2. Krishna Raj P.M., Ankith Mohan, K.G. Srinivasa, “Practical Social Network Analysis with Python, Springer, 2018.
3. John Scott, “What is Social Network Analysis”, Bloomsbury Academic, 2012.
4. Peter Mika, “Social Networks and the Semantic Web”, Springer, 2007.
5. Guandong Xu, Yanchun Zhang, Lin Li, “Web Mining and Social Networking”, Springer, 2011.

6. Charu C. Aggrwal, "Social Network Data Analytics", Springer, 2011.

**Reference Books:**

1. Stanley Wasserman, Katherine Faust, "Social Network Analysis: Methods and Applications", Cambridge University Press, 1994.
2. Stephen P Borgatti, Martin G Everett and Jeffrey C Johnson, "Analyzing Social Networks", SAGE, 2013.
3. Mehmet Kaya, Reda Alhajj, "Influence and Behavior Analysis in Social Networks and Social Media", Springer, 2019.

**Suggested List of Experiments:**

| **Social Network Analysis (DJS22CEL8012)** | |
|---|---|
| **Sr. No.** | **Suggested Practical** |
| **1** | Social Media analytics tools ( Facebook insights, google analytics )<br>e.g. Google Analytics https://marketingplatform.google.com/about/analytics/ https://netlytic.org |
| **2** | **Case study based**<br>Data Collection-Select the social media platforms of your choice (Twitter, Facebook, LinkedIn, YouTube, Web blogs etc) ,connect to and capture social media data for business ( scraping, crawling, parsing). |
| **3** | Data Cleaning and Storage- Preprocess, filter and store social media data for business. |
| **4** | Build a graph-based representation of the network. |
| **5** | Develop Content (text, emoticons, image, audio, video) based social media analytics model for business. (e.g. Content Based Analysis :Topic , Issue ,Trend, sentiment/opinion analysis, audio, video, image analytics) |
| **6** | Develop Structure based social media analytics model for any business. ( e.g. Structure Based Models -community detection, influence analysis). |
| **7** | Develop social media text analytics models for improving existing product/ service by analyzing customer's reviews/comments. |
| **8** | Exploratory Data Analysis and visualization of Social Media Data. |
| **9** | Simulation of Information Diffusion in Social Networks Using Independent Cascade and Linear Threshold Models. |
| **10** | Visualize the network using appropriate techniques (e.g., node-link diagrams, temporal evolution). (R, Gephi etc). |

Any other practical covering the syllabus topics and subtopics can be conducted.

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| Program: Computer Engineering | Final Year B.Tech. | Semester: VIII |
|---|---|---|
| **Course: Design UI/UX (DJS22CEC8013)** | | |
| **Course: Design UI/UX Laboratory (DJS22CEL8013)** | | |

**Prerequisite:** NIL

**Objectives:**

- Understand the foundational differences and complementary roles of UI and UX design.
- Analyze and apply design thinking processes and creativity techniques.
- Explore essential visual design and interaction principles applicable to user interfaces.
- Conduct user research and apply user-centered methodologies for design.
- Create wireframes, interactive prototypes, and evaluate usability through testing methods.

**Outcomes:** On completion of the course, learner will be able to:

1. Differentiate between user interface and user experience principles.
2. Apply the UI design elements in building user-friendly applications.
3. Analyze user behavior and requirements through research methods.
4. Develop user-centered design solutions using wireframes and prototypes.
5. Evaluate the effectiveness of design through usability testing and iterations.

| Design UI/UX (DJS22CEC8013) | | |
|---|---|---|
| **Unit** | **Description** | **Hours** |
| **1** | **Introduction to Design Thinking & User-Centered Design**<br>Understanding UI vs. UX and their synergy in product design, Principles of design thinking: stages and application, Creative ideation using divergent and convergent thinking, Brainstorming and gamification-based idea generation, Empathy through observation and contextual understanding. Multilingual designs.<br>Introduction to Web Accessibility and WCAG 2.1, Perceivable and Operable Content Understandable and Robust Content, Multilingual Aspect. | 7 |
| **2** | **Principles of Visual and Interface Design**<br>Visual & UI Principles: Color theory, typography, whitespace, hierarchy,<br>UI Elements & Patterns: Buttons, forms, navigation, cards etc.<br>Interaction Behaviors & Principles: Feedback, affordance, consistency<br>Branding & Style Guides: Logos, color palettes, iconography, component library | 8 |
| **3** | **UX Process and Research Methodologies**<br>Introduction to UX and UX design, Why You Should Care about User Experience, UX Processes, Lifecycles, Methods and Techniques. | 8 |

| | | |
|---|---|---|
| | User research methods: interviews, surveys, observational techniques, Mapping user needs with organizational goals. | |
| **4** | **Wireframing, Prototyping & Usability Testing**<br>Basics of sketching for UI concepts and identifying primary user tasks, Responsive Design Fundamentals, Wireframing & Wireflows, Building a Prototype, Designing interactive user flows and high-fidelity mockups, Prototyping Tools (Figma/Sketch/Adobe XD basics), Interaction Patterns, Conduct Usability Testing, Synthesizing Test Findings, Prototype Iteration | 8 |
| **5** | **Design Ideation, Personas & Information Architecture**<br>Defining problem statements, identifying appropriate research methods and applying insights, Creating Personas, Solution Ideation, Creating User Stories, Creating Scenarios, Flow Diagrams, Flow Mapping, Information Architecture. | 8 |

**Textbooks:**

1. Joel Marsh, "UX for Beginners", O'Reilly, 2022
2. A. Cooper, R. Reimann, D. Cronin, and C. Noessel, About Face: The Essentials of Interaction Design, 4th ed. Indianapolis, IN, USA: Wiley, 2014.
3. Jon Yablonski, "Laws of UX using Psychology to Design Better Product & Services" O'Reilly 2021

**Reference Books:**

1. Jenifer Tidwell, Charles Brewer, Aynne Valencia, "Designing Interface" 3rd Edition, O'Reilly 2020
2. Rex Hartson, Pardha S. Pyla, "The UX Book: Agile UX Design for a Quality User Experience" (2nd Edition)
3. Xia Jiajia, "UI UX Design", O"Reilly, Art power International, 2016
4. Steve Schoger, Adam Wathan "Refactoring UI", 2018
5. Regine M. Gilbert, "Inclusive Design for a Digital World", 2019

**Suggested List of Experiments:**

| **Design UI/UX (DJS22CEL8013)** | |
|---|---|
| **Sr. No.** | **Suggested Practical** |
| 1 | Identify and analyze the UI and UX of two digital products. |
| 2 | Conduct a mini-user study and document an empathy map. |
| 3 | Evaluate systems based on Web Content Accessibility Guidelines (WCAG) 2.1 |
| 4 | Create a Brand Style Guide: Choose a fictional brand and define its visual language. |
| 5 | UI Pattern Library Compilation: Curate commonly used UI elements with annotations. |
| 6 | Designing a Research Toolkit: Create a user interview script and online survey. |
| 7 | Organize research findings into clusters to identify common themes and user needs. |
| 8 | Design hand-drawn wireframes for a given app flow. |
| 9 | Develop a clickable prototype and conduct peer usability tests. |
| 10 | Create personas and corresponding user journeys. |
| 11 | Design the flow of an application using diagrams and IA concepts. |

Any other practical covering the syllabus topics and subtopics can be conducted.

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| Program: Computer Engineering | Final Year B.Tech. | Semester: VIII |
|---|---|---|
| **Course: Ethical Hacking & Digital Forensics (DJS22CEC8014)** | | |
| **Course: Ethical Hacking & Digital Forensics Laboratory (DJS22CEL8014)** | | |

**Prerequisite:** Information Security.
**Objectives:**

- To understand ethical hacking concepts, hacker classifications, and hacking methodologies.
- To understand and use basic tools and methods to find information about computer systems through footprinting, scanning, and enumeration.
- To introduce the phases and tools used in penetration testing and system hacking.
- To explain the fundamentals and significance of digital forensics in various domains.
- To develop the ability to collect, preserve, and analyze digital evidence using proper techniques and tools while considering legal and anti-forensic challenges.
- To familiarize students with modern forensic tools and techniques used in email and mobile device investigations.

**Outcomes:** On completion of the course, learner will be able to:

- Explain ethical hacking concepts, hacker types, legal aspects, and real-world applications.
- Use footprinting, scanning, and enumeration tools to gather system and network information.
- Perform penetration testing and demonstrate basic system hacking techniques.
- Identify digital evidence and apply file system and disk forensics tools.
- Apply evidence collection, hashing, and anti-forensics detection methods.
- Analyze network traffic, email artifacts, and mobile device data using forensic tools.

| **Ethical Hacking & Digital Forensics (DJS22CEC8014)** | | |
|---|---|---|
| **Unit** | **Description** | **Hours** |
| **1** | **Introduction to Ethical Hacking**:<br>Introduction to Ethical Hacking, Classification of Hackers (White Hat, Black Hat, Grey Hat), Phases of Ethical Hacking, Cybersecurity vs Ethical Hacking, Cyber Laws and Ethical Responsibilities, Introduction to Artificial Intelligence in Cybersecurity and Hacking, Industry Certifications in Ethical Hacking, Scope and Career Opportunities in Ethical Hacking, Real-World Case Studies of Ethical Hacking | **6** |

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|---|---|---|
| **2** | **Footprinting, Scanning, and Enumeration:**<br>Footprinting Techniques, DNS Interrogation, Email Harvesting, Social Engineering, Footprinting Tools (Maltego, Recon-ng), Scanning Methodology, Port Scanning Types and Tools (Nmap, Netcat), Enumeration Techniques, Enumeration Tools (SNMP, SMB, LDAP), Banner Grabbing, Use of AI for Automated Reconnaissance and Threat Detection | **6** |
| **3** | **Penetration Testing and System Hacking**<br>**Penetration Testing:** Fundamentals of Penetration Testing, Types of Penetration Testing (Black Box, White Box, Grey Box), Phases of Penetration Testing, Penetration Testing Tools (Metasploit, Burp Suite, Nikto,etc)<br>**System Hacking:** Password Attacks (Brute-force, Dictionary, Rainbow Tables), Privilege Escalation Techniques, Malware and Rootkits, Executing Applications and Hiding Files, System Hacking Tools, Introduction to Dark Web and TOR Network, Dark Web-based Threat Intelligence and Anonymity Tools | **7** |
| **4** | **Introduction to Digital Forensics**<br>Definition and Scope of Digital Forensics, Types and Characteristics of Digital Evidence, Phases of a Digital Investigation, File System Forensics (FAT, NTFS), Disk Imaging and Cloning (Bit-by-Bit Copy), Data Recovery Concepts, Deleted File and Slack Space Analysis, Metadata Extraction and Timestamp Interpretation, Disk Forensics Tools (FTK Imager, Autopsy, EnCase), Role of AI and Machine Learning in Digital Forensics | **7** |
| **5** | **Evidence Collection and Data Analysis**<br>Evidence Collection Techniques (Live vs Dead), Chain of Custody and Legal Considerations, Volatile and Non-Volatile Evidence Acquisition, Remote Evidence Acquisition, Hashing Algorithms (MD5, SHA1, SHA256) for Verification, Write Blockers and Imaging Devices, Anti-Forensics Techniques (Data Hiding, Steganography, File Obfuscation), Detection and Countering Anti-Forensics, Use of AI Tools for Pattern Detection and Data Anomaly Analysis , Data Carving and Signature-Based Recovery. | **7** |
| **6** | **Network, Email, and Mobile Forensics**<br>Network Forensics (Packet Capture, Flow Analysis), Live Traffic Monitoring Tools (Wireshark, TCPDump), Log File and Firewall Analysis, Intrusion Detection Logs, Honeynet and Sandbox Environments, Email Forensics (Header and Server Log Analysis, MIME Format), Mobile Device Forensics (Android and iOS), Acquisition Techniques (Logical, Physical, Cloud), SIM and App Data Extraction, Tools (Cellebrite, XRY, MOBILedit), Open Source Intelligence (OSINT) and Threat Attribution Techniques | **6** |

**Books Recommended:**

**Text books:**

1. EC-Council "Ethical Hacking and Countermeasures Attack Phases", Cengage Learning.2nd Edition, 2017
2. Rafay Boloch, "Ethical Hacking and Penetration Testing Guide", CRC Press, 2014.
3. John R. Vacca, "Computer Forensics", Computer Crime Investigation Firewall Media, New Delhi. 2012
4. Nelson, Phillips, Steuart, "guide to Computer Forensics and Investigations", CENGAGE Learning, 6th Edition, 2020.
5. E. Casey, "Digital Evidence and Computer Crime: Forensic Science, Computers and the Internet", 3rd ed. Burlington, MA, USA: Academic Press, 2011.
6. S. Davidoff and J. Ham, "Network Forensics: Tracking Hackers through Cyberspace". Upper Saddle River, NJ, USA: Prentice Hall, 2012.

**Reference Books:**

1. Kevin Smith, "Hacking How to Hack - The ultimate Hacking Guide", Hacking Intelligence.2018
2. Kevin Beaver, "Ethical Hacking for Dummies", Sixth Edition, Wiley, 2018.
3. Keith J. Jones, Richard Bejtiich, Curtis W. Rose, "Real Digital Forensics", Addison- Wesley Pearson Education 2006
4. Tony Sammes and Brian Jenkinson, "Forensic Compiling", A Tractitioneris Guide, Springer International edition.
5. Christopher L.T. Brown, "Computer Evidence Collection & Presentation", Firewall Media.
6. Jesus Mena, "Homeland Security, Techniques & Technologies", Firewall Media.
7. J. T. Luttgens, M. Pepe, and K. Mandia, "Incident Response and Computer Forensics", 3rd ed. New York, NY, USA: McGraw-Hill Education, 2014.

**Suggested List of Experiments:**

| **Ethical Hacking & Digital Forensics Laboratory (DJS22CEL8014)** | |
|---|---|
| **Sr. No.** | **Suggested Practical** |
| **1** | **Footprinting and Reconnaissance:**<br>Objective: Gather information about a target using passive and active footprinting techniques.<br>*Tools:* Recon-ng, theHarvester, SpiderFoot (for AI-powered OSINT), ThreatFox, VirusTotal |

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| **2** | **DNS Interrogation and Email Harvesting**<br>Objective: Perform WHOIS lookups, DNS zone transfers, and identify email addresses.<br>*Tools:* nslookup, dig, whois, theHarvester |
| **3** | **Scanning and Enumeration**<br>Objective: Identify open ports, services, and perform OS detection.<br>*Tools:* Nmap, Netcat |
| **4** | **Enumeration**<br>Objective: Extract user and system info via SMB and SNMP protocols.<br>*Tools:* enum4linux, snmpwalk |
| **5** | **Web Application Scanning**<br>Objective: Scan a web server for vulnerabilities.<br>*Tools:* Nikto, OWASP ZAP, Burp Suite Community Edition |
| **6** | **Exploitation Using Metasploit Framework**<br>Objective: Exploit vulnerabilities in a virtual test machine.<br>*Tools:* Metasploit Framework, DVWA, Metasploitable VM |
| **7** | **Password Cracking**<br>Objective: Perform brute-force and dictionary attacks on password hashes and login services.<br>*Tools:* John the Ripper, Hydra, Hashcat |
| **8** | **Disk Imaging and Basic Forensic Analysis**<br>Objective: Create and analyze a disk image.<br>*Tools:* FTK Imager, Autopsy, dd |
| **9** | **File System and Deleted File Analysis**<br>Objective: Recover deleted files and analyze file system metadata.<br>*Tools:* Autopsy, Sleuth Kit (fls, icat), Scalpel |
| **10** | **Hashing and Data Integrity Verification**<br>Objective: Generate and verify file hashes to maintain evidence integrity.<br>*Tools:* md5sum, sha256sum, HashCalc |
| **11** | **Network Traffic Capture and Protocol Analysis**<br>Objective: Capture and analyze live network traffic for suspicious activity.<br>*Tools:* Wireshark, TCPDump |
| **12** | Email Header Analysis and Evidence Extraction<br>Objective: Trace the source of an email and extract digital evidence.<br>*Tools:* Autopsy (email plugin), ExifTool |
| **13** | **Live Memory Acquisition and Analysis (Windows/Linux)**<br>Objective: Acquire and examine volatile memory for evidence.<br>*Tools:* WinPmem (Windows), LiME (Linux), Volatility |
| **14** | **Steganography and Anti-Forensics Detection**<br>Objective: Detect hidden data in images and analyze steganographic files. |

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|---|---|
| | *Tools:* OpenStego, Steghide, binwalk |
| **15** | **Dark Web Exploration & TOR-based Threat Discovery**<br>Objective:To explore TOR and Dark Web Securely<br>*Tools:* TOR browser, OnionScan, Ahmia |
| **16** | **Mobile Device Forensics and App Data Extraction**<br>Objective: TOR browser, OnionScan, Ahmia<br>*Tools:* MOBILedit, ADB, Cellebrite (demo) |

Any other practical covering the syllabus topics and subtopics can be conducted.

Prepared by Checked by Head of the Department Principal

| Program: Final Year (Common for All Programs) | Semester: VIII |
|---|---|
| Course: Project Management | Course Code: DJS22ILO8021 |

**Pre-requisites: Basic concepts of Management.**

**Objectives:**

1. To familiarize the students with the use of a structured methodology/approach for every unique project undertaken, utilizing project management concepts, tools and techniques.
2. To appraise the students with the project management life cycle and make them knowledgeable about the various phases from project initiation through closure.

**Outcomes: On completion of the course, learners will be able to:**

1. Explain project management life cycle and the various project phases as well as the role of project manager.
2. Apply selection criteria and select an appropriate project from different options.
3. Create a work breakdown structure for a project and develop a schedule based on it. Manage project risk strategically.
4. Use Earned value technique and determine & predict status of the project.
5. Capture lessons learned during project phases and document them for future reference.

**Detailed Syllabus (Unit wise)**

| Unit | Description | Duration in Hours |
|---|---|---|
| 1 | **Project Management Foundation:** Definition of a project, Project Vs Operations, Necessity of project management, Triple constraints, Project life cycles (typical & atypical) Project phases and stage gate process. Role of project manager, Negotiations and resolving conflicts, Introduction to project leadership, ethics in projects, Multicultural and virtual projects, Project management in various organization structures, PM knowledge areas as per Project Management Institute (PMI). | 07 |
| 2 | **Initiating Projects:** How to get a project started, selecting project strategically, Project selection models (Numeric /Scoring Models and Non-numeric models), Project portfolio process, Project sponsor and creating charter, Effective project team, Stages of team. development & growth (forming, storming, norming & performing), team dynamics. | 08 |
| 3 | **Project Planning:** Work Breakdown structure (WBS) and linear responsibility chart, Project cost estimation and budgeting, Top down and bottoms up budgeting. Networking and Scheduling techniques, PERT, CPM, Crashing project time, Resource loading and levelling, Goldratt's critical chain, GANTT chart, Project Stakeholders and Communication plan, Introduction to Project Management Information System (PMIS). Risk Management in projects: Risk management planning, Risk identification and risk register, Qualitative and quantitative risk assessment, Probability and impact matrix. Risk response strategies for positive and negative risks. | 10 |

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|---|---|---|
| **4** | **Monitoring and Controlling Projects:** Planning monitoring and controlling cycle, Information needs and reporting, engaging all stakeholders of the projects, communication and project meetings. With Earned Value Management techniques for measuring value of work completed, using milestones for measurement, change requests and scope creep, Project audit. Project Contracting Project procurement management, contracting and outsourcing. | 07 |
| **5** | **Closing the Project:** Customer acceptance, Reasons of project termination, Various types of project terminations (Extinction, Addition, Integration, Starvation), Process of project termination, completing a final report, doing a lessons learned analysis, acknowledging successes and failures. | 07 |
| | **Total** | 39 |

**Books Recommended:**

*Text books:*

1. Project Management: A managerial approach, Jack Meredith & Samuel Mantel, 7th Edition, Wiley India.
2. Project Management: The Managerial Process, 6th edition, Erik Larson, Clifford Gray, McGraw Hill Education.

*Reference Books:*

1. A Guide to the Project Management Body of Knowledge (PMBOK® Guide), 5th Ed. Project Management Institute PA, USA.
2. Project Management, Gido Clements, Cengage Learning.
3. Project Management, Gopalan, Wiley India.
4. Project Management, Dennis Lock, 9th Edition, Gower Publishing England.

Prepared by Checked by Head of the Department Principal

| **Program: Final Year (Common for All Programs)** | **Semester: VIII** |
|---|---|
| **Course: Entrepreneurship Development and Management** | **Course Code: DJS22ILO8022** |

**Objectives:**

1. To develop entrepreneurial abilities by providing background information about support systems, skill sets, financial and risk covering institutions.
2. To appraise the students with the fundamentals that can help them to make right decisions for

**Outcomes:** Learner will be able to…

1. Develop idea generation, creative and innovative skills
2. Prepare a Business Plan
3. Compare different entrepreneur supporting institutions
4. Correlate suitable MSME scheme for an entrepreneur
5. Interpret financial and legal aspect of a business.

| **Detailed Syllabus (Unit wise)** | | |
|---|---|---|
| **Unit** | **Description** | **Duration in Hours** |
| **1** | Meaning of entrepreneur - Evolution of the concept -Functions of an Entrepreneur-Types of Entrepreneurs Intrapreneur- an emerging class Concept of Entrepreneurship<br>Evolution of Entrepreneurship Development of Entrepreneurship<br>Entrepreneurial Culture Stages in entrepreneurial process Develop idea generation, creative and<br>innovative skills | 07 |
| **2** | Business Planning Process:<br>Meaning of business plan Business plan process Advantages of business planning Marketing plan - Production/operations plan - Organization plan - Financial plan-Final Project Report with Feasibility Study - Preparing a model project report for starting a new venture. | 08 |
| **3** | **Institutions Supporting Entrepreneurs:**<br>Small industry financing developing countries - A brief overview of financial institutions in India Central level and state level institutions - SIDBI-NABARD-IDBI-SIDCO - Indian Institute of Entrepreneurship System. District Industries Centers - Single Window | 07 |
| **4** | **Micro, Small, and Medium Enterprises (MSMES):**<br>MSMEs - Definition and Significance in Indian Economy; MSME Schemes, Challenges and Difficulties in availing MSME Schemes, Forms of Business; Make-In India, Start-Up India, Stand-Up India. Women Entrepreneurship; Rural Entrepreneurship; Family<br>Business and First-Generation Entrepreneurs | 08 |

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|---|---|---|
| **5** | **Finance, Account, Costing and Legal Aspect of Business:**<br>Funding new ventures Conventional Source of Finance bootstrapping, crowd sourcing- angel investors, VCs, debt financing, due diligence, Legal aspects of business (IPR, GST, Labour law)- Cost, volume, profit and break-even analysis - Margin of safety and degree of operating leverage Capital budgeting for comparing projects or<br>opportunities Product costing- Product pricing- Introduction to financial statements - Profit & Loss statement Balance sheet - Cash flow-Closure of Business | 09 |
| | **Total** | 39 |

**Books Recommended:**

*Reference Books:*

1. Effective Entrepreneurial Management: Strategy, Planning, Risk Management, and Organization - by Robert D. Hisrich Veland Ramadani, Springer Publication (2017)
2. Entrepreneurship-Theory, Process Practice -by Donald F.Kuratko, Cengage Learning(2014)
3. Entrepreneurship 6/E-by Robert D. Hisrich McGraw-Hill Education (India) (2011)
4. Entrepreneurship and small business- by Burns, P. New Jersey: Palgrave. (2001).
5. Innovation and entrepreneurship by Drucker. F. Peter, Harper business, (2006).
6. Entrepreneurship development small business enterprises, Poornima M Charantimath Pearson Publication (2013)
7. Entrepreneurial Development -Jayshree Suresh, Margham Publishers, Chennai
8. The Design of Business- by Martin Roger, Harvard Business Publishing (2009)
9. Entrepreneurship-by Roy Rajiv Oxford University Press (2011)

Prepared by Checked by Head of the Department Principal

| **Program: Final Year (Common for All Programs)** | **Semester: VIII** |
|---|---|
| **Course: Corporate Social Responsibility** | **Course Code: DJS22ILO8023** |

**Objectives:**

1. To make students understand the concept, theories and application of CSR for the Development of the Society.

**Outcomes:** On completion of the course, learner will be able to:

1. Understand the key characteristics of Corporate Social Responsibility (CSR) in the context of present-day management.
2. Apprise regarding business decision-making which is informed by ethical values and respect for people communities and the environment.
3. Become aware of creating a strategic plan that enables an organization to reach out to its internal and external stakeholders with consistent messages.
4. Understand critical issues of Corporate Social Responsibility (CSR) in a cross-cultural setting.

| **Detailed Syllabus (Unit wise)** | | |
|---|---|---|
| **Unit** | **Description** | **Duration in Hours** |
| **1** | **Introduction to CSR**<br>Meaning and Definition, History of CSR, Concepts of Charity, Corporate philanthropy, Corporate Citizenship, Sustainability and Stakeholder Management. Environmental aspect of CSR Chronological evolution and Models of CSR in India Carroll's model Major codes on CSR Initiatives in India. | 07 |
| **2** | **International framework for Corporate Social Responsibility**<br>Millennium Development Goals, Sustainable Development Goals, Relationship between CSR and MDGs. United Nations (UN) Global Compact 2011. UN guiding principles on business and human rights. OECD CSR policy tool, ILO tri-partite declaration of principles on multinational enterprises and social policy. | 08 |
| **3** | **CSR-Legislation in India and the World**<br>Section 135 of Companies Act 2013.Scope for CSR Activities under Schedule VII, Appointment of Independent Directors on the Board, and Computation of Net Profit's Implementing Process in India. | 08 |
| **4** | **The Drivers of CSR in India**<br>Market based pressure and incentives, civil society pressure, the regulatory environment in India Counter trends, Review of current trends and opportunities in CSR, Review of successful corporate initiatives and challenges of CSR. Case Studies of Major CSR<br>Initiatives, Corporate Social Responsibility and Public-Private Partnership (PPP). | 08 |
| **5** | **Identifying key stakeholders of CSR**<br>Role of Public Sector in Corporate, government programs, Nonprofit and Local Self Governance in implementing CSR, Global Compact Self-Assessment Tool, National Voluntary Guidelines by Govt. of India, Roles | 08 |

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|---|---|---|
| | and responsibilities of corporate foundations. | |
| | **Total** | 39 |

**Books Recommended:**

*Text books:*

1. Corporate Social Responsibility in India, Sanjay K Agarwal, Sage Publications, 2008
2. Corporate Social Responsibility in India, Bidyut Chakrabarty, Routledge, New Delhi, 2015.

*Reference Books:*

1. Corporate Social Responsibility: An Ethical Approach, Mark S. Schwartz, Broadview Press, 2011
2. Attaining Sustainable Growth through Corporate Social Responsibility, George Pohle and Jeff Hittner, IBA Global Business Services, 2008
3. Strategic Corporate Social Responsibility: Stakeholders in a Global Environment, William B. Werther Jr. and David Chandler, 2nd Edition, Sage Publications, 2011

Prepared by Checked by Head of the Department Principal

| Program: Final Year (Common for All Programs) | Semester: VIII |
|---|---|
| Course: Human Resource Management | Course Code: DJS22ILO8024 |

**Objectives:**

1. To introduce the students with basic concepts, techniques and practices of the human resource management.
2. To provide opportunity of learning Human resource management (HRM) processes, related with the functions, and challenges in the emerging perspective of today's organizations.
3. To familiarize the students about the latest developments, trends & different aspects of HRM.
4. To acquaint the student with the importance of inter-personal & inter-group behavioral skills in an organizational setting required for future stable engineers, leaders and managers.

**Outcomes:** On completion of the course, learner will be able to:

1. Understand the concepts, aspects, techniques and practices of the human resource management.
2. Understand the Human resource management (HRM) processes, functions, changes and challenges in today's emerging organizational perspective.
3. Gain knowledge about the latest developments and trends in HRM.
4. Apply the knowledge of behavioral skills learnt and integrate it with in inter personal and intergroup environment emerging as future stable engineers and managers.

| Detailed Syllabus (Unit wise) | | |
|---|---|---|
| **Unit** | **Description** | **Duration in Hours** |
| **1** | **Introduction to HR**<br>Human Resource Management- Concept, Scope and Importance, Interdisciplinary Approach Relationship with other Sciences, Competencies of HR Manager, HRM functions.<br>Human resource development (HRD): changing role of HRM<br>Human resource<br>Planning, Technological change, Restructuring and rightsizing. Empowerment, TQM,<br>Managing ethical issues. | 07 |
| **2** | **Organizational Behaviour (OB)**<br>Introduction to OB Origin, Nature and Scope of Organizational Behaviour, Relevance to Organizational Effectiveness and Contemporary issues.<br>Personality: Meaning and Determinants of Personality, Personality development, Personality Types, Assessment of Personality Traits for Increasing Self Awareness. Perception: Attitude and Value, Effect of perception on Individual Decision-making. Attitude and Behaviour.<br>Motivation: Theories of Motivation and their Applications for Behavioural Change (Maslow, Herzberg, McGregor);<br>Group Behaviour and Group Dynamics: Work groups formal and informal groups and stages of group development, Team Effectiveness: High performing teams, Team Roles, cross functional and self-directed team.<br>Case study. | 08 |

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| **3** | **Organizational Structure & Design**<br>Structure, size, technology, Environment of organization; Organizational Roles & conflicts: Concept of roles; role dynamics;<br>role conflicts and stress.<br>Leadership: Concepts and skills of leadership, Leadership and managerial roles, Leadership styles and contemporary issues in leadership.<br>Power and Politics: Sources and uses of power, Politics at workplace, Tactics and strategies. | 08 |
| **4** | **Human resource Planning**<br>Recruitment and Selection process, Job-enrichment, Empowerment-Job Satisfaction, employee morale.<br>Performance Appraisal Systems: Traditional & modern methods, Performance Counselling. Career Planning.<br>Training & Development: Identification of Training Needs, Training Methods.<br>Strategic HRM: Role of Strategic HRM in the modern business world, Concept of Strategy, Strategic Management Process, Approaches to Strategic Decision Making:<br>Strategic Intent-Corporate Mission, Vision, Objectives and Goals. | 08 |
| **5** | **Labor Laws & Industrial Relations:**<br>Evolution of IR, IR issues in organizations,<br>Overview of Labor Laws in India; Industrial Disputes Act, Trade Unions Act, Shops and Establishments Act.<br>**Emerging Trends in HR**<br>Organizational development; Business Process Re-engineering (BPR), BPR as a tool for organizational development, managing processes & transformation in HR. Organizational Change, Culture, Environment.<br>Cross Cultural Leadership and Decision Making: Cross Cultural Communication and diversity at work, Causes of diversity, managing diversity with special reference to handicapped, women and ageing people, intra company cultural difference in employee<br>motivation. | 08 |
| | **Total** | 39 |

**Books Recommended:**

*Reference Books:*
1. Stephen Robbins, Organizational Behavior, 16th Ed, 2013
2. V SP Rao, Human Resource Management, 3rd Ed, 2010, Excel publishing
3. Aswathapa, Human Resource Management: Text & Cases, 6th edition,
4. C. B. Mamoria and SV Gankar, Dynamics of Industrial Relations in India, 15th Ed, 2015, Himalaya Publishing, 15thedition, 2015
5. P. Subba Rao, Essentials of Human Resource management and Industrial relations, 5th Ed, 2013, Himalaya Publishing
6. Laurie Mullins, Management & Organizational Behavior, Latest Ed, 2016, Pearson Publications

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| **Program: Final Year (Common for All Programs)** | **Semester: VIII** |
|---|---|
| **Course: Corporate Finance Management** | **Course Code: DJS22ILO8025** |

**Pre-requisites:** Basic Knowledge of Algebra, Probability and Statistics.

**Objectives:**

1. Overview of Indian financial system, instruments and market.
2. Basic concepts of value of money, returns and risks, corporate finance, working capital and its management.
1. Knowledge about sources of finance, capital structure, dividend policy.

**Outcomes:** On completion of the course, learner will be able to:

1. Understand Indian finance system.
2. Apply concepts of time value money and risk returns to product, services and business.
3. Understand corporate finance; evaluate and compare performance of multiple firms.
4. Take Investment, finance as well as dividend decisions.

| **Detailed Syllabus (Unit wise)** | | |
|---|---|---|
| **Unit** | **Description** | **Duration in Hours** |
| **01** | **Overview of Indian Financial System:** Characteristics, Components and Functions of Financial System. Financial Instruments: Meaning, Characteristics and Classification of Basic Financial Instruments Equity Shares, Preference Shares, Bonds-Debentures, Certificates of Deposit, and Treasury Bills. Financial Markets: Meaning, Characteristics and Classification of Financial Markets - Capital Market, Money Market and Foreign Currency Market Financial Institutions: Meaning, Characteristics and Classification of Financial Institutions-Commercial Banks, Investment-Merchant Banks and Stock Exchanges | 07 |
| **02** | **Overview of Corporate Finance:** Objectives of Corporate Finance; Functions of Corporate Finance Investment Decision, Financing Decision, and Dividend Decision. Financial Ratio Analysis:<br>**Overview of Financial Statements:** Balance Sheet, Profit and Loss Account, and Cash Flow Statement; Purpose of Financial Ratio Analysis; Liquidity Ratios; Efficiency or Activity Ratios; Profitability Ratios; Capital Structure Ratios: Stock Market Ratios;<br>Limitations of Ratio Analysis | 08 |
| **03** | **Concepts of Returns and Risks:** Measurement of Historical Returns and Expected Returns of a Single Security and a Two-security Portfolio; Measurement of Historical Risk and Expected Risk of a Single Security and a Two-security Portfolio.<br>Time Value of Money: Future Value of a Lump Sum, Ordinary Annuity, and Annuity Due; Present Value of a Lump Sum, Ordinary Annuity, and Annuity Due; Continuous Compounding and Continuous Discounting. | 07 |

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| **04** | **Working Capital Management:** Concepts of Meaning Working Capital; Importance of Working Capital Management; Factors Affecting an Entity's Working Capital Needs; Estimation of Working Capital Requirements; Management of Inventories; Management of Receivables; and Management of Cash and Marketable Securities.<br>Capital Budgeting: Meaning and Importance of Capital Budgeting; Inputs for Capital Budgeting Decisions; Investment Appraisal Criterion-Accounting Rate of Return, Payback Period, Discounted Payback Period, Net Present Value(NPV), Profitability Index, Internal Rate of Return (IRR), and Modified Internal Rate of Return (MIRR). | 09 |
| **05** | **Capital Structure:** Factors Affecting an Entity's Capital Structure; Overview of Capital Structure Theories and Approaches Net Income Approach, Net Operating Income Approach; Traditional Approach, and Modigliani-Miller Approach. Relation between Capital Structure and Corporate Value; Concept of Optimal Capital Structure Dividend Policy: Meaning and Importance of Dividend Policy; Factors Affecting an Entity's Dividend Decision; Overview of Dividend Policy Theories and Approaches- Gordon's Approach, Walter's Approach, and Modigliani-Miller Approach | 08 |
| | **Total** | 39 |

**Books Recommended:**

*Reference Books:*

1. Fundamentals of Financial Management, 13th Edition (2015) by Eugene F. Brigham and Joel F. Houston; Publisher: Cengage Publications, New Delhi.
2. Analysis for Financial Management, 10th Edition (2013) by Robert C. Higgins; Publishers: McGraw Hill Education, New Delhi.
3. Indian Financial System, 9th Edition (2015) by M. Y. Khan; Publisher: McGraw Hill Education, New Delhi.
4. Financial Management, 11th Edition (2015) by 1. M. Pandey; Publisher: S. Chand (G/L) & Company Limited, New Delhi.
5. Financial Management, Theory & Practice 8th Edition (2011), by Prasanna Chandra: Tata McGraw Hill Education Private Limited, New Delhi.

Prepared by Checked by Head of the Department Principal

| **Program: Final Year (Common for All Programs)** | **Semester: VIII** |
|---|---|
| **Course: Logistic and Supply Chain Management** | **Course Code: DJS22ILO8026** |

**Objectives:**

1. To acquaint with the concept of key drivers of supply chain performance and their inter-relationships with strategy.
2. To acquaint with the design problems and develop an understanding of information technology in supply chain optimization.
3. To acquaint with the complexity of inter-firm and intra-firm coordination in implementing programs such as e-collaboration, quick response, jointly managed inventories and strategic alliances.

**Outcomes:** On completion of the course, learner will be able to:

1. Demonstrate the functional strategy map of supply chain management.
2. Analyze the determinants of Supply Chain and Transportation networks design.
3. Demonstrate the need of coordination and sourcing decisions in supply chain.
4. Understand pricing, revenue management and role of IT in supply chain.
5. Understand various sustainability aspects of a supply chain.

| **Detailed Syllabus (Unit wise)** | | |
|---|---|---|
| **Unit** | **Description** | **Duration in Hours** |
| **01** | **Understanding the Supply Chain:**<br>Objective, Importance, Decision Phases, Process Views.<br>**Achieving Strategic Fit and Scope:**<br>Competitive and Supply Chain Strategies, Achieving Strategic Fit, Expanding Strategic<br>Scope, Challenges to Achieving and Maintaining Strategic Fit.<br>**Supply Chain Drivers and Metrics:**<br>Financial Measures of Performance, Drivers of Supply Chain Performance, Framework for<br>Structuring Drivers, Facilities, Inventory, Transportation, Information, Sourcing, Pricing.<br>**Creating the Responsive Supply Chain:**<br>Product push versus demand pull, The Japanese philosophy, The foundations of agility, A route-map to responsiveness. | 08 |

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|---|---|---|
| **02** | **Designing the Supply Chain and Transportation Networks**<br>**Designing Distribution Networks:**<br>The Role of Distribution in the Supply Chain, Factors Influencing Distribution Network Design, Design Options for a Distribution Network.<br>**Network Design in the Supply Chain:**<br>The Role of Network Design in the Supply Chain, Factors Influencing Network Design Decisions, Framework for Network Design Decisions, Models for Facility Location and Capacity Allocation.<br>**Designing Global Supply Chain Networks:**<br>The Impact of Globalization on Supply Chain Networks, The Offshoring Decision: Total Cost, Risk Management in Global Supply Chains, Discounted Cash Flows, Evaluating Network Design Decisions Using Decision Trees.<br>**Transportation in a Supply Chain:** | 11 |
| | The Role of Transportation in a Supply Chain, Modes of Transportation and their Performance Characteristics, Design Options for a Transportation Network, Trade-Offs in<br>Transportation Design, Tailored Transportation. | |
| **03** | **Coordination in a Supply Chain:**<br>Lack of Supply Chain Coordination and the Bullwhip Effect, The Effect on Performance of Lack of Coordination, Obstacles to Coordination in a Supply Chain, Managerial Levers to Achieve Coordination, Continuous Replenishment and Vendor-Managed Inventories, Collaborative Planning, Forecasting, and Replenishment.<br>**Sourcing Decisions in a Supply Chain:**<br>The Role of Sourcing in a Supply Chain, In-House or Outsource, Third- and Fourth-Party Logistics Providers, Using Total Cost to Score and Assess Suppliers, Supplier Selection- Auctions and Negotiations, Contracts, Risk Sharing and Supply Chain Performance,<br>Design Collaboration, The Procurement Process. | 07 |
| **04** | **Pricing and Revenue Management in a Supply Chain:**<br>The Role of Pricing and Revenue Management in a Supply Chain, Pricing and Revenue Management for Multiple Customer Segments, Pricing and Revenue Management for Perishable Assets, Pricing and Revenue Management for Seasonal Demand, Pricing and Revenue Management for Bulk and Spot Contracts.<br>**Information Technology in a Supply Chain:**<br>The Role of IT in a Supply Chain, The Supply Chain IT Framework, Customer Relationship Management, Internal Supply Chain Management, Supplier Relationship Management, The Transaction Management Foundation, Managing the supply chain as a network, Seven major business transformations, From 3PL to 4PL. The Future of IT in the<br>Supply Chain. | 08 |
| **05** | **Creating a Sustainable Supply Chain:**<br>The Role of Triple Bottom Line, Key Metrics for Sustainability, Greenhouse gases and the supply chain, Reducing the transport-intensity of supply chains, Beyond the carbon footprint, Reduce, reuse, recycle, Sustainability and Supply Chain Drivers.<br>**Introduction to the Supply Chain of the Future:** Emerging Megatrends. | 05 |
| | **Total** | 39 |

**Books Recommended:**

*Reference Books:*

1. Logistics & Supply Chain Management, Martin Christopher, Pearson Education Limited, 2016.
2. Supply Chain Management Strategy, Planning, and Operation, Sunil Chopra and Peter Meindl, Pearson, 2016.
3. Essentials of Supply Chain Management, Michael H. Hugos, Wiley, 2018.
4. Supply Chain Management For Dummies, Daniel Stanton, Wiley, 2020.
5. Global Supply Chain and Operations Management A Decision-Oriented Introduction to the Creation of Value, Dmitry Ivanov, Alexander Tsipoulanidis and Jörn Schönberger, Springer International Publishing, 2016.
6. Supply Chain Management, Sinha, McGraw-Hill Education (India) Pvt Limited, 2012.

Prepared by Checked by Head of the Department Principal

| **Program: Final Year (Common for All Programs)** | **Semester: VIII** |
|---|---|
| **Course: IPR and Patenting** | **Course Code: DJS22ILO8027** |

**Objectives:**

1. Understanding, defining and differentiating different types of intellectual properties (IPs)
2. Assessing different IP management (IPM) approaches
3. Exposure to the Legal management of IP and understanding of real life practice of IPM.

**Outcomes:** On completion of the course, learner will be able to:

1. Recognize the crucial role of IP for the purposes of product and technology development.
2. Understand how and when to file a patent
3. Apply the knowledge to understand the entire ecosystem
4. Derive value from IP and leverage its value in new product and service development.

| **Detailed Syllabus (Unit wise)** | | |
|---|---|---|
| **Unit** | **Description** | **Duration in Hours** |
| **1** | **Concept of Intellectual Property Law**<br>Idea/Expression dichotomy, Introduction and the need for intellectual property right (IPR), Intellectual Property laws, IPR in India: Genesis and development, IPR abroad, Major International Instruments concerning Intellectual Property Rights: Paris Convention, the Berne Convention, the Universal Copyright Convention, the WIPO Convention, the Patent Cooperation Treaty, the TRIPS Agreement, incentive theory, types of IPR, India's New National IP Policy, 2016, Govt. Schemes in IPR IP | 06 |
| **2** | **Patents and Trademarks**<br>Elements of Patentability: Novelty, Non Obviousness, Industrial Application, Non Patentable Subject Matter, Registration Procedure, Rights and Duties of Patentee, Assignment and licence, Restoration of lapsed Patents, Surrender and Revocation of Patents, Infringement, Remedies & Penalties, Patent office and Appellate Board, Case study of existing patents related to software, healthcare, devices<br>Concept of Trademarks, Different kinds of marks (brand names, logos, signatures, symbols, well known marks, certification marks and service marks), Non Registrable Trademarks, Registration of Trademarks, Rights of holder and assignment and licensing of marks, Infringement, Remedies & Penalties, Trademarks registry and appellate board | 11 |
| **3** | **Copyrights and Design**<br>Copyrights: Nature, Subject matter: original literary, dramatic, musical, artistic works, cinematograph films and sound recordings, Registration Procedure, Term of protection, Ownership of copyright, Assignment and licence of copyright, Infringement, Remedies & Penalties, Related Rights, distinction between related rights and copyrights<br>Design: meaning and concept of novel and original, procedure for registration, effect of registration and term of protection. | 09 |

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|---|---|---|
| **4** | **GI, PVP and LDP**<br>Geographical indication: meaning, difference between GI and trademarks,procedure for registration, effect of registration and term of protection Plant variety protection: meaning, benefit sharing, farmers' rights, procedure for registration, effect of registration and term of protection Layout Design protection: meaning, procedure for registration, effect of registration, term of protection | 07 |
| **5** | **Beyond IP**<br>Introduction to Competition Law: concept of competition, relationship and Interaction between IPR and competition law, IP and competition issues, Technology transfer agreements. EU experience with IP and Competition Law, Indian Competition Act and IPR protection, IPR issues in merger and acquisition, harmonization of IP protection and competition Law in India. | 06 |
| | **Total** | 39 |

**Books Recommended:**

*Reference Books :*

1. Feroz Ali, The Law of Patents, LexisNexis
2. Ronald D. Slusky, Invention Analysis and Claiming - A Patent Lawyer's Guide, Second Edition, American Bar Association, 2012.
3. Feroz Ali, The Touchstone Effect The Impact of Pre-grant Opposition on Patents, LexisNexis, 2009.
4. Innovation and entrepreneurship by Drucker. F. Peter, Harper business, (2006).
5. Intellectual Property Rights, Deborah. E. Bouchoux, Cengage Learing.
6. Intellectual Property Rights-Unleashmy The Knowledge Economy, Prabuddha Ganguli, Tate Mc Graw Hill Publishing Company Ltd.,
7. The Design of Business- by Martin Roger, Harvard Business Publishing (2009)

Prepared by Checked by Head of the Department Principal

| Program: Final Year (Common for All Programs) | Semester: VIII |
|---|---|
| Course: Digital Marketing and Management | Course Code: DJS22ILO8028 |

**Objectives:**

1. To explain the evolution of digital marketing and outline the underlying technology and frameworks within which digital marketing operates.
2. To understand digital marketing business models elucidating on the six core digital value elements and how they can be used to generate customer value.
3. To understand the key concepts of developing strategy for digital business and the emerging business structures.
4. To plan the digital marketing strategy roadmap, its four key stages and their elements and understand the 6S Digital Marketing Implementation Stages.
5. To understand digital marketing planning & operations setup.
6. To explain the implementation of search campaigns which include Search Engine Marketing (SEM) and Search Engine Optimization (SEO) concepts.
7. To explain upcoming digital marketing concepts including Big Data and Internet of Things (IoT), Small and Medium Businesses (SMB), B2B marketing and Social, Local and Mobile (SoLoMo) concept.

**Outcomes:** Upon Completion of the course, the learner should be able to:

1. Understand the digital marketing framework & model and consumer behaviour.
2. Develop digital marketing strategy roadmap.
3. Explain the terminology and concepts for developing web-specific media plans.
4. Understand concepts related to digital campaign management and revenue generation models.
5. Get a perspective on global digital marketing technology/tools and future trends.

| Detailed Syllabus (Unit wise) | | |
|---|---|---|
| **Unit** | **Description** | **Duration in Hours** |
| **1** | **Introduction to Digital Marketing**<br>Emergence of Digital Marketing as a tool, media consumption drivers for new marketing environment, applications and benefits of digital marketing.<br>**Digital Marketing Framework**<br>Delivering enhanced customer value, market opportunity analysis and digital services development, ASCOR framework, critical success factors for digital marketing.<br>**Digital Marketing Models Creation**<br>Factors impacting digital marketplace, value chain digitization, business models.<br>**The Consumer for Digital Marketing**<br>Consumer behavior on the internet, evolution of consumer behavior models, managing consumer demand, integrated marketing communications (IMC), impact of digital channels on IMC. | 08 |

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|---|---|---|
| **2** | **Digital marketing Strategy Development**<br>Elements of assessment phase, macro-micro environmental analysis, marketing situation analysis.<br>**Digital Marketing Internal Assessment and Objectives Planning**<br>Analyzing present offerings mix, marketing mix, core competencies analysis and internal resource mapping. Digital presence analysis, digital marketing objectives development and review. | 10 |
| | **Digital Marketing Strategy Definition**<br>Understanding digital business strategy and structures, consumer development strategy, offering mix for Digital, digital pricing models, managing promotional channels and developing the extended Ps- People, process, programs and performance.<br>**Digital marketing Strategy Roadmap**<br>Developing digital marketing strategy roadmap, the 6s digital marketing implementation strategy, marketing across the product life cycle. | |
| **3** | **Digital Marketing Planning and Setup**<br>Understanding digital media planning terminology and stages, steps to creating marketing communications strategy, introduction to search marketing, display marketing, social media marketing.<br>**Digital Marketing Operations Setup**<br>Basics of lead generation and conversion marketing, website content development and management, elements of user experience, web usability and evaluation. | 08 |
| **4** | **Digital marketing Execution**<br>Basic elements of digital campaign management, search execution, display execution, social media execution, content marketing.<br>Digital marketing Execution Elements<br>Digital revenue generation models, managing service delivery and payments, managing digital implementation challenges like e commerce, internal & external and consumer specific challenges. | 08 |
| **5** | **Digital Business - Present and Future**<br>Digital Marketing - Global Landscape, digital marketing overview global spend, advertising spend, and technology/tools landscape.<br>Data technologies (Big data and IOT) impacting marketing, segment based digital marketing and SoLoMo - the next level of hyperlocal marketing. | 05 |
| | **Total** | 39 |

**Books Recommended:**

*Reference Books:*

1. Fundamentals of Digital Marketing by Puneet Singh Bhatia, Pearson Education Limited,
2. Digital Marketing by Seema Gupta- McGraw Hill Education.
3. Digital Marketing Excellence: Planning, Optimizing and Integrating Online Marketing by Dave Chaffey and P. R. Smith, 5 th edition, Taylor & Francis.
4. Digital Marketing: Strategy, Implementation and Practice- 6 th edition by Dave Chaffey Fiona Ellis-Chadwick, Pearson Education Limited,
5. Digital marketing by Vandana Ahuja, Oxford University Press.
6. The Art of Digital Marketing by Ian Dodson, John Wiley & Sons.

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| **Program: Final Year Mechanical Engineering** | **Semester: VIII** |
|---|---|
| **Course: Environmental Management** | **Course Code: DJS22ILO8029** |

**Pre-requisites:** Basic Knowledge of Probability and Statistics.

**Objectives:**

1. Understand and identify environmental issues relevant to India and global concerns
2. Learn concepts of ecology
3. Familiarise environment related legislations
4. Understand Environmental Auditing Procedures.

**Outcomes:** On completion of the course, learner will be able to:

1. Identify Environmental issues and get familiarized to the concept of Ecosystem and environmental management.
2. Know policies and legal aspects and understand EM system standards.
3. Understand Environment Impact assessment.
4. Understand Environment Auditing procedures.
5. Describe Environmental management Techniques

| **Detailed Syllabus (Unit wise)** | | |
|---|---|---|
| **Unit** | **Description** | **Duration in Hours** |
| **1** | **Principles of Environmental management (EM):** Introduction of EM, Definition, Ecosystem concept, Participants in EM, Ethics and the environment, International Environmental Movement, Environmental issues relevant to India. | 08 |
| **2** | **Policy and Legal Aspects of EM: -** Introduction to various Environmental Policies, Indian and International Environmental laws and legislation. **EM system Standards:** Core Elements, Benefits, Certification Body Assessment & Documentation for EMS, ISO-14000 Standards. | 09 |
| **3** | **Environmental Impact Assessment (EIA):** Purpose, steps, hierarchy of EIA, Environmental Impact Statement and Impact Indicators, Evolution of IA in India and worldwide. Preliminary stages of EIA, Impact, Prediction, Evaluation and Mitigation. | 09 |
| **4** | **Environmental Auditing (EA):-** Objectives, Scope and Types of EA, Audit Methodology, Elements of Audit Process, Auditing of EMS. | 06 |
| **5** | **Environmental Management Techniques: -** Environmental Monitoring and Modelling, Environmental technology Assessment and Environmental Risk Assessment, Eco- mapping. | 05 |
| | **Total** | 39 |

**Books Recommended:**

*Text Books:*

1. Environmental Management, T V Ramachandra and Vijay Kulkarni, TERI Press

2. Environmental Management: Principles and Practice, CJ Barrow, Routledge Publishers London, 1999

*Reference Books:*

1. A Handbook of Environmental Management Edited by Jon C. Lovett and David G. Ockwell, Edward Elgar Publishing
2. Indian Standard Environmental Management Systems - Requirements with Guidance for Use, Bureau Of Indian Standards, February 2005
3. Environmental Management: An Indian Perspective, S N Chary and Vinod Vyasulu, Macmillan India, 2000
4. Introduction to Environmental Management, Mary K Theodore and Louise Theodore, CRC Press
5. Environment and Ecology, Majid Hussain, 3rd Ed. Access Publishing.2015

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| **Program: Final Year (Common for All Programs)** | **Semester: VIII** |
|---|---|
| **Course: Labour and Corporate Law** | **Course Code: DJS22ILO8030** |

**Objectives:**

1. To understand the development and judicial setup of Labour Laws.
2. To learn the laws relating to Industrial Disputes, Social Security and Working conditions.
3. To analyse the laws related to corporate governance in different settings.
4. To develop awareness of legal principles involved in economic relationships and business transactions.
5. To develop an understanding of free enterprise system and legal safeguards of the same.

**Outcomes:** On completion of the course, learner will be able to:

1. Illustrate the role of trade union in the industrial setup.
2. Understand the important causes, impact of industrial disputes and settlement procedures.
3. To provide in-depth understanding of corporate social responsibility.
4. Apply concepts, principles and theories to understand simple business laws.
5. Analyse the principle of international business and strategies adopted by firms to expand globally.

| **Detailed Syllabus (Unit wise)** | | |
|---|---|---|
| **Unit** | **Description** | **Duration in Hours** |
| **1** | **Trade Unions and Collective Bargaining:** Trade Unionism in India, Definition of Trade Union and Trade Dispute, General and Political Funds of Trade Union, Civil and Criminal Immunities of Registered Trade Unions, Recognition of Trade Union, Collective Bargaining | 08 |
| **2** | **Industrial Dispute and Instruments of Economic Coercion:** Industrial Dispute and Individual Dispute, Settlement of Industrial Dispute. Concept of strike Gherao, Bandh and Lock-out, Types of Strike Rights to Strike and Lock-out | 07 |
| **3** | **Formation of a Company and Corporate governance:** Company and Other Forms of Business Organizations, Different Kinds of Company: One Person Company, Foreign Company. Kinds of Company Meetings and Procedure Powers, Duties and Kinds of Director: Independent Director, Women Director Different Prevention of Oppression and Mismanagement Investor Protection, Insider Trading, Corporate Fraud. | 08 |
| **4** | **Corporate Social Responsibility and Corporate Liquidation:** Evolution of Corporate Social Responsibility, Corporate Criminal liability, Corporate Environmental Liability Different Types of Winding up of Company, Role of Courts in Winding up of Company Merger and Acquisition of Company, Cross Border Merger, Takeover Code: Role of SEBI | 09 |
| **5** | Case Studies on A) Labour law B) Labour relations C) Corporate laws D) Securities laws | 07 |
| | **Total** | 39 |

**Books Recommended:**

*Reference Books:*

1. Surya Narayan Misra, An Introduction to Labour and Industrial Law, Allahabad Law Agency, 1978
2. Indian Law Institute, Cases and Materials on Labour Law and Labour Relations
3. P.L. Malik, Industrial Law, Eastern Book Company, 2013
4. S.C. Srivastava, Industrial Relations and Labour Law, Vikas Publishing House, New Delhi
5. C.A. Kamal Garg, Bharat's Corporate and Allied Laws, 2013.
6. Institute of Company Secretaries of India, Companies Act 2013, CCH Wolter Kluver Business, 2013
7. Saleem Sheikh & William Rees, Corporate Governance & Corporate Control, Cavendish Publishing Ltd., 1995
8. Taxmann, A Comparative Study of Companies Act 2013 and Companies Act 1956

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| Program: Computer Engineering | Final Year B.Tech. | Semester: VIII |
|---|---|---|
| Course: Project Stage-II (DJS22CEP803) | | |

**Course Objectives:**

The primary objective is to meet the milestone s formed in the overall project plan decided in Project -I. The idea presented in Project -I should be implemented in Project -II with results, conclusion and future work. The project will culminate in the production of a thesis by each individual student.

**Guidelines:**

Project Report Format: At the end of semester a student need to prepare a project report as per the guidelines. Along with project report a storage drive containing: project documentation, Implementation code, required utilities, Softwares and user manuals need to be attached.

**Evaluation Scheme:**

***Semester End Examination (A):***

*Laboratory:*

- Oral examination of Project stage-II should be conducted by Internal and External examiners.
- Students have to give presentation and demonstration on the project

***Continuous Assessment (B):***

*Laboratory: (Term work)*

The distribution of marks for term work shall be as follows:

1. Weekly Attendance on Project Day
2. Project work contribute
3. Mid-Sem Review
4. Project Report
5. Term End Presentation
6. Technical Paper/Patent publication

The final certification and acceptance of term work will be subject to satisfactory performance of laboratory work and upon fulfilling minimum passing criteria in the term work.

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| **Program: Final Year (Common for All Programs)** | **Semester: VIII** |
|---|---|
| **Course: Disaster Management and Preparedness** | **Course Code: DJS22A4** |

**Objectives:**

1. To provide basic understanding of hazards, disasters and various types and categories of disaster occurring around the world.
2. To identify extent and damaging capacity of a disaster.
3. To study and understand the means of losses and methods to overcome /minimize it.
4. To understand roles and responsibilities of individual and various organizations during and after disaster.
5. To appreciate the significance of GIS, GPS in the field of disaster management.
6. To understand the emergency government response structures before, during and after disaster.

Outcomes: On completion of the course, the learner will be able to:

1. Apply disaster management principles & guidelines.
2. Conduct risk assessments.
3. Develop community awareness & participation.
4. Utilize Science & Technology tools (GIS, GPS).
5. Prepare disaster management plans.

**Detailed Syllabus: (unit-wise)**

| Unit | Description | Duration |
|---|---|---|
| 1 | **Understanding Disasters & Hazards:**<br>• **Definition and types of disasters**: Natural, Man-made and hybrid disasters, **Study of Natural disasters**: Flood, drought, cloud burst, Earthquake, Landslides, Avalanches, Volcanic eruptions, Mudflow, Cyclone, Storm, Storm Surge, climate change, global warming, sea level rise, ozone depletion etc. **Study of Human/Technology Induced Disasters**: Chemical, Industrial and Nuclear disasters, internally displaced persons, road and train accidents Fire Hazards, terrorism, militancy,<br>• Hazard & Vulnerability profiles of India (seismic zones, flood-prone areas).<br>• India's vulnerability to disasters, and the impact of disasters on National development. | **06** |

| | | |
|---|---|---|
| **2** | **Disaster Risk Reduction (DRR) & Mitigation:**<br>• **Disaster Management Cycle**: Prevention, Mitigation, Preparedness, Response, Recovery. Need for disaster prevention and mitigation, mitigation guiding principles, challenging areas, structural and non-structural measures for disaster risk reduction.<br>• Risk Assessment & Vulnerability Analysis.<br>• **Science & Technology**: Use of information management, Geo informatics like RS, GIS, GPS and remote sensing mitigation measure. | **06** |
| **3** | **Disaster Preparedness & Response:**<br>• Preparedness Planning, Early Warning Systems (EWS), & Communication.<br>• Emergency Response: Search & Rescue, Logistics, Medical Aid.<br>• Psychological Response & Management (Trauma, Stress).<br>• Role of IT, Media, Govt., NGOs, & Community. | **04** |
| **4** | **Recovery, Rehabilitation & Reconstruction:**<br>• Post-disaster damage assessment.<br>• Rehabilitation, Reconstruction, & Livelihood Restoration.<br>• Sanitation, Hygiene, & Waste Management. | **04** |
| **5** | **Policy, Governance & Capacity Building:**<br>• National Disaster Management Authority (NDMA) & Legislation.<br>• Institutional Mechanisms & Community Mobilization. Non-Structural Mitigation: Community based disaster preparedness, capacity development and training, awareness and education, contingency plans. | **04** |
| **6** | **Case studies on disaster (National /International):**<br>• Case study discussion of National Disasters: Tsunami (2004), Bhopal gas tragedy, Kerala and Uttarakhand flood disaster, 26th July 2005 Mumbai flood<br>• Case study discussion of International Disasters: Hiroshima – Nagasaki (Japan), Cyclone Phailin (2013), Fukushima, Daiichi nuclear disaster (2011), Chernobyl meltdown | **04** |
| | **Total Number of Hours** | **28** |

**Books Recommended:**

Reference Books and Reports:

1. Disaster Management, by Harsh K. Gupta, Universities Press Publications (2003).
2. Disaster Management: An Appraisal of Institutional Mechanisms in India, by O. S. Dagur, published by Centre for land warfare studies, New Delhi, 2011.
3. Introduction to International Disaster Management, by Damon Copolla, Butterworth Heinemann Elsevier Publications (2015).
4. Disaster Management Handbook, by Jack Pinkowski, CRC Press, Taylor and Francis group (2008).
5. Disaster management & rehabilitation, by Rajdeep Dasgupta, Mittal Publications, New Delhi (2007).

6. Natural Hazards and Disaster Management, Vulnerability and Mitigation, by R B Singh, Rawat Publications (2006).
7. Concepts and Techniques of GIS, by C. P. Lo Albert, K.W. Yonng, Prentice Hall (India) Publications (2006).
8. Risk management of natural disasters, by Claudia G. Flores Gonzales, KIT Scientific Publishing (2010).
9. Disaster Management – a disaster manger's handbook, by W. Nick Carter, Asian Development Bank (2008).
10. Disaster Management in India, by R. K. Srivastava, Ministry of Home Affairs, GoI, New Delhi (2011)
11. The Chernobyl Disaster: Legacy and Impact on the Future of Nuclear Energy, by Wil Mara, Marshall Cavendish Corporation, New York, 2011.
12. The Fukushima 2011 Disaster, by Ronald Eisler, Taylor & Francis, Florida, 2013.

(Learners are expected to refer reports published at national and international level and updated information available on authentic web sites.)

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