**B.Tech. Computer Science and Engineering (CSE)**
**MODIFIED SCHEME OF EXAMS W.E.F 2026-27**
**KURUKSHETRA UNIVERSITY, KURUKSHETRA**
**SEMESTER-VII**

| S.No. | Course No./ Code | Subject | L:T:P | Hours / Week | Credits | End Semester Exam | Internal Assessment | Practical Exam | Total | Duration of Exam (Hours) |
|---|---|---|---|---|---|---|---|---|---|---|
| 1 | B23-CSE-401 | Cloud Computing | 3:0:0 | 3 | 3 | 70 | 30 | 0 | 100 | 3 |
| 2 | -- | Program Elective-III | 3:0:0 | 3 | 3 | 70 | 30 | 0 | 100 | 3 |
| 3 | -- | Open Elective-I | 3:0:0 | 3 | 3 | 70 | 30 | 0 | 100 | 3 |
| 4 | B23-CSE-403 | Unix and Linux programming | 3:0:0 | 3 | 3 | 70 | 30 | 0 | 100 | 3 |
| 5 | B23-CSE-405 | Cloud Computing Lab | 0:0:4 | 4 | 2 | 0 | 40 | 60 | 100 | 3 |
| 6 | B23-CSE-407 | Unix and Linux Programming Lab | 0:0:4 | 4 | 2 | 0 | 40 | 60 | 100 | 3 |
| 7 | B23-CSE-409 | Project-II | 0:0:8 | 8 | 4 | 0 | 40 | 60 | 100 | 3 |
| 8 | B23-CSE-411 | Industrial Training-II | 0:0:2 | 2 | 1 | -- | 100 | -- | 100 | 3 |
| 9 | B23-VAC-401/403/405/407/409/411 | NCC/NSS/Sports/ Yoga/ Technical or Cultural Club/Society activities | 0:0:2 | 2 | 1 | -- | 100 | -- | 100 | -- |
| | **TOTAL** | | | **32** | **22** | **280** | **440** | **180** | **900** | |

Notes:

- The course of both Program Elective and Open Elective will be offered at 1/3rd strength or 20 students (whichever is smaller) of the section.
- B23-CSE-411 is a mandatory non-credit course in which the students will be required to get passing marks.
- B23-VAC-401/403/405/407/409/411 are single credit value added courses in which activities joined by students in the first year will be evaluated in the 7th semester by the institute based upon continuous evaluation model as per guidelines.

| **Program Elective-III** | | **Open Elective-I** | |
|---|---|---|---|
| Soft Computing | B23-PEC-413 | Cyber Law and Ethics | B23-OEC-419 |
| Neural network and Fuzzy logic | B23-PEC-415 | International and Corporate Law | B23-OEC-421 |
| Simulation and Modelling | B23-PEC-417 | Internet of Things | B23-OEC-423 |
| | | Bioinformatics | B23-OEC-425 |

| B23-CSE-401 | Cloud Computing | | | | | | |
|---|---|---|---|---|---|---|---|
| **Lecture** | **Tutorial** | **Practical** | **Credit** | **End Semester Exam** | **Internal Assessment** | **Total** | **Time** |
| **3** | **-** | **-** | **3** | **70** | **30** | **100** | **3 Hrs.** |
| **Purpose** | To introduce various concepts of Cloud Computing. | | | | | | |
| **Course Outcomes** | | | | | | | |
| **CO1** | Introduction & Overview of Computing Paradigm. | | | | | | |
| **CO2** | To Study Cloud Computing Architecture. | | | | | | |
| **CO3** | To study the concepts of Service Management in Cloud Computing. | | | | | | |
| **CO4** | To study the concepts of Cloud Security. | | | | | | |

**Unit-I**

Overview of Computing Paradigm: Recent trends in Computing, Grid Computing, Cluster Computing, Distributed Computing, Utility Computing, Cloud Computing, evolution of cloud computing.
Introduction to Cloud Computing: Cloud Computing (NIST Model), introduction to Cloud Computing, History of Cloud Computing, Cloud service providers, Properties, Characteristics & Disadvantages, Pros and Cons of Cloud Computing, Benefits of Cloud Computing, Cloud computing vs. Cluster computing vs. Grid computing.

**Unit-II**

Cloud Computing Architecture: Cloud computing stack, Comparison with traditional computing architecture (client/server), Services provided at various levels, How Cloud Computing Works, Role of Networks in Cloud computing, protocols used, Role of Web services,
Service Models (XaaS) - Infrastructure as a Service (IaaS), Platform as a Service (PaaS), Software as a Service (SaaS), Deployment Models- Public cloud, Private cloud, Hybrid cloud, Community cloud.

**Unit-III**

Service Management in Cloud Computing: Service Level Agreements (SLAs), Billing & Accounting, comparing Scaling Hardware: Traditional vs. Cloud, Economics of scaling: Benefitting enormously, Managing Data-Looking at Data, Scalability & Cloud Services, Database & Data Stores in Cloud, Large Scale Data Processing.
Cloud Applications: Scientific Applications – Health care, Geoscience and Biology. Business and Consumer Applications- CRM and ERP, Social Networking, Media Applications and Multiplayer Online Gaming.
Case study: Eucalyptus, Microsoft Azure, Amazon EC2.

**Unit-IV**

Cloud Security: Infrastructure Security, Network level security, Host level security, Application level security, Data security and Storage, Data privacy and security Issues, Jurisdictional issues raised by Data location, Identity & Access Management, Access Control, Trust, Reputation, Risk, Authentication in cloud computing, Client access in cloud, Cloud contracting Model.

**Suggested books:**


1. Cloud Computing Bible, Barrie Sosinsky, Wiley-India, 2010
2. Cloud Computing: Principles and Paradigms, Editors: Rajkumar Buyya, James Broberg, Andrzej M. Goscinski, Wile, 2011
3. Cloud Computing: Principles, Systems and Applications, Editors: Nikos Antonopoulos, Lee Gillam, Springer, 2012
4. Cloud Security: A Comprehensive Guide to Secure Cloud Computing, Ronald L. Krutz, Russell Dean Vines, Wiley-India, 2010

| B23-PEC-413 | Soft Computing | | | | | | |
|---|---|---|---|---|---|---|---|
| **Lecture** | **Tutorial** | **Practical** | **Credit** | **End Semester Exam** | **Internal Assessment** | **Total** | **Time** |
| **3** | **-** | **-** | **3** | **70** | **30** | **100** | **3 Hrs.** |
| **Purpose** | Soft Computing deals with imprecision, uncertainty, partial truth, approximation to achieve practicability, robustness, and low-cost solution for complex problems in real world using neural networks, fuzzy systems, evolutionary computation with optimization approaches to design intelligent systems. | | | | | | |
| **Course Outcomes (CO)** | | | | | | | |
| **CO1** | Learn about various supervised and unsupervised Artificial Neural Networks. | | | | | | |
| **CO2** | Apply the concepts of Fuzzy Logic for decision making in Fuzzy based Systems | | | | | | |
| **CO3** | Analyze Nature-Inspired Algorithms like Genetic, Differential Evolution, PSO, ABC. | | | | | | |
| **CO4** | Evaluate the values of new ideas by creating a new solution using Optimization. | | | | | | |

### Unit I: Artificial Neural Networks

Fundamentals of Biological Neural Network and Artificial Neural Network, Evolution of Neural Networks, Learning – supervised, unsupervised and reinforcement, Terminologies – weights, bias, threshold, learning rate, Hebb Network, Perceptron Networks, Backpropagation Network, Associative Memory Network, Hopfield Networks, Counterpropagation Networks, Adaptive Resonance Theory Network, Optical Neural Networks, Applications of Neural Networks.

### Unit II: Fuzzy Systems

Introduction to Fuzzy Logic, Classical Sets and Fuzzy Sets, Operations on Crisp Sets and Fuzzy Sets, Classical Relation and Fuzzy Relations, Membership Functions, Methods of Membership Value Assignments, Fuzzy Arithmetic and Fuzzy Measures, Fuzzy Rule Base and Approximate Reasoning, Fuzzy Decision Making, Fuzzy Logic Control Systems, Applications of Fuzzy Logic based systems.

### Unit III: Nature-Inspired Algorithms

Introduction to Nature-Inspired algorithms, Swarm Intelligence, Genetic Algorithm (GA), Operators in Genetic Algorithm – Encoding, Selection, Crossover, Mutation, Stopping Condition for GA, Differential Evolution (DE) Algorithm, Particle Swarm Optimization (PSO) Algorithm, Ant Bee Colony (ABC) Algorithm, Flower Pollination Algorithm, Solution of Real World Problems using Nature-Inspired Algorithms.

### Unit IV: Optimization

Objective of Optimization, Single-objective Optimization, Multi-objective Optimization, Pareto-optimal solutions, Travelling Salesman Problem solution using any optimization technique, Engineering problems solution using any Soft Computing approach, Architecture of Neuro-Fuzzy Systems and Genetic Neuro-Fuzzy Hybrid Systems, Applications of Soft Computing.

**Text Books**:


1. "Principle of Soft Computing" by Dr. S.N. Sivanandam and Dr. S.N Deepa, 2nd. Edition Wiley India 2012, ISBN: 978-81-265-2741-0
2. "Soft Computing" Fundamentals, Techniques and Applications by Dr. Saroj Kaushik and Dr. Sunita Tiwari, McGraw Hill Education 2018, ISBN: 10:93-5316-066-9
3. "Neuro-Fuzzy and Soft Computing" A Computational Approach to Learning and Machine Intelligence by Jyh-Shing Roger Jang, Chuen-Tsai Sun and Eiji Mizutani Pearson 2018, ISBN: 978-93-325-4988-3
4. "Neural Networks, Fuzzy Logic and Genetic Algorithms" Synthesis and Applications by S. Rajasekaran and G.A Vijayalakshmi Pai PHI 2012, ISBN: 978-81-203-2186-1


**Reference Book:**


1. "Nature-Inspired Optimization Algorithms" Xin-She Yang Elsevier USA 2014, ISBN: 978-0-12-416743-8

| B23-PEC-415 | Neural Networks and Fuzzy Logic | | | | | | |
|---|---|---|---|---|---|---|---|
| **Lecture** | **Tutorial** | **Practical** | **Credit** | **End Semester Exam** | **Internal Assessment** | **Total** | **Time** |
| **3** | **-** | **-** | **3** | **70** | **30** | **100** | **3 Hrs.** |
| **Purpose** | Neural network and fuzzy logic solves complex problems that require analytical calculations similar to those of the human brain. | | | | | | |
| **Course Outcomes (CO)** | | | | | | | |
| **CO1** | Learn about various concepts related to Neural Networks. | | | | | | |
| **CO2** | Understand about various supervised and unsupervised neural networks. | | | | | | |
| **CO3** | Explore the knowledge about advanced types of Neural Networks. | | | | | | |
| **CO4** | Construct fuzzy inference systems for decision-making and control applications. Develop hybrid neuro-fuzzy systems for intelligent problem solving. | | | | | | |

## Unit I: Artificial Neural Networks

Human Brain, Model of an artificial Neuron, Basic concepts of Neural Networks, Fundamentals of Biological Neural Network and Artificial Neural Network, Evolution of Neural Networks, Characteristics of Neural Networks, Learning Methods – supervised, unsupervised and reinforcement, Taxonomy of Neural Network Architectures, Terminologies – weights, bias, threshold, learning rate, Applications of Neural Networks.

## Unit II: Supervised and Unsupervised Neural Networks

Hebb Network theory and training algorithm, Perceptron Networks architecture and training algorithm, Backpropagation Network architecture and training algorithm, Associative Memory Network architecture and training algorithm, Hopfield Networks architecture and training algorithm, Counterpropagation Networks architecture and training algorithm, Adaptive Resonance Theory Network architecture and training algorithm.

## Unit III: Advanced Neural Networks

Kohonen Self-Organising Feature Maps architecture and training algorithm, Learning Vector Quantization architecture and training algorithm, Boltzmann Machine, Cognitron Network, Neocognitron Network, Optical Neural Networks Electro-optical Multipliers and Holographic Correlators.

## Unit IV: Fuzzy Logic

Introduction to Fuzzy Logic, Crisp Sets vs Fuzzy Sets, Membership Functions, Fuzzy Set Operations, Linguistic Variables, Fuzzy Relations, T-Norms and T-Conorms, Fuzzy Composition. Fuzzification and Defuzzification Methods, Mamdani Fuzzy Model, Sugeno Fuzzy Model, Rule Base Design, Adaptive Neuro-Fuzzy Inference System (ANFIS), Applications in Control Systems, Pattern Recognition and Decision Support.

**Text Books**:


5. "Neural Networks and Deep Learning" by Michaeil Nielsen, Online Book
6. "Principle of Soft Computing" by Dr. S.N. Sivanandam and Dr. S.N Deepa, 2nd. Edition Wiley India 2012, ISBN: 978-81-265-2741-0
7. "Soft Computing" Fundamentals, Techniques and Applications by Dr. Saroj Kaushik and Dr. Sunita Tiwari, McGraw Hill Education 2018, ISBN: 10:93-5316-066-9
8. "Neuro-Fuzzy and Soft Computing" A Computational Approach to Learning and Machine Intelligence by Jyh-Shing Roger Jang, Chuen-Tsai Sun and Eiji Mizutani Pearson 2018, ISBN: 978-93-325-4988-3

| B23-PEC-417 | Simulation and Modelling | | | | | | |
|---|---|---|---|---|---|---|---|
| **Lecture** | **Tutorial** | **Practical** | **Credit** | **End Semester Exam** | **Internal Assessment** | **Total** | **Time** |
| **3** | - | - | **3** | **70** | **30** | **100** | **3 Hour** |
| **Purpose** | To introduce the principles and paradigms of Computer Modeling and Simulation for solving a wide variety of problems. In addition, how to use simulator to simulate the live systems. | | | | | | |
| **Course Outcomes (CO)** | | | | | | | |
| **CO1** | Learn the basic concepts of System, System Modeling, types of Models, simulation, and need of simulation. | | | | | | |
| **CO2** | Learn the simulation of continuous and discrete systems with the help of different examples. | | | | | | |
| **CO3** | Learn the concept of generation of uniformly and non-uniformly distributed random numbers. | | | | | | |
| **CO4** | Learn the simulation of queuing system and PERT. | | | | | | |

## Unit-1

**Modeling:** System Concepts, system boundaries and environment, continuous and discrete systems, system modeling, types of Models, Model validation, Principles & Nature of Computer modeling.

**Simulation:** Introduction, Basic nature of simulation, when to simulate, Advantages, disadvantages and limitations of simulation, Concepts of simulation of continuous and discrete system with the help of example.

## Unit-2

**Continuous System Simulation:** Analog vs. digital simulation, continuous simulation vs. numerical integration, simulation of a chemical reactor, simulation of a water reservoir system.

**Discrete system simulation:** Fixed time-step vs. event-to-event model, Monte-Carlo computation vs. stochastic simulation, generation of random numbers, and generation of non-uniformly distributed random numbers.

## Unit-3

**Simulators for the Live systems:** Simulation of queuing Systems: basic concepts of queuing theory, simulation of single server, two server and more general queuing system.

**Simulation of PERT network:** Network model of a project, analysis of an activity network, critical path computation, uncertainties in activity durations, simulation of an activity network.

## Unit-4

**Simulation of inventory control systems:** Elements of inventory theory, inventory models, generation of Poisson and Erlang variates, simulator for complex inventory systems.

**Design and Evaluation of Simulation Experiments: V**ariance reduction techniques. Experiment layout and Validation. **Case Study**: SciLab, Octave.

**Text Books:**

1.Gordon G.: System simulation, Prentice-Hall of India Pvt. Ltd. New Delhi 1993

2.NarsinghDeo: System Simulation with Digital Computer: PHI New Delhi, 1993

**Reference books:**

1. Neelankavil Frances: Computer Simulation and Modelling, John Wiley & Sons, NewYork, 1987.

2. Payne, James A.: Introduction to simulation: Programming Techniques and Methods of Analysis, McGraw-Hill International Editions, Computer Science services, New York (1998).

3. 3.ReitamJulian: Computer Simulation Experiments, Wiley Interscience 1971.

| B23-OEC-419 | Cyber Law and Ethics | | | | | | |
|---|---|---|---|---|---|---|---|
| **Lecture** | **Tutorial** | **Practical** | **Credit** | **End Semester Exam** | **Internal Assessment** | **Total** | **Time** |
| **3** | **-** | **-** | **3** | **70** | **30** | **100** | **3 Hrs.** |
| **Purpose** | To gain broad understanding of Cyber law and Ethics. | | | | | | |
| **Course Outcomes** | | | | | | | |
| **CO1** | To facilitate the basic knowledge of Cyber Law. | | | | | | |
| **CO2** | To learn about how to maintain the Confidentiality, Integrity and Availability of information technology act. | | | | | | |
| **CO3** | To get enable to fix the various Cyber Law and Related Legislation. | | | | | | |
| **CO4** | To deal with the Cyber Ethics. | | | | | | |

### Unit-1: Introduction to Cyber Law

Evolution of computer technology, emergence of cyber space. Cyber Jurisprudence, Jurisprudence and law, Doctrinal approach, Consensual approach, Real Approach, Cyber Ethics, Cyber Jurisdiction, Hierarchy of courts, Civil and criminal jurisdictions, Cyberspace-Web space, Web hosting and web Development agreement, Legal and Technological Significance of domain Names, Internet as a tool for global access.

### Unit-2: Information Technology Act

Overview of IT Act, 2000, Amendments and Limitations of IT Act, Digital Signatures, Cryptographic Algorithm, Public Cryptography, Private Cryptography, Electronic Governance, Legal Recognition of Electronic Records, Legal Recognition of Digital Signature, Certifying Authorities, Cyber Crime and Offences, Network Service Providers Liability, Cyber Regulations Appellate Tribunal.

### Unit-3: Cyber Law and Related Legislation

Patent Law, Trademark Law, Copyright, Software – Copyright or Patented, Domain Names and Copyright disputes, Electronic Data Base and its Protection, IT Act and Civil Procedure Code, IT Act and Criminal Procedural Code, Relevant Sections of Indian Evidence Act, Relevant Sections of Bankers Book Evidence Act, Relevant Sections of Indian Penal Code, Relevant Sections of Reserve Bank of India Act, Law Relating To Employees And Internet, Alternative Dispute Resolution , Online Dispute Resolution (ODR).

### Unit-4: Cyber Ethics

The Importance of Cyber Law, Significance of Cyber Ethics, Need for Cyber regulations and Ethics. Ethics in Information society, Introduction to Artificial Intelligence Ethics: Ethical Issues in AI and core Principles, Introduction to Block chain Ethics.

**Suggested Books:**

1. Cyber Security: Understanding Cyber Crimes, Computer Forensics and Legal Perspectives by Nina Godbole, Sunit Belapur, Wiley
2. Understanding cybercrime: phenomena and legal challenges response, ITU 2012.

| B23-OEC-421 | International and Corporate Law | | | | | | |
|---|---|---|---|---|---|---|---|
| **Lecture** | **Tutorial** | **Practical** | **Credit** | **End Semester Exam** | **Internal Assessment** | **Total** | **Time** |
| **3** | **-** | **-** | **3** | **70** | **30** | **100** | **3 Hrs.** |
| **Purpose** | Introduces students with different aspects of corporate law. | | | | | | |
| **Course Outcomes** | | | | | | | |
| **CO1** | The students will be able to articulate international trade law. | | | | | | |
| **CO2** | The students will be able to learn about Bills of Exchange and Contact of Carriage. | | | | | | |
| **CO3** | The students will be able to demonstrate working of WTO. | | | | | | |
| **CO4** | The students will be able to differentiate the working of GATT and WTO. | | | | | | |

## Unit-1

Meaning and evolution of international trade law. International commercial terms. Formation and enforcement of international contracts under United Nations convention on contracts for the international sales of Goods, 1980, Mode of E-Commerce, 1996.

## Unit-2

Law relating to Bills of Exchange; Latter of Credit; characteristics and its kind, Bank Guarantee in International Trade Transaction, Carriage of Goods by Land, Sea and Air. Rights and Liabilities of the parties to contract of Carriage.

## Unit-3

Introduction to General Agreement of tariffs and Trade, The WTO: objective, structure and functions, decision making process, Most Favoured Nations treatment, Exception to MFN; National Treatment Principle, Regional Trade agreements and WTO.

## Unit-4

Anti-dumping agreements and WTO; Dispute settlement under GATT. Dispute settlement procedure under WTO; Difference between WTO and GATT functioning. India and WTO.

**References:**

Tison M, De Wulf H, Van der Elst C, Steennot R, eds. *Perspectives in Company Law and Financial Regulation*. Cambridge University Press; 2009.

| B23-OEC-423 | Internet Of Things | | | | | | |
|---|---|---|---|---|---|---|---|
| **Lecture** | **Tutorial** | **Practical** | **Credit** | **End Semester Exam** | **Internal Assessment** | **Total** | **Time** |
| **3** | **-** | **-** | **3** | **70** | **30** | **100** | **3 Hrs.** |
| **Purpose** | To study fundamental concepts of IoT and correlate the connection of smart objects and IoT access technologies. | | | | | | |
| **Course Outcomes (CO)** | | | | | | | |
| **CO1** | Understand the concepts of Internet of Things. | | | | | | |
| **CO2** | Analyze basic protocols network. | | | | | | |
| **CO3** | Understand the concepts of Web of Things and basic understanding of Cloud Computing. | | | | | | |
| **CO4** | Design IoT applications in different domains and be able to analyze their performance. | | | | | | |

**Unit 1**

**INTRODUCTION TO IoT**: Introduction to IoT, Characteristics of IoT, Physical design of IoT. Logical design of IoT, Functional blocks of IoT, Communication models & APIs IoT & M2M Machine to Machine, Difference between IoT and M2M, Software define Network, Challenges in IoT (Design Development, Security**).**

**Unit 2**

**NETWORK AND COMMUNICATION ASPECTS**: Wireless medium access issues, MAC protocol survey, Survey routing protocols, Sensor deployment & Node discovery, Data aggregation & dissemination.

**Unit 3**

**WEB OF THINGS**: Web of Things vs Internet of things, two pillars of web, Architecture and standardization of IoT, Unified multitier-WoT architecture, WoT portals and Business intelligence, Cloud of things: Grid/SOA and cloud computing, Cloud middleware, cloud standards, Role of cloud in IoT.

**Unit 4**

**RESOURCE MANAGEMENT IN IoT**: Domain specific applications of IoT, Home automation, industry applications, Surveillance applications, Other IoT applications Clustering, Synchronization, Software agents.

**Text Books:**


1. Raj Kamal ,"Internet of Things: Architecture and Design", McGraw Hill. 2nd edition June 2022.
2. Vijay Madisetti, Arshdeep Bahga, "Internet of Things: A Hands-On Approach"
3. Waltenegus Dargie, Christian Poellabauer, "Fundamentals of Wireless Sensor Networks: Theory and Practice"
4. Cuno Pfister, "Getting Started with the Internet of Things", Shroff Publisher/Maker Media.

Internet of Things, RMD Sundaram Shriram K. Vasudevan, Abhishek S Nagarajan, John Wiley and Sons.

| B23-OEC-425 | Bioinformatics | | | | | | |
|---|---|---|---|---|---|---|---|
| **Lecture** | **Tutorial** | **Practical** | **Credits** | **End Semester Exam** | **Internal Assessment** | **Total** | **Time (Hrs.)** |
| **3** | **0** | **0** | **3** | **70** | **30** | **100** | **3 Hrs** |
| **Purpose** | This course is beneficial for students to understand the principles of analysing biological data, building models and testing hypotheses using computer science algorithms. It will also introduce information technology practices in the field of biotechnology. | | | | | | |
| **Course Outcomes** | | | | | | | |
| **CO 1** | Knowledge about basic overview of various information repositories widely used in biological sciences; and tools for searching or querying those databases | | | | | | |
| **CO 2** | Student will learn about the foundation of sequence alignment techniques. | | | | | | |
| **CO 3** | Student will learn about the foundation for how to find evolutionary connections | | | | | | |
| **CO 4** | Knowledge about analyzing mRNA expression data and gene annotations | | | | | | |

## UNIT-I

General Introduction: To study bioinformatics and its applications. Biological databases and tools: a.) Sequence Databases: introduction of Databases, primary and secondary databases, nucleotide and protein sequence databases: Genbank, EMBL, DDBJ, Swissprot, pfam. b) Structure Databases: Introduction to structures. PDB (Protein Data bank) Molecular Modeling database at NCBI, database structure viewers. c) Sequence and Structure File Formats: The gene bank Flat file- a dissection.

## UNIT- 2

The Entrez system: Integrated information axis, Information retrieval from biological database, retrieving database entries, integrated information retrieval, and sequence database beyond NCBI. Medical databases. Sequence Alignment and Database Searching: Pair-wise Alignment, Dot matrix, Dynamic programming and gap penalties, Database similarity searching: BLAST and its types, low-complexity regions, Tool of multiple sequence alignment: CLUSTAL W/X.

## UNIT- 3

Phylogenetic Analysis: Elements of phylogenetic models, phylogenetic data analysis: alignment, substitution model building, tree building and tree evaluation, phylogenic software (PHYLIP). phylogenetics online tool and Applications.

## UNIT- 4

Computational Epigenetic: Epigenetic and its role in transcription regulation, development, and diseases. Transcription factor regulation and motif finding. Molecular modeling and validation, docking.

**Text Books/References:**

1. Jonathan Pevsner. Bioinformatics and Functional Genomics, 2nd Edition. ISBN: 978-0- 470-08585
2. Greg Gibson and Spencer V. Muse. A Primer of Genome Science, Third Edition. ISBN: 978-0- 87893-309-9.
3. Essential Bioinformatics, Jin Xiong, Cambridge University Press; 1st edition 2006.
4. Bioinformatics: methods and applications, S. C. Rastogi, PHI learning; 4th edition, 2013.
5. The Dictionary of Genomics, Transcriptomics and Proteomics, Günter Kahl, Willey VCH, 2015.

**Note: The paper setter will set the paper as per the question paper template provided.**

| B23-CSE-403 | Unix and Linux Programming | | | | | | |
|---|---|---|---|---|---|---|---|
| **Lecture** | **Tutorial** | **Practical** | **Credit** | **End Semester Exam** | **Internal Assessment** | **Total** | **Time** |
| **3** | **-** | **-** | **3** | **70** | **30** | **100** | **3 Hrs.** |
| **Purpose** | Expertisation in computational programming skills on Unix/Linux Environment. | | | | | | |
| **Course Outcomes (CO)** | | | | | | | |
| **CO1** | Learning of simple & advanced commands with features and characteristics of Unix /Linux Systems. | | | | | | |
| **CO2** | Exploring knowledge of programming development skills using Shell, Filters, editors and other utilities. | | | | | | |
| **CO3** | Analyzing the programming behaviour based on programming development/management on Unix /Linux Systems. | | | | | | |
| **CO4** | Developing creativity as system administrative with networking expertisation in Unix /Linux Systems. | | | | | | |

**Unit 1**

Module 1: Introduction to Linux/Unix and Fedora Environment . Overview: History of UNIX and Linux (GNU/Linux) and features. Architecture: Kernel, Shell, and User Utilities. Basic Commands: ls, cd, pwd, mkdir, rm, cp, mv, cat. Package Management: Installing and upgrading software. Permissions: chmod, chown, chgrp, and default file permissions (umask). File compression and decompression: tar, gzip, zip commands.

**Unit 2**

The Shell and Text Processing. Introduction to Bash: Shell variables, input/output redirection, pipes (|), and command substitution. File Handling: Inodes, hard links, and symbolic links (ln). Text Processing Tools: grep, sed, awk, head, tail, sort, wc, uniq. Editor: vi or vim editor basics. Script Basics: Shebang (#!/bin/bash), running scripts, comments and simple programs. Variables & Scope: System and User-defined variables, environment variables. Control Structures: if-else, case statements, for loops, while loops.

**Unit 3**

The C Language Environment : C language programming in Unix/Linux, C compiler options, C Shell operators, C Shell Script & programming. Project Management: MakeFile Utility for keeping program up-to-date & its use for dependency calculations, dynamic linking and loading of libraries modules, static and shared libraries, dynamic . Searching pattern :grep, egrep, fgrep.

**Unit 4**

Networking and Administration. Security: User authentication and password administration. Networking Commands: ip, ifconfig, ping, netstat, dig. Firewall: Configuring firewall(Fedora default) or iptables. SSH: Secure shell configuration and key-based authentication. System Management: Controlling services (systemctl start/stop/enable/status). User Management: useradd, usermod, userdel, /etc/passwd. Processes: ps, top, kill, nice, bg, fg. Process Control: fork(), exec(), wait(), exit(). job control : at, batch, crontab.

Case Study : Database Server and SSH server in linux

**Suggested Books :**

1. Sumitbha Das : Unix – Concept and Applications, Fourth Edition TMH, 2015
2. B.M Harwani, Unix and Shell Programming, Oxford University Press, 2013
3. Neil Matthew, Richard Stones : Beginning Linux Programming, 4th. Edition, Wrox-Shroff, 2011.
4. Welsh & Kaufmann : Running Linux, O' Reiley & Associates, 2013.

| B23-CSE-405 | Cloud Computing Lab | | | | | | |
|---|---|---|---|---|---|---|---|
| **Lecture** | **Tutorial** | **Practical** | **Credit** | **Internal Assessment** | **Practical Exam** | **Total** | **Time** |
| **--** | **--** | **4** | **2** | **40** | **60** | **100** | **3 Hour** |
| **Purpose** | Design and implement various cloud related applications. | | | | | | |
| **Course Outcomes (CO)** | | | | | | | |
| **CO1** | Hands on experiments on Hadoop. | | | | | | |
| **CO2** | To Install Google App Engine and create web applications. . | | | | | | |
| **CO3** | To Demonstrate the use of Map and Reduce tasks. | | | | | | |
| **CO4** | To run applications like word count.. | | | | | | |

## List of Practicals

1. Write a program to use the API's of Hadoop to interact with it.
2. Install a C compiler in the virtual machine created using virtual box and execute Simple Programs
3. Install Google App Engine. Create hello world app and other simple web applications using python/java.
4. Use GAE launcher to launch the web applications.
5. Show the virtual machine migration based on the certain condition from one node to the other.
6. Write a word count program to demonstrate the use of Map and Reduce tasks.
7. Find procedure to set up the one node Hadoop cluster and run simple applications like word count.

| B23-CSE-407 | Unix and Linux Programming Lab | | | | | | |
|---|---|---|---|---|---|---|---|
| **Lecture** | **Tutorial** | **Practical** | **Credit** | **Internal Assessment** | **Practical Exam** | **Total** | **Time** |
| **--** | **--** | **4** | **2** | **40** | **60** | **100** | **3 Hour** |
| **Purpose** | Experimental knowledge of programming skills with expertization on Unix/Linux platform | | | | | | |
| **Course Outcomes (CO)** | | | | | | | |
| **CO1** | Learning of simple and advanced commands of Unix /Linux operating systems. | | | | | | |
| **CO2** | Develop shell programming using Bash or any other shell scripts. | | | | | | |
| **CO3** | Backup and job scheduling management | | | | | | |
| **CO4** | Configure SSH server on linux platform | | | | | | |

## List of Practicals

1. Write a command of Basic File & Directory Management in Linux Operating System.
2. Write a program to Check if Number is Even or Odd in bash shell.
3. Write a program to Factorial of a Number in bash shell.
4. Write a program to design Simple Calculator using Case Statement in shell programming.
5. Write a program to Backup a Directory Tusing tar command.
6. Write a disk command for Storage Management.
7. Write a job scheduling using Crontab.
8. Write command to manage Process in linux.
9. Write a command of User & Group Management in linux.
10. Configure a Web + Database Server on linux.
11. Configure a SSH Server on linux.
12. Configure Firewall on server.

**B.Tech. Computer Science and Engineering (CSE)**
**MODIFIED SCHEME OF EXAMS W.E.F 2026-27**
**KURUKSHETRA UNIVERSITY, KURUKSHETRA**
**SEMESTER-VIII**

| S.No. | Course No./Code | Subject | L:T:P | Hours/ Week | Credits | End Semester Exam | Internal Assessment | Practical Exam | Total | Duration of exam (Hours) |
|---|---|---|---|---|---|---|---|---|---|---|
| 1 | -- | Program Elective-IV | 3:0:0 | 3 | 3 | 70 | 30 | 0 | 100 | 3 |
| 2 | -- | Program Elective-V | 3:0:0 | 3 | 3 | 70 | 30 | 0 | 100 | 3 |
| 3 | B23-CSE-402 | Project-III / Industrial Project/ Research Lab/ /Startups / Entrepreneurship | 0:0:20 | 20 | 10 | | 200 | 200 | 400 | 3 |
| | **TOTAL** | | | **26** | **16** | **140** | **260** | **200** | **600** | |

Notes:

- The course of both Program Elective and Open Elective will be offered at 1/3rd strength or 20 students (whichever is smaller) of the section.
- In case of semester-long project work done in industry/external institute, the Program Elective- IV and Open Elective-IV may be offered in online mode through MOOC courses offered by SWAYAM/NPTEL portal. These courses may be done from 3rd semester till completion of the degree.

| **Program Elective -IV** | | **Program Elective -V** | |
|---|---|---|---|
| Agile Software Engineering | B23-PEC-404 | Social Networks | B23-PEC -410 |
| Software Verification, Validation and Testing | B23-PEC -406 | AI and Robotics | B23-PEC -412 |
| Software Project Management | B23-PEC-408 | Block Chain Technology | B23-PEC -414 |
| Health Care and Analytics | B23-PEC -416 | | |

| B23-PEC-404 | Agile Software Engineering | | | | | | |
|---|---|---|---|---|---|---|---|
| **Lecture** | **Tutorial** | **Practical** | **Credit** | **End Semester Exam** | **Internal Assessment** | **Total** | **Time** |
| **3** | **-** | **-** | **3** | **70** | **30** | **100** | **3 Hrs.** |
| **Purpose** | Introduces the business value of adopting Agile approaches and provide complete understanding of the Agile development practices. | | | | | | |
| **Course Outcomes** | | | | | | | |
| **CO1** | Understand the background and driving forces for taking an Agile approach to software development. | | | | | | |
| **CO2** | Understand the business value of adopting Agile approaches. | | | | | | |
| **CO3** | Drive development with unit tests using Test Driven Development. | | | | | | |
| **CO4** | Apply design principles and refactoring to achieve Agility. | | | | | | |

### Unit I: Fundamentals of Agile

The Genesis of Agile, Introduction and background, Agile Manifesto and Principles, Overview of Scrum, Extreme Programming, Feature Driven development, Lean Software Development, Agile project management, Design and development practices in Agile projects, Test Driven Development, Continuous Integration, Refactoring, Pair Programming, Simple Design, User Stories, Agile Testing, Agile Tools

### Unit II: Agile Scrum Framework

Introduction to Scrum, Project phases, Agile Estimation, Planning game, Product backlog, Sprint backlog, Iteration planning, User story definition, Characteristics and content of user stories, Acceptance tests and Verifying stories, Project velocity, Burn down chart, Sprint planning and retrospective, Daily scrum, Scrum roles – Product Owner, Scrum Master, Scrum Team, Scrum case study, Tools for Agile project management.

### Unit III: Agile Testing

Agile Testing Planning and Managing Testing Cycle, Agile Lifecycle and its impact on testing, Principles of Agile Testing, Agile Testing Techniques, Test-Driven Development, User Acceptance Tests, Test Automation. Agile Project Management Scheduling in an agile project, scheduling challenges, estimating costs, monitoring project progress, burning down the product backlog, reporting, controlling the project

### Unit IV: Agile Software Design and Development

Agile design practices, Role of design Principles including Single Responsibility Principle, Open Closed Principle, Liskov Substitution Principle, Interface Segregation Principles, Dependency Inversion Principle in Agile Design, Need and significance of Refactoring, Refactoring Techniques, Continuous Integration, Automated build tools, Version control.

**Suggested Books:**


- Ken Schawber, Mike Beedle, *Agile Software Development with Scrum*, Pearson publications
- Robert C. Martin, *Agile Software Development, Principles, Patterns and Practices*, Prentice Hall
- Lisa Crispin, Janet Gregory, *Agile Testing: A Practical Guide for Testers and Agile Teams*, Addison Wesley
- Alistair Cockburn, *Agile Software Development: The Cooperative Game*, Addison Wesley
- Mike Cohn, *User Stories Applied: For Agile Software,* Addison Wesley
- Enterprise-Scale Agile Software Development James Schiel Latest edition, CRC Press
  Succeeding with Agile: Software Development Using Scrum Mike Cohn Latest edition, Addison-Wesley

| B23-PEC-406 | Software Verification and Validation and Testing | | | | | | |
|---|---|---|---|---|---|---|---|
| **Lecture** | **Tutorial** | **Practical** | **Credit** | **End Semester Exam** | **Internal Assessment** | **Total** | **Time** |
| **3** | **0** | **0** | **3** | **70** | **30** | **100** | **3hrs** |
| **Program Objective (PO)** | The objective of this course is to provide the in-depth coverage of software quality models and software testing strategies. It focuses on test case generation techniques and testing levels. It also focuses on testing different kinds of software. | | | | | | |
| **Course Outcomes (CO)** | | | | | | | |
| **CO1** | To develop test cases for any problem | | | | | | |
| **CO2** | To pursue testing on any level of software design by using different testing strategies | | | | | | |
| **CO3** | To learn the test management and testing activities by using different testing methods. | | | | | | |
| **CO4** | To apply testing and quality model of software testing in achieving high- quality software. | | | | | | |

## UNIT – I

**Introduction:** Overview of software evolution, SDLC, Testing Process, Terminologies in Testing: Error, Fault, Failure, Verification, Validation, Definition of software testing, Test Cases, Test Oracles,Testing Process, Limitations of Testing.

## UNIT - II

**Functional Testing:** Boundary Value Analysis, Equivalence Class Testing, Decision Table Based Testing, Cause Effect Graphing Technique.

**Structural Testing:** Path testing, DD-Paths, Cyclomatic Complexity, Graph Metrics, Data Flow Testing, Mutation testing.

## UNIT - III

**Testing Activities:** Unit Testing, Levels of Testing, Integration Testing, System Testing, Debugging, Domain Testing.

**Reducing the number of test cases:** Prioritization guidelines, Priority category, Scheme, Risk Analysis, Regression Testing, and Slice based testing

## UNIT - IV

Overview of SQM: Concepts of Software Quality, Quality Attributes, Software Quality Models: McCall, Boehm, ISO-9000, CMM.

Miscellaneous topics: Stress Testing, Ad hoc testing: Buddy testing, Exploratory testing, Agile and extreme testing.

**Suggested Books:**


1. Naresh Chauhan "Software Testing Principles and Practices" Oxford Publications, 2012
2. Louise Tamres, "Software Testing", Pearson Education Asia, 2002
3. Robert V. Binder, "Testing Object-Oriented Systems-Models, Patterns and Tools", Addison Wesley.
4. William Perry, "Effective Methods for Software Testing", John Wiley & Sons, New York.
5. CemKaner, Jack Falk, Nguyen Quoc, "Testing Computer Software", Second Edition, Van Nostrand Reinhold, New York.
6. K.K. Aggarwal & Yogesh Singh, "Software Engineering", 2nd Ed., New Age International Publishers, New Delhi, 2005

Boris Beizer, "Software Testing Techniques", Second Volume, Second Edition, Van Nostrand Reinhold, New York.

| B23-PEC-408 | Software Project Management | | | | | | |
|---|---|---|---|---|---|---|---|
| **Lecture** | **Tutorial** | **Practical** | **Credit** | **End Semester Exam** | **Internal Assessment** | **Total** | **Time** |
| **3** | **0** | **0** | **3** | **70** | **30** | **100** | **3hrs** |
| **Program Objective (PO)** | The course provides an understanding of the purpose, methods and benefits of process management by exposing the student to the concepts, practices, processes, tools and techniques used in process management for software development. | | | | | | |
| **Course Outcomes (CO)** | | | | | | | |
| **CO1** | To understand the basic concepts, terminologies and issues of software project management. | | | | | | |
| **CO2** | To apply appropriate methods and models for the development of solutions. | | | | | | |
| **CO3** | To analyze the cost-benefits of calculations so as to optimize the selection strategy | | | | | | |
| **CO4** | To evaluate methods, models and technologies towards achieving project success | | | | | | |

## UNIT I-PROJECT CONCEPTS AND ITS MANAGEMENT

Project life cycle models-ISO 9001 model-Capability Maturity Model-Project Planning-Project tracking-Project closure. Evolution of Software Economics – Software Management Process Framework: Phases, Artifacts, Workflows, Checkpoints – Software Management Disciplines: Planning / Project Organization and Responsibilities / Automation / Project Control – Modern Project Profiles

## UNIT II-COST ESTIMATION

Problems in Software Estimation – Algorithmic Cost Estimation Process, Function Points, SLIM (Software Life cycle Management), COCOMO II (Constructive Cost Model) – Estimating Web Application Development – Concepts of Finance, Activity Based Costing and Economic Value Added (EVA) – Balanced Score Card.

## UNIT III-SOFTWARE QUALITY MANAGEMENT

Software Quality Factors – Software Quality Components – Software Quality Plan – Software Quality Metrics – Software Quality Costs – Software Quality Assurance Standard – Certification – Assessment.

## UNIT IV-SOFTWARE MANAGEMENT AND METRICS

Software Configuration Management – Risk Management: Risk Assessment: Identification / Analysis / Prioritization – Risk Control: Planning / Resolution / Monitoring – Failure Mode and Effects Analysis (FMEA) – Defect Management – Cost Management. Software Metrics – Classification of Software Metrics: Product Metrics: Size Metrics, Complexity Metrics, Halstead's Product Metrics, Quality Metrics, and Process metrics.

## REFERENCES


1. Ramesh Gopalaswamy , *"Managing and global Software Projects"*, Tata McGraw Hill Tenth Reprint, 2011.
2. Roger S.Pressman, "*Software Engineering- A Practitioner's Approach ", 7*th Edition , McGraw Hill, 2010.
3. Daniel Galin, "*Software Quality Assurance: from Theory to Implementation*", Addison- Wesley, 2003.
4. Pankaj Jalote, "*Software Project Management in Practice*", Pearson, 2002.
5. Stephen H, Kan, "*Metrics and Models in Software Quality Engineering*","*,* Addison- Wesley, 2002.

Bob hughes and mike cotterell, *"Software project Management"* second edition,1999.

| B23-PEC-410 | Social Networks | | | | | | |
|---|---|---|---|---|---|---|---|
| **Lecture** | **Tutorial** | **Practical** | **Credit** | **End Semester Exam** | **Internal Assessment** | **Total** | **Time** |
| **3** | **-** | **-** | **3** | **70** | **30** | **100** | **3 Hrs.** |
| **Program Objective (PO)** | This emerging and innovative field provides insight into the latest communication mechanisms used in online social networks. It focuses on identifying and representing relationships and predicting links through the effective integration of graph theory, matrices, clustering techniques, and equivalence concepts. The course enables students to understand the fundamental principles of social networks, including link prediction, community detection, and network structure analysis. | | | | | | |
| **Course Outcomes (CO)** | | | | | | | |
| **CO1** | Understand clustering, community detection, and structural relationships among nodes to determine their relative importance within a network. | | | | | | |
| **CO2** | Explain key concepts such as homophily, selection, closure, segregation, relationship formation, and graph construction for efficient network representation. | | | | | | |
| **CO3** | Analyze social networks using measures such as betweenness, centrality, equivalence relations, centralization, clustering coefficient, structural cohesion, PageRank, and random graph models, and perform visualization and empirical analysis of network data. | | | | | | |
| **CO4** | Interpret and synthesize network analysis results using epidemic models, generative and experimental models, and equivalence concepts to analyze complex datasets and improve recommendation systems. | | | | | | |

**Unit-I (Fundamentals of Social Networks)**

Introduction to Social Networks, Google Page Rank, Link Prediction, Importance of Acquaintances, Web Graph, Introduction: Emergence of Connectedness, Granovetter's Strength of weak ties, Triads, clustering coefficient and neighborhood overlap, Structure of weak ties, bridges, and local bridges, Emeddedness, Betweenness Measures and Graph Partitioning, Finding Communities in a graph (Brute Force Method), Community Detection Using Girvan Newman Algorithm, Strong and Weak Relationship.

**Unit-II (Network Formation and Social Structure)**

Introduction to Homophily, Selection and Social Influence, Foci Closure and Membership Closure, Introduction to Fatman Evolutionary model, Triadic Closure, Spatial Segregation: An Introduction, Schelling Model Implementation, Positive and Negative Relationships – Introduction, Structural Balance, Creating graph, displaying it and counting unstable triangles, Equal Coin Distribution, Random Walk Coin Distribution.

**Unit-III (Network Metrics and Models)**

Metrics in social network analysis (Betweenness, Centrality, Equivalence relation, Centralization, Clustering coefficient and Structural cohesion), Diffusion in Networks, Impact of Communities on Diffusion, Cascade and Clusters, Introduction to Hubs and Authorities, Hubs and Authorities, PageRank as a Matrix Operation, Introduction to Power Law, Rich Get Richer Phenomenon, Implementing a Random Graph (Erdos-Renyi Model).

**Unit-IV (Advanced Topics and Application)**

Rich Get Richer - The Long Tail, Epidemics- An Introduction, Simple Branching Process for Modeling Epidemics, Basic reproductive number, SIR and SIS spreading models, Percolation model, Milgram's Experiment, The Generative Model, Decentralized Search, Basic of Equivalence concepts in Social Networks.

**Suggested Books:**


1. Networks, Crowds, and Markets — David Easley and Jon Kleinberg, Cambridge University Press.
2. Social and Economic Networks — Matthew O. Jackson, Princeton University Press.
3. Mining the Social Web — Matthew A. Russell, O'Reilly Media, Second Edition.

4. Introduction to Social Network Methods — Robert A. Hanneman and Mark Riddle, University of California, Riverside.
5. Social Network Analysis: Theory and Applications — Free Wikibook, available online.
6. Social Network Analysis — John Scott and Peter J. Carrington, SAGE Publications.

| B23-PEC-412 | AI and Robotics | | | | | | |
|---|---|---|---|---|---|---|---|
| **Lecture** | **Tutorial** | **Practical** | **Credit** | **End Semester Exam** | **Internal Assessment** | **Total** | **Time (Hrs)** |
| **3** | **0** | **0** | **3** | **70** | **30** | **100** | **3** |
| **Course Objectives** | To enlighten the students about the fundamentals of Artificial Intelligence and Robotics. | | | | | | |
| **Course Outcomes** | | | | | | | |
| **At the end of this course, the student should be able to understand** | | | | | | | |
| **CO1** | Apply AI techniques to solve engineering problems. | | | | | | |
| **CO2** | Design ML models for intelligent systems. | | | | | | |
| **CO3** | Model robot kinematics and dynamics. | | | | | | |
| **CO4** | Integrate AI with ROS for robotic applications. | | | | | | |

## UNIT I

**Foundations of Artificial Intelligence:** Definitions, History, Scope, Intelligent agents, Turing test, and applications of AI in engineering and industry; Problem-solving techniques: state-space representation, uninformed search: DFS, BFS; Informed search: A*, heuristic methods; Knowledge representation: predicate logic, semantic networks, frames, ontologies; Reasoning under uncertainty: Bayesian networks, fuzzy logic, probabilistic reasoning.

## UNIT II

**AI Techniques and Applications:** Expert systems: Architecture and applications; Natural language processing basics; Machine learning concepts: Supervised vs. unsupervised learning (introductory level); Neural networks basics and evaluation metrics; AI applications in engineering, robotics, and decision-making, Case studies: AI in healthcare, finance, and robotics.

## UNIT III

**Fundamentals of Robots:** Introduction to robotics: industrial, mobile, humanoid, Definition, History, and Development in Robot Technology; Characteristics, Basic Components, Robot Anatomy, Robot Generations, Robot Selection, Present and Future Applications; Robot Classification, Robot End Effectors, Robot Drive Systems; Kinematics**:** forward and inverse kinematics, Denavit–Hartenberg parameters; Dynamics & control: Newton-Euler formulation, trajectory planning; PID control, Sensors & actuators: proximity, vision, tactile sensors, integration in robotic systems.

## UNIT IV

**Robotics Design & AI Integration:** Path planning & navigation- graph-based methods: Dijkstra, A*; sampling-based methods: RRT, PRM; Robot Operating System: architecture, nodes, topics, services; Human-Robot Interaction: interfaces, safety, usability; AI in robotics: vision-based navigation, autonomous vehicles, swarm robotics; Case studies: self-driving cars, warehouse automation, surgical robots.

**Suggested Books:**


1. Vinod Chandra S.S. and Anand Hareendran S, "Artificial Intelligence: Principles and Applications" **PHI Learning (2nd Edition, 2020)**
2. Francis X. Govers, “Robotics & ROS**:** *Artificial Intelligence for Robotics”,* **Packt Publishing.**
3. M. Gopal, “Foundations of Machine Learning”, **McGraw-Hill Education India**
4. James G. Keramas, “Robot technology fundamentals”, **Delmar Publishers.**
5. Saeed B. Niku, “Introduction to robotics analysis, control and applications”, **2nd ed., Wiley India.**

R. K. Mittal, I. J. Nagrath, “Robotics and Control”, **TMH Education Pvt.**

| B23-PEC-414 | Block Chain Technology | | | | | | |
|---|---|---|---|---|---|---|---|
| **Lecture** | **Tutorial** | **Practical** | **Credit** | **End Semester Exam** | **Internal Assessment** | **Total** | **Time** |
| **3** | **-** | **-** | **3** | **70** | **30** | **100** | **3 Hrs.** |
| **Purpose** | To Understand and explain the fundamental concepts of blockchain technology, security, privacy and cryptocurrency. | | | | | | |
| **Course Outcomes (CO)** | | | | | | | |
| **CO1** | Understand and explain the fundamental concepts of blockchain technology, including its structure | | | | | | |
| **CO2** | Analyze the basics of cryptocurrencies, including Bitcoin, altcoins, and tokens | | | | | | |
| **CO3** | To Understand types of blockchains (public, private, consortium) | | | | | | |
| **CO4** | Examine the security, privacy, and scalability challenges in blockchain systems. | | | | | | |

## UNIT I

**Introduction to Blockchain:**

Fundamentals of Blockchains Technology, The Structure of Blockchains, Blockchain Applications, The Blockchain Life Cycle,Distributed Ledger vs Centralized System, Merkel Root, Nonce Value, Hash Algorithm, and its applications

## UNIT II

**Cryptocurrency – Bitcoin, Altcoin and Token:**

Introduction, Bitcoin and the Cryptocurrency, Cryptocurrency Basics, Types of Cryptocurrencies, Cryptocurrency Usage

## UNIT III

**Blockchain Types and Consensus mechanism:**

Introduction, Decentralization and Distributed system, Types of Blockchain: Public Blockchain,Private Blockchain and Consortium Blockchain, Consensus Protocol: POW, POS, POC, POB, BFT and PBFT

## UNIT IV

**Security Aspects**

Security Aspects in Bitcoin, Security and Privacy Challenges of Blockchain in General, Performance and Scalability, Identity Management and Authentication, Regulatory Compliance and Assurance

**Reference Books:**


| | |
|---|---|
| **1** | Blockchain Technology By Chandramouli Subramanian, Asha George, Abhilash K A and Meena Karthikeyan , Universities Press Publication |
| **2** | Blockchain Blueprint for a New Economy, By Melanie Swan,O'Reilly Publication |
| **3** | Blockchain For Dummies By Tiana Laurence, Wiley Publication |

| B23-PEC-416 | Healthcare and analytics | | | | | | |
|---|---|---|---|---|---|---|---|
| **Lecture** | **Tutorial** | **Practical** | **Credits** | **End Semester Exam** | **Internal Assessment** | **Total** | **Time (Hrs.)** |
| **3** | **0** | **0** | **3** | **70** | **30** | **100** | **3Hrs** |
| **Purpose** | This course's objective is to acquaint students with the healthcare system so they may comprehend its uses in analytics and simulations. | | | | | | |
| **Course Outcomes** | | | | | | | |
| **CO 1** | Knowledge about basic overview of data analytics in healthcare. | | | | | | |
| **CO 2** | The student will know about algorithms regarding phenotyping. | | | | | | |
| **CO 3** | The student will learn about know the importance of clinical trials and prediction models. | | | | | | |
| **CO 4** | To know how to use pervasive health analysis. | | | | | | |

## UNIT I

**Introduction to Healthcare Data Analytics-** Electronic Health Records–Components of EHR- Coding Systems- Benefits of EHR. Barrier to Adopting EHR and its main Challenges.

## UNIT-II

**Algorithms regarding phenotyping:** Phenotyping Algorithms. Challenges in Healthcare Data Analysis, Acquisition Challenges, Pre-processing, Transformation, Social Media Analytics for Healthcare.

## UNIT-III

**Advanced Data Analytics for Healthcare:** Review of clinical trials, Prediction Models. Statistical Prediction Models, Alternative Clinical Prediction Models, Survival Models, Predictive Models for Integrating Clinical and Genomic Data.

## UNIT-IV

**Pervasive health analysis**: Data Analytics for Pervasive Health, Fraud Detection in Healthcare, Pharmaceutical Discoveries and Clinical Decision Support Systems.

**Text Books/Reference Books:**


1. Chandan K. Reddy and Charu C Aggarwal, "*Healthcare data analytics*", Taylor & Francis, 2015
2. Hui Yang and Eva K. Lee, "*Healthcare Analytics: From Data to Knowledge to Healthcare Improvement*, Wiley, 2016.


**Note: The paper setter will set the paper as per the question paper template provided.**