

**INFORMATION THEORY AND CODING**  
(PROFESSIONAL ELECTIVE – V)

**B.Tech. IV Year II Sem.**  
**Course Code: CS851PE**

<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
<b>3</b>	<b>0</b>	<b>0</b>	<b>3</b>

**Prerequisite:** Digital Communications

**Course Objectives:**

- To acquire the knowledge in measurement of information and errors.
- Understand the importance of various codes for communication systems
- To design encoder and decoder of various codes.
- To know the applicability of source and channel codes

**Course Outcomes:** Upon completing this course, the student will be able to

- Learn measurement of information and errors.
- Obtain knowledge in designing various source codes and channel codes
- Design encoders and decoders for block and cyclic codes
- Understand the significance of codes in various applications

**UNIT - I**

**Coding for Reliable Digital Transmission and storage**

Mathematical model of Information, A Logarithmic Measure of Information, Average and Mutual Information and Entropy, Types of Errors, Error Control Strategies.

**Source Codes:** Shannon-fano coding, Huffman coding

**UNIT - II**

**Linear Block Codes:** Introduction to Linear Block Codes, Syndrome and Error Detection, Minimum Distance of a Block code, Error-Detecting and Error-correcting Capabilities of a Block code, Standard array and Syndrome Decoding, Probability of an undetected error for Linear Codes over a BSC, Hamming Codes. Applications of Block codes for Error control in data storage system

**UNIT - III**

**Cyclic Codes:** Description, Generator and Parity-check Matrices, Encoding, Syndrome Computation and Error Detection, Decoding, Cyclic Hamming Codes, shortened cyclic codes, Error-trapping decoding for cyclic codes, Majority logic decoding for cyclic codes.

**UNIT - IV**

**Convolutional Codes:** Encoding of Convolutional Codes- Structural and Distance Properties, state, tree, trellis diagrams, maximum likelihood decoding, Sequential decoding, Majority- logic decoding of Convolution codes. Application of Viterbi Decoding and Sequential Decoding, Applications of Convolutional codes in ARQ system.

**UNIT - V**

**BCH Codes:** Minimum distance and BCH bounds, Decoding procedure for BCH codes, Syndrome computation and iterative algorithms, Error locations polynomials for single and double error correction.

**TEXT BOOKS:**

1. Error Control Coding- Fundamentals and Applications –Shu Lin, Daniel J. Costello, Jr, Prentice Hall, Inc 2014.
2. Error Correcting Coding Theory-Man Young Rhee, McGraw – Hill Publishing 1989

**REFERENCE BOOKS:**

1. Digital Communications- John G. Proakis, 5<sup>th</sup> ed, TMH 2008.
2. Introduction to Error Control Codes-Salvatore Gravano-oxford
3. Error Correction Coding – Mathematical Methods and Algorithms – Todd K. Moon, 2006, Wiley India.
4. Information Theory, Coding and Cryptography – Ranjan Bose, 2<sup>nd</sup> Edition, 2009, TMH.

**REAL-TIME SYSTEMS**  
**(PROFESSIONAL ELECTIVE – V)**

**B.Tech. IV Year II Sem.**  
**Course Code: CS852PE**

**L T P C**  
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**Prerequisite:** Computer Organization and Operating System

**Course Objectives:**

- To provide broad understanding of the requirements of Real Time Operating Systems.
- To make the student understand, applications of these Real Time features using case studies.

**Course Outcomes:**

- Be able to explain real-time concepts such as preemptive multitasking, task priorities, priority inversions, mutual exclusion, context switching, and synchronization, interrupt
- latency and response time, and semaphores.
- Able describe how a real-time operating system kernel is implemented.
- Able explain how tasks are managed.
- Explain how the real-time operating system implements time management.
- Discuss how tasks can communicate using semaphores, mailboxes, and queues.
- Be able to implement a real-time system on an embedded processor.
- Be able to work with real time operating systems like RT Linux, Vx Works, MicroC /OSII, Tiny OS

**UNIT – I: Introduction**

Introduction to UNIX/LINUX, Overview of Commands, File I/O, (open, create, close, lseek, read, write), Process Control (fork, vfork, exit, wait, waitpid, exec).

**UNIT - II: Real Time Operating Systems**

Brief History of OS, Defining RTOS, The Scheduler, Objects, Services, Characteristics of RTOS, defining a Task, asks States and Scheduling, Task Operations, Structure, Synchronization, Communication and Concurrency. Defining Semaphores, Operations and Use, Defining Message Queue, States, Content, Storage, Operations and Use

**UNIT - III: Objects, Services and I/O**

Pipes, Event Registers, Signals, Other Building Blocks, Component Configuration, Basic I/O Concepts, I/O Subsystem

**UNIT - IV: Exceptions, Interrupts and Timers**

Exceptions, Interrupts, Applications, Processing of Exceptions and Spurious Interrupts, Real Time Clocks, Programmable Timers, Timer Interrupt Service Routines (ISR), Soft Timers,

Operations.

**UNIT - V: Case Studies of RTOS**

RT Linux, MicroC/OS-II, Vx Works, Embedded Linux, and Tiny OS.

**TEXT BOOKS:**

1. Real Time Concepts for Embedded Systems – Qing Li, Elsevier, 2011

**REFERENCE BOOKS:**

1. Embedded Systems- Architecture, Programming and Design by Rajkamal, 2007, TMH.
2. Advanced UNIX Programming, Richard Stevens
3. Embedded Linux: Hardware, Software and Interfacing – Dr. Craig Hollabaugh

**DATA ANALYTICS**  
**(PROFESSIONAL ELECTIVE – V)**

**B.Tech. IV Year II Sem.**  
**Course Code: CS853PE**

<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
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Prerequisites

1. A course on “Database Management Systems”
2. Knowledge of probability and statistics

**Course Objectives:** To explore the fundamental concepts of data analytics.

- To learn the principles and methods of statistical analysis
- Discover interesting patterns, analyze supervised and unsupervised models and estimate the accuracy of the algorithms.
- To understand the various search methods and visualization techniques.

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

- Understand the impact of data analytics for business decisions and strategy
- Carry out data analysis/statistical analysis
- To carry out standard data visualization and formal inference procedures
- Design Data Architecture
- Understand various Data Sources

**UNIT - I**

Data Management: Design Data Architecture and manage the data for analysis, understand various sources of Data like Sensors/Signals/GPS etc. Data Management, Data Quality (noise, outliers, missing values, duplicate data) and Data Processing & Processing.

**UNIT - II**

Data Analytics: Introduction to Analytics, Introduction to Tools and Environment, Application of Modeling in Business, Databases & Types of Data and variables, Data Modeling Techniques, Missing Imputations etc. Need for Business Modeling.

**UNIT - III**

Regression – Concepts, Blue property assumptions, Least Square Estimation, Variable Rationalization, and Model Building etc.

Logistic Regression: Model Theory, Model fit Statistics, Model Construction, Analytics applications to various Business Domains etc.

**UNIT - IV**

Object Segmentation: Regression Vs Segmentation – Supervised and Unsupervised Learning, Tree Building – Regression, Classification, Overfitting, Pruning and Complexity, Multiple Decision Trees etc.

Time Series Methods: Arima, Measures of Forecast Accuracy, STL approach, Extract features from generated model as Height, Average Energy etc and Analyze for prediction

**UNIT - V**

Data Visualization: Pixel-Oriented Visualization Techniques, Geometric Projection Visualization Techniques, Icon-Based Visualization Techniques, Hierarchical Visualization Techniques, Visualizing Complex Data and Relations.

**TEXT BOOKS:**

1. Student's Handbook for Associate Analytics – II, III.
2. Data Mining Concepts and Techniques, Han, Kamber, 3<sup>rd</sup> Edition, Morgan Kaufmann Publishers.

**REFERENCE BOOKS:**

1. Introduction to Data Mining, Tan, Steinbach and Kumar, Addison Wesley, 2006.
2. Data Mining Analysis and Concepts, M. Zaki and W. Meira
3. Mining of Massive Datasets, Jure Leskovec Stanford Univ. Anand Rajaraman Millway Labs Jeffrey D Ullman Stanford Univ.

**MODERN SOFTWARE ENGINEERING  
(PROFESSIONAL ELECTIVE – V)**

**B.Tech. IV Year II Sem.**  
**Course Code: CS854PE**

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**UNIT - I****Introduction Extreme Programming (XP) - Agile Development**

Why Agile - Understanding Success, Beyond Deadlines, Importance of Organizational Success, Introduction to Agility, How to Be Agile - Agile methods, Don't make your own method, Road to mastery, Understanding XP (Extreme Programming) - XP life cycle, XP team, XP Concepts, Adopting XP - Knowing whether XP is suitable, Implementing XP, assessing Agility, Practicing XP - Thinking - Pair Programming, Energized work, Informative Workspace, Root cause Analysis, Retrospectives

**UNIT - II**

**Collaborating:** Trust, Sit together, Real customer involvement, Ubiquitous language, meetings, coding standards, Iteration demo, Reporting

**UNIT - III**

**Releasing:** Bugfree Release, Version Control, fast build, continuous integration, Collective ownership, Documentation

**UNIT - IV**

**Planning:** Version, Release Plan, Risk Management, Iteration Planning, Slack, Stories, Estimating

**UNIT - V**

**Developing:** Incremental requirements, Customer tests, Test driven development, Refactoring, Incremental design and architecture, spike solutions, Performance optimization, Exploratory testing

**TEXT BOOK:**

1. The art of Agile Development, James Shore and Shane Warden, 11<sup>th</sup> Indian Reprint, O'Reilly, 2018

**REFERENCES:**

1. Learning Agile, Andrew Stellman and Jennifer Greene, O'Reilly, 4<sup>th</sup> Indian Reprint, 2018
2. Practices of an Agile Developer, Venkat Subramaniam and Andy Hunt, SPD, 5<sup>th</sup> Indian Reprint, 2015
3. Agile Project Management - Jim Highsmith, Pearson Low price Edition 2004

**ADVANCED ALGORITHMS**  
**(PROFESSIONAL ELECTIVE – VI)**

**B.Tech. IV Year II Sem.**  
**Course Code: CS861PE**

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**Prerequisites:**

1. A course on “Computer Programming & Data Structures”.
2. A course on “Advanced Data Structures & Algorithms”.

**Course Objectives:**

- Introduces the recurrence relations for analyzing the algorithms.
- Introduces the graphs and their traversals.
- Describes major algorithmic techniques (divide-and-conquer, greedy, dynamic programming, Brute Force, Transform and Conquer approaches) and mention problems for which each technique is appropriate.
- Describes how to evaluate and compare different algorithms using worst-case, average-case and best-case analysis.
- Introduces string matching algorithms.
- Introduces linear programming.

**Course Outcomes:**

- Ability to analyze the performance of algorithms.
- Ability to choose appropriate data structures and algorithm design methods for a specified application.
- Ability to understand how the choice of data structures and the algorithm design methods impact the performance of programs.

**UNIT - I**

**Introduction:** Role of Algorithms in computing, Order Notation, Recurrences, Probabilistic Analysis and Randomized Algorithms. Sorting and Order Statistics: Heap sort, Quick sort and Sorting in Linear Time.

**Advanced Design and Analysis Techniques:** Dynamic Programming- Matrix chain Multiplication, Longest common Subsequence and optimal binary Search trees.

**UNIT - II**

**Greedy Algorithms** - Huffman Codes, Activity Selection Problem. Amortized Analysis.

**Graph Algorithms:** Topological Sorting, Minimum Spanning trees, Single Source Shortest Paths, Maximum Flow algorithms.

**UNIT - III**

**Sorting Networks:** Comparison Networks, Zero-one principle, bitonic Sorting Networks, Merging Network, Sorting Network.

**Matrix Operations-** Strassen's Matrix Multiplication, inverting matrices, Solving system of linear Equations

**UNIT - IV**

**String Matching:** Naive String Matching, Rabin-Karp algorithm, matching with finite Automata, Knuth- Morris - Pratt algorithm.

**UNIT - V**

**NP-Completeness and Approximation Algorithms:** Polynomial time, polynomial time verification, NP-Completeness and reducibility, NP-Complete problems. Approximation Algorithms- Vertex cover Problem, Travelling Sales person problem

**TEXT BOOK:**

1. Introduction to Algorithms," T. H. Cormen, C.E. Leiserson, R. L. Rivest, and C. Stein, Third Edition, PHI.

**REFERENCES:**

1. Fundamentals of Computer Algorithms, Ellis Horowitz, Satraj Sahni and Rajasekharam, Galgotia publications pvt. Ltd.
2. Design and Analysis Algorithms - Parag Himanshu Dave, Himanshu Bhalchandra Dave Publisher: Pearson
3. Algorithm Design: Foundations, Analysis and Internet examples, M.T. Goodrich and R. Tomassia, John Wiley and sons.
4. Data structures and Algorithm Analysis in C++, Allen Weiss, Second edition, Pearson education.

**WEB SERVICES AND SERVICE ORIENTED ARCHITECTURE  
(PROFESSIONAL ELECTIVE – VI)**

**B.Tech. IV Year II Sem.**  
**Course Code: CS862PE**

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**Course Objectives:**

- To Understand Web Services and implementation model for SOA
- To Understand the SOA, its Principles and Benefits
- To Understand XML concepts
- To Understand paradigms needed for testing Web Services
- To explore different Test Strategies for SOA-based applications
- To implement functional testing, compliance testing and load testing of Web Services
- To Identify bug-finding ideas in testing Web Services

**UNIT - I**

**Evolution and Emergence of Web Services** - Evolution of distributed computing, Core distributed computing technologies – client/server, CORBA, JAVA RMI, Microsoft DCOM, MOM, Challenges in Distributed Computing, role of J2EE and XML in distributed computing, emergence of Web Services and Service Oriented Architecture (SOA).

**Introduction to Web Services** – The definition of web services, basic operational model of web services, tools and technologies enabling web services, benefits and challenges of using web services.

**UNIT - II**

**Web Services Architecture** – Web services Architecture and its characteristics, core building blocks of web services, standards and technologies available for implementing web services, web services communication, basic steps of implementing web services. Describing Web Services – WSDL introduction, nonfunctional service description, WSDL1.1 Vs WSDL 2.0, WSDL document, WSDL elements, WSDL binding, WSDL tools, WSDL port type, limitations of WSDL.

**UNIT – III**

Brief Over View of XML – XML Document structure, XML namespaces, Defining structure in XML documents, Reuse of XML schemes, Document navigation and transformation. SOAP: Simple Object Access Protocol, Inter-application communication and wire protocols, SOAP as a messaging protocol, Structure of a SOAP message, SOAP envelope, Encoding, Service Oriented Architectures, SOA revisited, Service roles in a SOA, Reliable messaging, The enterprise Service Bus, SOA Development Lifecycle, SOAP HTTP binding, SOAP communication model, Error handling in SOAP.

**UNIT – IV**

Registering and Discovering Services: The role of service registries, Service discovery, Universal Description, Discovery, and Integration, UDDI Architecture, UDDI Data Model,

Interfaces, UDDI Implementation, UDDI with WSDL, UDDI specification, Service Addressing and Notification, Referencing and addressing Web Services, Web Services Notification.

#### **UNIT – V**

SOA and web services security considerations, Network-level security mechanisms, Application-level security topologies, XML security standards, Semantics and Web Services, The semantic interoperability problem, The role of metadata, Service metadata, Overview of .NET and J2EE, SOA and Web Service Management, Managing Distributed System, Enterprise management Framework, Standard distributed management frameworks, Web service management, Richer schema languages, WS-Metadata Exchange.

#### **TEXT BOOKS:**

1. Web Services & SOA Principles and Technology, Second Edition, Michael P. Papazoglou.
2. Developing Java Web Services, R. Nagappan, R. Skoczylas, R.P. Sriganesh, Wiley India.
3. Developing Enterprise Web Services, S. Chatterjee, J. Webber, Pearson Education.

#### **REFERENCE BOOKS:**

1. XML, Web Services, and the Data Revolution, F.P. Coyle, Pearson Education.
2. Building web Services with Java, 2nd Edition, S. Graham and others, Pearson Education.
3. Java Web Services, D.A. Chappell & T. Jewell, O'Reilly, SPD.
4. McGovern, et al., "Java web Services Architecture", Morgan Kaufmann Publishers, 2005.
5. J2EE Web Services, Richard Monson-Haefel, Pearson Education.

**COMPUTER FORENSICS**  
**(PROFESSIONAL ELECTIVE – VI)**

**B.Tech. IV Year II Sem.**  
**Course Code: CS863PE**

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**Prerequisite:** Network Security

**Course Objectives**

- A brief explanation of the objective is to provide digital evidences which are obtained from digital media.
- In order to understand the objectives of computer forensics, first of all, people have to recognize the different roles computer plays in a certain crime.
- According to a snippet from the United States Security Service, the functions computer has in different kinds of crimes.

**Course Outcomes**

- Students will understand the usage of computers in forensic, and how to use various forensic tools for a wide variety of investigations.
- It gives an opportunity to students to continue their zeal in research in computer forensics

**UNIT- I**

Introduction of Cybercrime: Types, The Internet spawns crime, Worms versus viruses, Computers' roles in crimes, Introduction to digital forensics, Introduction to Incident - Incident Response Methodology –Steps - Activities in Initial Response, Phase after detection of an incident

**UNIT-II**

Initial Response and forensic duplication, Initial Response & Volatile Data Collection from Windows system -Initial Response & Volatile Data Collection from Unix system – Forensic Duplication: Forensic duplication: Forensic Duplicates as Admissible Evidence, Forensic Duplication Tool Requirements, Creating a Forensic. Duplicate/Qualified Forensic Duplicate of a Hard Drive

**UNIT – III**

**Forensics analysis and validation:** Determining what data to collect and analyze, validating forensic data, addressing data-hiding techniques, performing remote acquisitions

**Network Forensics:** Network forensics overview, performing live acquisitions, developing standard procedures for network forensics, using network tools, examining the honeynet project.

#### **UNIT - IV**

**Current Forensic tools:** evaluating computer forensic tool needs, computer forensics software tools, computer forensics hardware tools, validating and testing forensics software  
**E-Mail Investigations:** Exploring the role of e-mail in investigation, exploring the roles of the client and server in e-mail, investigating e-mail crimes and violations, understanding e-mail servers, using specialized e-mail forensic tools.

**Cell phone and mobile device forensics:** Understanding mobile device forensics, understanding acquisition procedures for cell phones and mobile devices.

#### **UNIT - V**

**Working with Windows and DOS Systems:** understanding file systems, exploring Microsoft File Structures, Examining NTFS disks, Understanding whole disk encryption, windows registry, Microsoft startup tasks, MS-DOS startup tasks, virtual machines.

#### **TEXT BOOKS:**

1. Kevin Mandia, Chris Proise, "Incident Response and computer forensics", Tata McGraw Hill, 2006.
2. Computer Forensics, Computer Crime Investigation by John R. Vacca, Firewall Media, New Delhi.
3. Computer Forensics and Investigations by Nelson, Phillips Enfinger, Steuart, CENGAGE Learning

#### **REFERENCES:**

1. Real Digital Forensics by Keith J. Jones, Richard Bejtich, Curtis W. Rose, Addison-Wesley Pearson Education
2. Forensic Compiling, A Tractitioneris Guide by Tony Sammes and Brian Jenkinson, Springer International edition.

**NEURAL NETWORKS & DEEP LEARNING  
(PROFESSIONAL ELECTIVE – VI)**

**B.Tech. IV Year II Sem.**  
**Course Code: CS864PE**

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**Course Objectives:**

- To introduce the foundations of Artificial Neural Networks
- To acquire the knowledge on Deep Learning Concepts
- To learn various types of Artificial Neural Networks
- To gain knowledge to apply optimization strategies

**Course Outcomes:**

- Ability to understand the concepts of Neural Networks
- Ability to select the Learning Networks in modeling real world systems
- Ability to use an efficient algorithm for Deep Models
- Ability to apply optimization strategies for large scale applications

**UNIT - I**

**Artificial Neural Networks** Introduction, Basic models of ANN, important terminologies, Supervised Learning Networks, Perceptron Networks, Adaptive Linear Neuron, Back-propagation Network. Associative Memory Networks. Training Algorithms for pattern association, BAM and Hopfield Networks.

**UNIT - II**

Unsupervised Learning Network- Introduction, Fixed Weight Competitive Nets, Maxnet, Hamming Network, Kohonen Self-Organizing Feature Maps, Learning Vector Quantization, Counter Propagation Networks, Adaptive Resonance Theory Networks. Special Networks- Introduction to various networks.

**UNIT - III**

Introduction to Deep Learning, Historical Trends in Deep learning, Deep Feed - forward networks, Gradient-Based learning, Hidden Units, Architecture Design, Back-Propagation and Other Differentiation Algorithms

**UNIT - IV**

**Regularization for Deep Learning**

Parameter norm Penalties, Norm Penalties as Constrained Optimization, Regularization and Under-Constrained Problems, Dataset Augmentation, Noise Robustness, Semi-Supervised learning, Multi-task learning, Early Stopping, Parameter Typing and Parameter Sharing, Sparse Representations, Bagging and other Ensemble Methods, Dropout, Adversarial Training, Tangent Distance, tangent Prop and Manifold, Tangent Classifier

## **UNIT - V**

### **Optimization for Train Deep Models**

Challenges in Neural Network Optimization, Basic Algorithms, Parameter Initialization Strategies, Algorithms with Adaptive Learning Rates, Approximate Second-Order Methods, Optimization Strategies and Meta-Algorithms

**Applications:** Large-Scale Deep Learning, Computer Vision, Speech Recognition, Natural Language Processing

### **TEXT BOOKS:**

1. Deep Learning: An MIT Press Book By Ian Goodfellow and Yoshua Bengio and Aaron Courville
2. Neural Networks and Learning Machines, Simon Haykin, 3<sup>rd</sup> Edition, Pearson Prentice Hall.