| STATISTICS, PROBABILITY AND LINEAR PROGRAMMING | |
|---|---|
| **Course Code: CI41** | **Credits: 2:1:0** |
| **Pre – requisites: Basic Probability** | **Contact Hours: 28L+14T** |
| **Course Coordinator: Dr. Govindaraju M V** | |

## Course Contents

### Unit I

**Statistics:** Curve fitting by the method of least squares, fitting linear, quadratic and geometric curves, correlation, regression and multiple regression.

**Probability Distributions:** Random variables, Binomial distribution, Poisson distribution.

- Pedagogy/Course delivery tools: Chalk and talk, Power Point Presentation, Videos
- Links: https://nptel.ac.in/courses/111/105/111105035/
- Impartus recording: https://a.impartus.com/ilc/#/course/96127/452
  https://a.impartus.com/ilc/#/course/132243/636
  https://a.impartus.com/ilc/#/course/119635/593

### Unit II

**Probability Distributions**: Uniform distribution, Exponential distribution, Gamma distribution and Normal distribution.

**Joint probability distribution**: Joint probability distribution (both discrete and continuous), conditional probability, conditional expectation.

- Pedagogy/Course delivery tools: Chalk and talk, PowerPoint Presentation, Videos
- Links: https://nptel.ac.in/courses/111/105/111105035/
  https://nptel.ac.in/courses/111/107/111107119/
- Impartus recording: https://a.impartus.com/ilc/#/course/96127/452
  https://a.impartus.com/ilc/#/course/119635/593

### Unit III

**Markov Chain:** Introduction to stochastic process, probability vectors, stochastic matrices, regular stochastic matrices, Markov chains, higher transition probabilities, stationary distribution of regular Markov chains and absorbing states, Markov and Poisson processes.

**Queuing theory**: Introduction, symbolic representation of a queuing model, single server Poisson queuing model with infinite capacity (M/M/1 : $\infty$ /FIFO), single server Poisson queuing model with finite capacity (M/M/S : N/FIFO), multiple server Poisson

queuing model with infinite capacity (M/M/S : ∞ /FIFO), Multiple server Poisson queuing model with finite capacity (M/M/S : N/FIFO), introduction to M/G/1 queuing model.

- Pedagogy/Course delivery tools: Chalk and talk, Power Point Presentation, Videos
- Links:https://nptel.ac.in/courses/111103022
- Impartus recording: https://a.impartus.com/ilc/#/course/96127/452
  https://a.impartus.com/ilc/#/course/119635/593

## Unit IV

**Sampling and Statistical Inference:** Sampling distributions, central limit theorem, concepts of standard error and confidence interval, level of significance, type I and type II errors, one tailed and two tailed tests, Z-test: for single mean, for single proportion and for difference between means, Student's t –test: for single mean and for difference between two means, F – test for equality of two variances, Chi-square test: for goodness of fit and for independence of attributes.

- Pedagogy/Course delivery tools: Chalk and talk, Power Point Presentation, Videos
- Links: https://nptel.ac.in/courses/111/105/111105035/
  https://nptel.ac.in/courses/111/107/111107119/

## Unit V

**Linear Programming:** Introduction to linear programming problem (LPP), formulation of the problem, graphical method, general, canonical and standard forms of LPP, simplex method, big-M method, two-phase simplex method and duality in linear programming.

- Pedagogy/Course delivery tools: Chalk and talk, Power Point Presentation, Videos
- Links:https://nptel.ac.in/courses/111104027

**Text Books:**


1. R.E. Walpole, R. H. Myers, R. S. L. Myers and K. Ye – Probability and Statistics for Engineers and Scientists – Pearson Education – Delhi – 9th edition – 2012.
2. B.S.Grewal - Higher Engineering Mathematics - Khanna Publishers – 44th edition-2017.
3. T. Veerarajan- Probability, Statistics and Random processes – Tata McGraw-Hill Education – 3rd edition -2017.
4. Kanti Swarup, P.K. Gupta and Man Mohan -Operations Research-Sultan Chand & Sons Publishers–2014.

**Reference Books:**


1. Erwin Kreyszig - Advanced Engineering Mathematics-Wiley-India publishers-10th edition-2015.
2. Sheldon M. Ross – Probability models for Computer Science – Academic Press, Elsevier– 2009.
3. Murray R Spiegel, John Schiller & R. Alu Srinivasan – Probability and Statistics – Schaum's outlines -4nd edition-2012.
4. Kishore S. Trivedi – Probability & Statistics with Reliability, Queuing and Computer Science Applications – John Wiley & Sons – 2nd edition – 2008.
5. Johnson/Miller: Miller & Freund's Probability and Statistics for Engineers , Eighth Edition, Pearson Education India -2015


**Course Outcomes (COs):**

At the end of the course, students will be able to

1. Fit a least squares curve to the given data and analyze the given random data and its probability distributions. (PO-1, 2, PSO-2, 3)
2. Find parameters of Continuous Probability distributions and calculate the marginal and conditional distributions of bivariate random variables. (PO-1, 2, PSO-2, 3)
3. Predict future events using Markov chain and in queuing models. (PO-1, 2, PSO-2, 3)
4. Choose an appropriate test of significance and make inference about the population from a sample. (PO-1, 2, PSO-2, 3)
5. Formulate and solve a simple linear programming problem. (PO-1, 2, PSO-1, 3)

**Course Assessment and Evaluation:**

| **Continuous Internal Evaluation (CIE):** 50 Marks | | |
|---|---|---|
| **Assessment Tool** | **Marks** | **Course outcomes addressed** |
| Internal test-I | 30 | CO1, CO2, CO3 |
| Internal test-II | 30 | CO3, CO4, CO5 |
| Average of the two internal tests shall be taken for 30 marks. | | |
| **Other components** | **Marks** | **Course outcomes addressed** |
| Quiz | 10 | CO1, CO2, CO3 |
| Assignment | 10 | CO3, CO4, CO5 |
| **Semester End Examination (SEE):** | 100 | CO1, CO2, CO3, CO4, CO5 |

| DATA COMMUNICATION AND NETWORKING | |
|---|---|
| **Course Code: CI42** | **Credits: 3:0:1** |
| **Pre – requisites: Nil** | **Contact Hours: 42L+14P** |
| **Course Coordinator: Mr. Anil** | |

## Course Contents

### Unit I

**Data communication Fundamentals:** Introduction, components, Data Representation, Data Flow; Networks – Network criteria, Physical Structures, Network Models, Categories of networks; Protocols, Standards, Standards organization; The Internet – Brief history, Internet today; **Network Models** -Layered tasks; The OSI model – Layered architecture, Peer-to-Peer Process, Encapsulation; Layers in the OSI model; TCP/IP Protocol suite; Addressing.

- Pedagogy/Course delivery tools: Chalk and talk, PowerPoint Presentation, Videos
- Links: https://nptel.ac.in/courses/106108098
  https://nptel.ac.in/courses/106105082
- Impartus Recording: https://a.impartus.com/ilc/#/course/96149/452

### Unit II

**Digital Transmission Fundamentals (with problems to solve):** Analog & Digital data, Analog & Digital signals (basics); Transmission Impairment – Attenuation, Distortion and Noise; Data rate limits – Nyquist Bit Rate, Shannon Capacity; Performance, **Digital Transmission (with problems to solve):** Digital-to-Digital conversion - Line coding, Line coding schemes (unipolar, polar, bipolar)

- Pedagogy/Course delivery tools: Chalk and talk, PowerPoint Presentation, Videos
- Links: https://nptel.ac.in/courses/106108098
  https://nptel.ac.in/courses/106105082
- Impartus Recording: https://a.impartus.com/ilc/#/course/96149/452

### Unit III

**Error detection & correction (with problems to solve):** Introduction, Block coding, Linear Block codes, Cyclic codes – CRC, Polynomials, **Datalink control:** Framing, Flow& error control, Protocols, Noiseless channels (Simplest Protocol, Stop-and-wait protocol); Noisy channels (Stop-and-wait ARQ).

- Pedagogy/Course delivery tools: Chalk and talk, PowerPoint Presentation, Videos
- Links: https://nptel.ac.in/courses/106108098
  https://nptel.ac.in/courses/106105082
- Impartus Recording: https://a.impartus.com/ilc/#/course/96149/452

**Unit IV**

**Multiple Access:** Random Access (CSMA, CSMA/CD, CSMA/CA), Controlled Access (Reservation, Polling, Token Passing), Channelization (FDMA, TDMA, CDMA)

- Pedagogy/Course delivery tools: Chalk and talk, PowerPoint Presentation, Videos
- Links: https://nptel.ac.in/courses/106108098
  https://nptel.ac.in/courses/106105082
- Impartus Recording: https://a.impartus.com/ilc/#/course/96149/452

**Unit V**

**Wired LANs:** IEEE standards; Standard Ethernet; **Wireless LANs:** IEEE802.11 Architecture, MAC sublayer, addressing mechanism, Bluetooth and its architecture; Connecting devices.

- Pedagogy/Course delivery tools: Chalk and talk, PowerPoint Presentation, Videos
- Links: https://nptel.ac.in/courses/106108098
  https://nptel.ac.in/courses/106105082
- Impartus Recording: https://a.impartus.com/ilc/#/course/96149/452

**Lab Experiments:**

Students need to use OPNET Simulator to simulate the following experiments:

1. Simulate a 3-node point to point network with duplex links in between them. Set the Queue size and vary the bandwidth and find the number of packets dropped.
2. Simulate a 4-node point to point network and connect the link as follows: -
3. No-n2, n1-n2 and n2-n3. Apply TCP agent between n0-n3 and UDP n1-n3. Apply relevant applications over TCP and UDP agents changing the parameters and determine the no. of packets sent by TCP/UDP.
4. Simulate the different types of internet traffic such as FTP and TELNET over network and analyze the throughput.
5. Simulate the transmission of PING message over a network topology consisting of 6 nodes and find the number of packets dropped due to congestion.

6. Simulate an Ethernet LAN using N nodes (6-10), change error rate and data rate and compare Throughput.
7. Simulate an Ethernet LAN using N nodes and set multiple traffic nodes and determine collision across different nodes.
8. Simulate an Ethernet LAN using N nodes and set multiple traffic nodes and plot congestion window for different source / destination.
9. Simulate simple ESS and with transmitting nodes in WIRELESS LAN by simulation and determine the performance with respect to transmission of packets.

**Suggested Learning Resources**

**Text Books:**

1. Behrouz A. Forouzan, Data Communications and Networking, Fourth Edition, Tata McGraw-Hill, 2006.

**Reference Books:**

1. Alberto Leon-Garcia and Indra Widjaja, Communication Networks – Fundamental Concepts and Key architectures, Second Edition, Tata McGraw-Hill, 2004.
2. Wayne Tomasi, Introduction to Data Communications and Networking, Pearson Education, 2005.

**Course Outcomes (COs):**

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

1. Distinguish different communication models / protocol stacks (OSI & TCP/IP) and analyze the usage of appropriate network topology for a given scenario. (PO-1, 2, 3, PSO-1,2)
2. Handle the issues associated with digital data signals and solve the problems on data transmission by measuring the performance parameters. (PO-1, 2, 3, PSO-1, 2)
3. Apply different error detection, error correction as well as flow control strategies to solve error and flow control issues induced during data communication. (PO-1, 2, 3, PSO-2)
4. Use the different strategies of multiple access to achieve better network efficiency and analyze the network performance. (PO-1, 2, 3, PSO-1, 2)
5. Illustrate the IEEE standards for wired, wireless LANs and their connecting devices. (PO-3, 10, PSO-2)

**Course Assessment and Evaluation:**

| **Continuous Internal Evaluation (CIE):** 50 Marks | | |
|---|---|---|
| **Assessment Tools** | **Marks** | **Course Outcomes (COs) addressed** |
| Internal Test-I (CIE-I) | 30 | CO1, CO2 |
| Internal Test-II CIE-II) | 30 | CO3, CO4, CO5 |
| **Average of the two CIE shall be taken for 30 marks** | | |
| **Other Components** | | |
| Lab Test | 10 | CO1, CO2, CO3, CO4, CO5 |
| Progamming Assignment | 10 | CO1, CO2, CO3, CO4, CO5 |
| **The Final CIE out of 50 Marks = Average of two CIE tests for 30 Marks+ Marks scored in Lab Test +Marks scored for Programming Assignment** | | |
| **Semester End Examination (SEE)** | 100 | CO1, CO2, CO3, CO4, CO5 |

| DESIGN AND ANALYSIS OF ALGORITHMS | |
|---|---|
| **Course Code: CI43** | **Credits: 3:0:0** |
| **Pre – requisites: Nil** | **Contact Hours: 42L** |
| **Course Coordinator: Dr. Sini Anna Alex** | |

## Course Contents

### Unit I

**Asymptotic Bounds and Representation problems of Algorithms**: Computational Tractability: Some Initial Attempts at Defining Efficiency, Worst-Case Running Times and Brute-Force Search, Polynomial Time as a Definition of Efficiency, Asymptotic Order of Growth: Properties of Asymptotic Growth Rates, Asymptotic Bounds for Some Common Functions, A Survey of Common Running Times: Linear Time, O(n log n) Time, $O(n^k)$ Time, Beyond Polynomial Time. Substitution Method, Some Representative Problems, A First Problem: Stable Matching. (Textbook 1)

- Pedagogy/Course delivery tools: Chalk and talk, PowerPoint Presentation, Videos
- Links: https://nptel.ac.in/courses/106106131
  https://nptel.ac.in/courses/106102064
  https://www.geeksforgeeks.org/fundamentals-of-algorithms/?ref=shm

### Unit II

**Graphs & Divide and Conquer**: Graph Connectivity and Graph Traversal, Breadth-First Search: Exploring a Connected Component, Depth-First Search, Implementing Graph Traversal Using Queues and Stacks: Implementing Breadth-First Search, Implementing Depth-First Search, An Application of Breadth-First Search and Depth-First Search, Directed Acyclic Graphs and Topological Ordering. Divide and Conquer Technique: Masters Theorem for recurrence relations, The Merge sort Algorithm, Quick Sort Algorithm. (Textbook 2)

- Pedagogy/Course delivery tools: Chalk and talk, PowerPoint Presentation, Videos
- Links: https://nptel.ac.in/courses/106106131
  https://nptel.ac.in/courses/106102064
  https://www.geeksforgeeks.org/fundamentals-of-algorithms/?ref=shm

### Unit III

**Transform and Conquer:** Heaps and Heapsort. (Textbook 2) **Greedy Algorithms:** Interval Scheduling: The Greedy Algorithm Stays Ahead: Designing a Greedy

Algorithm, Analyzing the Algorithm, Scheduling to Minimize Lateness: An Exchange Argument: The Problem, Designing the Algorithm. (Textbook 1)
Prim's Algorithm, Kruskal's Algorithm, Dijkstra's Algorithm, Huffman Trees and Codes. (Textbook 2)

- Pedagogy/Course delivery tools: Chalk and talk, PowerPoint Presentation, Videos
- Links: https://nptel.ac.in/courses/106106131
  https://nptel.ac.in/courses/106102064
  https://www.geeksforgeeks.org/fundamentals-of-algorithms/?ref=shm

## Unit IV

**Dynamic Programming:** Weighted Interval Scheduling: A Recursive Procedure, Subset Sums and Knapsacks: Adding a Variable: The Problem, Designing the Algorithm. (Textbook 1)
**Dynamic Programming:** Warshall's and Floyd's Algorithm. (Textbook 2)
**Iterative Improvement:** The Simplex Method, The Maximum-Flow Problem. (Textbook 2)

- Pedagogy/Course delivery tools: Chalk and talk, PowerPoint Presentation, Videos
- Links: https://nptel.ac.in/courses/106106131
  https://nptel.ac.in/courses/106102064
  https://www.geeksforgeeks.org/fundamentals-of-algorithms/?ref=shm

## Unit V

**NP and Computational Intractability:** Polynomial-Time Reductions NP-Complete Problems: Circuit Satisfiability: A First NP-Complete Problem, General Strategy for Proving New Problems NPComplete, Sequencing Problems: The Traveling Salesman Problem, The Hamiltonian Cycle Problem.

- Pedagogy/Course delivery tools: Chalk and talk, PowerPoint Presentation, Videos
- Links: https://www.geeksforgeeks.org/fundamentals-of algorithms/?ref=shm

**Suggested Learning Resources**

**Text Books:**


1. Algorithm Design, Jon Kleinberg and Eva Tardos, Pearson, 1st Edition 2013.
2. Introduction to the Design & Analysis of Algorithms, Anany Levitin, 3rd Edition, Paperback Publication -2017, Pearson education.

**Reference Books:**


1. Design and Analysis of Algorithms, Michael. T. Goodrich, Roberto Tamassia, An Indian Adaptation, Wiley, 2023
2. Introduction to Algorithms, H., Cormen, Charles E. Leiserson, Ronal L. Rivest, Clifford Stein Thomas, 3rd Edition, 2009, MIT press.
3. Fundamentals of Computer Algorithms, Horowitz E., Sartaj Sahni S., Rajasekaran S, 2008, Galgotia Publications.


**Course Outcomes (COs):**

At the end of the course student will be able to:

1. Define the basic concepts and analyse worst-case running times of algorithms using asymptotic analysis. (PO-1,2 PSO-1,3)
2. Recognize the design techniques for graph traversal using representative algorithms. (PO-1,2,3 PSO-1,3)
3. Identify how divide and conquer, transform and conquer works and analyse complexity of the methods by solving recurrence. (PO-1,2,3 PSO-1,3)
4. Illustrate Greedy paradigm and Dynamic programming paradigm using representative algorithms. (PO-1,2,3,4 PSO-2,3)
5. Describe the classes P, NP, and NP-Complete and be able to prove that a certain problem is NP-Complete. (PO-1,2,3,4 PSO-2,3)

**Course Assessment and Evaluation:**

| **Continuous Internal Evaluation (CIE):** 50 Marks | | |
|---|---|---|
| **Assessment Tools** | **Marks** | **Course Outcomes (COs) addressed** |
| Internal Test-I (CIE-I) | 30 | CO1, CO2 |
| Internal Test-II CIE-II) | 30 | CO3, CO4, CO5 |
| **Average of the two CIE shall be taken for 30 marks** | | |
| **Other Components** | | |
| Assessment Test | 10 | CO1, CO2, CO3 |
| Assignment | 10 | CO4, CO5 |
| **The Final CIE out of 50 Marks = Average of two CIE tests for 30 Marks+ Marks scored in Assessment Test +Marks scored in Assignment** | | |
| **Semester End Examination (SEE)** | 100 | CO1, CO2, CO3, CO4, CO5 |

| INTRODUCTION TO ARTIFICIAL INTELLIGENCE | |
|---|---|
| **Course Code: CI44** | **Credits: 3:0:0** |
| **Pre – requisites: Nil** | **Contact Hours: 42L** |
| **Course Coordinator: Dr. M N Thippeswamy** | |

## Course Contents

### Unit I

**Introduction**: Why study AI? What is AI? The Turing tests. Rationality. Branches of AI. Brief history of AI. Challenges for the future. What is an intelligent agent? Doing the right thing (rational action). Performance measure. Rational agent, Rationality, Environment and agent design, Structure of Agents, **Examples of Agent,** Environment types, PEAS, Agent types-simple reflex, model, Goal and Utility based agents, implementation of these agents in C++/Python.

**Chapter: 1 and 2 (First book)**

- Pedagogy/Course delivery tools: Chalk and talk, PowerPoint Presentation.
- Links: https://nptel.ac.in/courses/106105077
  https://nptel.ac.in/courses/106102220

### Unit II

Problem-Solving Agents, Search problems and solutions, Standardized problems- grid world problem (two-cell vacuum world, sliding-tile puzzle). **Uninformed Search**: Depth-first, Breadth-first, Uniform-cost, Depth-Limited Search, Iterative Deepening Depth-First Search, Bidirectional **Search,** Informed **search**: Best-first, A* search, Heuristic search, Iterative deepening A* **(IDA*).**

Chapter 3 and 4 **(First book)**

- Pedagogy/Course delivery tools: Chalk and talk, PowerPoint Presentation.
- Links: https://nptel.ac.in/courses/106105077
  https://nptel.ac.in/courses/106102220

### Unit III

**Problem reduction: AND-OR(AO*) algorithm, Game Playing:** Minimax algorithm, Alpha-beta pruning. Knowledge Representation, Expert system Approaches to knowledge representation, knowledge representation using semantic network, extended semantic networks for KR, Knowledge representation using Frames. Knowledge -based agents, the architecture, the Wumpus world, simple knowledge base, simple inference procedure, First-order logic.Chapter 6, 7 and 8**(First book)**

- Pedagogy/Course delivery tools: Chalk and talk, PowerPoint Presentation.
- Links: https://nptel.ac.in/courses/106105077
  https://nptel.ac.in/courses/106102220

## Unit IV

Advanced problem-solving paradigm: Planning: types of planning system, block world problem, logic-based planning, Algorithms for Classical Planning, Linear planning using a goal stack, Means-ends analysis, Non linear planning strategies, Planning and Acting in Nondeterministic Domains.
Chapter 6(Second book), chapter 11 (First book)

- Pedagogy/Course delivery tools: Chalk and talk, PowerPoint Presentation.
- Links: https://nptel.ac.in/courses/106105077
  https://nptel.ac.in/courses/106102220

## Unit V

Expert system and reasoning: introduction, phases, architecture of Expert system, Expert systems verses Traditional system, characteristics of Expert systems, Advantages and disadvantages, Implementation of Expert system in Python, Applications of Expert systems, knowledge engineering, Rule-Based Expert systems, probabilistic reasoning.
Chapter 7 and 8 of Second textbook. Chapter 13(first book)

- Pedagogy/Course delivery tools: Chalk and talk, PowerPoint Presentation.
- Links: https://nptel.ac.in/courses/106105077
  https://nptel.ac.in/courses/106102220

**Suggested Learning Resources**

**Text Books:**

1. Artificial Intelligence-A Modern Approach, Stuart J. Russell and Peter Norvig, Pearson 4th Edition, Eleventh Impression 2022.
2. Saroj Kaushik, Artificial Intelligence, Cengage learning, 2nd edition, 2022.

**Reference Books:**

1. Elaine Rich, Kevin Knight, Shivashanka B Nair: Artificial Intelligence, Tata MCGraw Hill 3rd edition. 2013
2. Nils J. Nilsson: "Principles of Artificial Intelligence", Elsevier, ISBN-13: 9780934613101

**Course Outcomes (COs):**

At the end of the course student will be able to:

1. Understanding AI, Structure of Agents, Idea behind search algorithms, analyzing Uninformed and Informed search. (PO-1,2,3,4,12, PSO-1,2,3)

2. Develop knowledge base sentences using propositional logic and first order logic. (PO4,5, PSO-1,2,3)
3. Apply the knowledge of Artificial Intelligence to write simple algorithm for agents. (PO-1,4,5,6,7, PSO-1,2,3)
4. Apply the AI knowledge to solve problem on search algorithm. (PO-1,2,3,4,12, PSO-1,2,3)
5. Apply first order logic to solve knowledge engineering process. (PO-4,5,9,10,11,12, PSO-1,2,3)

**Course Assessment and Evaluation:**

| **Continuous Internal Evaluation (CIE):** 50 Marks | | |
|---|---|---|
| **Assessment Tools** | **Marks** | **Course Outcomes addressed** |
| Internal Test-I (CIE-I) | 30 | CO1, CO2 |
| Internal Test-II CIE-II) | 30 | CO3, CO4, CO5 |
| **Average of the two CIE shall be taken for 30 marks** | | |
| **Other Components** | | |
| Case Study | 10 | CO1, CO2, CO3 |
| Assignment | 10 | CO4, CO5 |
| **The Final CIE out of 50 Marks = Average of two CIE tests for 30 Marks+ Marks scored in Case Study +Marks scored in Assignment** | | |
| **Semester End Examination (SEE)** | 100 | CO1, CO2, CO3, CO4, CO5 |

# OPERATING SYSTEMS

| | |
|---|---|
| **Course Code: CI45** | **Credits: 3:0:0** |
| **Pre – requisites: Nil** | **Contact Hours: 42L** |
| **Course Coordinator: Ms. Akshatha G C** | |

## Course Contents

### Unit I

**Introduction:** What operating systems do; Computer System organization; Computer System architecture; Operating System structure; Operating System operations.

**Operating system structures:** operating system services, user operating system Interface, System calls, Types of system calls, Operating system structure, System boot.

- Pedagogy/Course delivery tools: Chalk and talk, PowerPoint Presentation, Videos
- Links: https://nptel.ac.in/courses/106105214
- Impartus recording: https://a.impartus.com/ilc/#/course/148805/703

### Unit II

**Process Management:** Basic concept; Process scheduling; Operations on processes; Inter process Communication.

**Threads:** Overview; Multithreading models;

**Process scheduling:** Basic concepts, Scheduling criteria, scheduling algorithms, multiple processor scheduling, Algorithm evaluation.

- Pedagogy/Course delivery tools: Chalk and talk, PowerPoint Presentation, Videos
- Links: https://nptel.ac.in/courses/106105214
- Impartus recording: https://a.impartus.com/ilc/#/course/148805/703

### Unit III

**Process Synchronization:** Synchronization, The Critical section problem; Peterson's solution; Synchronization hardware; Semaphores; Classical problems of synchronization; Monitors.

**Deadlocks:** System model; Deadlock characterization; Methods for handling deadlocks; Deadlock prevention; Deadlock avoidance; Deadlock detection and recovery from deadlock.

- Pedagogy/Course delivery tools: Chalk and talk, PowerPoint Presentation, Videos
- Links: https://nptel.ac.in/courses/106105214
- Impartus recording: https://a.impartus.com/ilc/#/course/148805/703

**Unit IV**

**Memory Management Strategies:** Background; Swapping; Contiguous memory allocation; Paging; Structure of page table; Segmentation.

**Virtual Memory Management:** Background; Demand paging; Copy-on write; Page replacement; Allocation of frames; Thrashing.

- Pedagogy/Course delivery tools: Chalk and talk, PowerPoint Presentation, Videos
- Links: https://nptel.ac.in/courses/106105214
- Impartus recording: https://a.impartus.com/ilc/#/course/148805/703

**Unit V**

**File System:** File concept; Access methods; Directory structure; File system mounting; file sharing; protection.

**Secondary Storage Structures:** Disk scheduling; FCFS Scheduling, SSTF scheduling, SCAN, C-SCAN scheduling, Look Scheduling, CLOOK scheduling.

**System Protection:** Goals of protection, Principles of protection, Domain of protection, Access matrix.

- Pedagogy/Course delivery tools: Chalk and talk, PowerPoint Presentation, Videos
- Links: https://nptel.ac.in/courses/106105214
- Impartus recording: https://a.impartus.com/ilc/#/course/148805/703

**Suggested Learning Resources**

**Text Books:**

1. Abraham Silberschatz, Peter Baer Galvin, Greg Gagne Operating System Principles, 8th edition Wiley- India,2011.

**Reference Books:**

1. D.M Dhamdhere Operating systems - A concept-based Approach, 2nd Edition, Tata McGraw-Hill, 2002
2. Harvey M Deital Operating systems, 3rd Edition, Addison Wesley, 1990.
3. Operating Systems: Principles and Practice (2nd Edition), by Thomas Anderson and Michael Dahlin.

**Course Outcomes (COs):**

At the end of the course students will be able to:

1. Describe the structure of computer system and services provided by Operating system. (PO-1,2, PSO-1,2)
2. Apply different scheduling algorithms for Process/Memory/Disk Management. (PO-1,2,3,4, PSO-1,2,3)
3. Describe Process management and need for controlled access to computing resources by co-operative processes. (PO-1,2,3,4, PSO-1,2)
4. Apply deadlock detection and prevention algorithms to solve the given problem. (PO-1,2,3,4, PSO-1,2,3)
5. Illustrate memory management strategies and operating system principles for achieving protection and security. (PO-1,2,3,4, PSO-1,2)

**Course Assessment and Evaluation:**

| **Continuous Internal Evaluation (CIE):** 50 Marks | | |
|---|---|---|
| **Assessment Tools** | **Marks** | **Course Outcomes (COs) addressed** |
| Internal Test-I (CIE-I) | 30 | CO1, CO2 |
| Internal Test-II CIE-II) | 30 | CO3, CO4, CO5 |
| **Average of the two CIE shall be taken for 30 marks** | | |
| **Other Components** | | |
| Case study-System Calls | 10 | CO1, CO2, CO3 |
| Assignment | 10 | CO4, CO5 |
| **The Final CIE out of 50 Marks = Average of two CIE tests for 30 Marks+ Marks scored in Case Study – System calls +Marks scored in Assignment** | | |
| **Semester End Examination (SEE)** | 100 | CO1, CO2, CO3 CO4, CO5 |

| EMBEDDED SYSTEM LABORATORY | |
|---|---|
| Course Code: CIL46 | Credits: 0:0:1 |
| Pre – requisites: Nil | Contact Hours: 14P |
| Course Coordinator: Dr. Mohana Kumar S | |

## Course Contents

**Introduction to Embedded Systems:** What is an Embedded System?, Embedded Systems vs. General Computing Systems, History of Embedded Systems, Classification of Embedded Systems, Major Application Areas of Embedded System.
Microcontroller Architecture, Differences between microprocessor and microcontroller, type of microcontrollers, Importance of microcontroller in embedded system, Arduino platforms for programming: Simple programs to blink LEDs.
**Introduction to Embedded C Programming, Data types**: byte, int, long, float, arrays. Structures: setup (), loop (), functions, {} curly braces, ; semicolon, /*….*/ block comments, // line comments. Variables: variable declaration, variable scope. Arithmetic: compound assignments, comparison operators, and logical operators. Constants: true/false, high/low, input/output. Flow control: if, if else, for, while, do while.**Introduction to Sensors and actuators**, Communication – Wireless Communication using Bluetooth, Wi-Fi and RF Modules. Communication Controllers.
**RTOS:** Real time Operating System, Tasks, Process and Treads, Multiprocessing and Multitasking, Task Scheduling.
***Note: Practical Contents will be based on the theory portions.**

**Reference Books:**


1. Introduction to Embedded Systems, Shibu K V McGraw Hill Publication.
2. Embedded System Design: Frank Wahid, Tony Givargis A Unified Hardware / Software, Wiley India


**Course Outcomes (COs):**

At the end of course, Student will be able to:

1. Describe and Analyze the Salient aspects of differentiation between Real time systems and Data Processing system. (PO-1,2,3,4,5,9, 10,12, PSO-1,3)
2. Design embedded systems using Arduino board and Embedded C. (PO-1,2,3,4,5,9, 10,12, PSO-1,3)
3. Conversant with various Sensors, communication protocols used in Embedded applications. (PO-1,2,3,4,5,9, 10,12, PSO-1,3)

**Course Assessment and Evaluation:**

| **Continuous Internal Evaluation (CIE):** 50 Marks | | |
|---|---|---|
| **Assessment Tools** | **Marks** | **Course Outcomes (COs) addressed** |
| Lab Test-I | 10 | CO1, CO2 |
| Lab Test-II | 10 | CO3 |
| Weekly Evaluation+Lab Record | 30 | - |
| **The Final CIE out of 50 Marks = Marks of Lab Record + Marks scored in Lab Test-I + Marks scored in Lab Test-II** | | |
| **Semester End Examination (SEE)** | 50 | CO1, CO2, CO3 |

| ALGORITHMS LABORATORY | |
|---|---|
| **Course Code: CIL47** | **Credits: 0:0:1** |
| **Pre – requisites: Nil** | **Contact Hours: 14P** |
| **Course Coordinator: Dr. Sini Anna Alex** | |

## Course Contents

Design and Develop algorithms to implement the concepts in design and analysis of algorithms

| Sl. No. | Lab Course Contents |
|---|---|
| 1. | Asymptotic bounds and functions: Best Case, Average Case and Worst-Case Complexity |
| 2. | Sorting and searching algorithms with Brute Force technique |
| 3. | Stable matching algorithm using Iterative Improvement |
| 4. | Graph Traversal: Breadth first search |
| 5. | Graph Traversal: Depth first search |
| 6. | Divide and Conquer Technique: Merge sort algorithm |
| 7. | Divide and Conquer Technique: Quick sort algorithm |
| 8. | Minimum Spanning Tree using Greedy Technique: Prim's and Kruskal algorithm |
| 9. | Single Source Shortest Path using Greedy Technique: Dijkstra's algorithm |
| 10. | Greedy approach: Job Sequencing with deadlines |
| 11. | Dynamic Programming approach: Knapsack problem |
| 12. | Branch and Bound Technique: Travelling Salesman Problem |

Lab experiments will be scenario based implementation for the algorithm techniques specified in the course contents.

## Suggested Learning Resources

**Reference Books:**


1. Algorithm Design - Jon Kleinberg and Eva Tardos, Tsinghua University Press (2005).
2. Anany Levitin: Introduction to the Design & Analysis of Algorithms, 2nd Edition, Pearson Education, 2007.


**Course Outcomes (COs):**

At the end of the course, the student will be able to:

1. Define the basic concepts and analyze worst-case running times of algorithms using asymptotic analysis. (PO-1,4,10, PSO-1,2)
2. Recognize the design techniques for graph traversal, divide and conquer, greedy and dynamic programming paradigm using representative algorithms. (PO-1,2,3, 5, 7, 9, 10, PSO-1,2,3)
3. Illustrate Branch and bound paradigm through NP complete problems. (PO-1, 3, 4, 10,12, PSO-2,3)

**Course Assessment and Evaluation:**

| **Continuous Internal Evaluation (CIE):** 50 Marks | | |
|---|---|---|
| **Assessment Tools** | **Marks** | **Course Outcomes (COs) addressed** |
| Lab Test-I | 10 | CO1, CO2 |
| Lab Test-II | 10 | CO3 |
| Weekly Evaluation+Lab Record | 30 | CO1, CO2, CO3 |
| **The Final CIE out of 50 Marks = Marks of Lab Record + Marks scored in Lab Test-I + Marks scored in Lab Test-II** | | |
| **Semester End Examination (SEE)** | 50 | CO1, CO2, CO3 |

| ADVANCED WEB PROGRAMMING LABORATORY | |
|---|---|
| Course Code: CIL48 | Credits: 0:0:1 |
| Pre – requisites: Nil | Contact Hours: 14P |
| Course Coordinator: Dr. Thippeswamy M N | |

## Course Contents

**LABORATORY OVERVIEW:** A Web Technologies Laboratory is a practical environment where students can gain hands-on experience with various web technologies and frameworks. The primary goal of such a laboratory is to provide students with practical skills in designing, developing, and maintaining dynamic web-based applications. The specific technologies covered in a Web Technologies Lab include common topics are: HTML, CSS, JavaScript, XML, Bootstrap, Jquery, NodeJS and MySQL.

The course helps the students to solve the inter-disciplinary applications through web programming.

**Course Objectives:**

- Develop a static, interactive and well-formed webpage using JavaScript, CSS and HTML,XML.
- Use MySQL and NodeJS to improve accessibility of a web document.
- Gain necessary skills for designing and developing web applications.

**Front- End:** The front end of a web application is the part of the application that users interact with directly. It encompasses everything that users experience visually and interactively in their web browsers. Front-end development involves designing and implementing the user interface (UI) and user experience (UX) of a web application. This includes the layout, design, interactivity, and overall look and feel of the application. The technologies are as follows.

1. Html, html5
2. CSS
3. JavaScript
4. XML
5. Bootstraps
6. jQuery

**Back –End:** The backend of a web application refers to the server-side, where data is processed, stored, and managed. It is responsible for handling tasks such as database operations, authentication, and application logic. Users typically don't interact directly with the backend; instead, it works behind the scenes to support and enable the functionality provided by the frontend. Here are the technologies as follows.

1. Node.js
2. MySQL
3. PHP

## Suggested Learning Resources

**Reference Books:**


1. Web Application Design and Implementation: Apache 2, PHP5, MySQL, JavaScript, and Linux/UNIX Steven A. Gabarro, December 2006, ©2007, Wiley-IEEE Computer Society Press.
2. Nate Murray, Felipe Coury, Ari Lerner and Carlos Taborda, "ng-book, The Complete Book on Angular 4" September 2016 3. Krasimir Tsonev,
3. "Node.js by Example Paperback", May 2015.
4. Web link for Angular4.0: https://angular.io/
5. Web link for Node.js : https://nodejs.org/en/
6. Web link for MongoDB: https://www.mongodb.com


**Course Outcomes (COs):**

At the end of the course the student will be able to:

1. Develop web pages with various media contents using HTML5 (PO-1,2,3,4,5, 9,10,12, PSO-1,3)
2. Create a robust Client-side validation with java script. (PO-1,2,3,4,5,9, 10,12, PSO-1,3)
3. Design dynamic data-driven Web sites using MongoDB and Node.js (PO-1,2, 3,4,5,9, 10,12, PSO-1,3)

**Course Assessment and Evaluation:**

| **Continuous Internal Evaluation (CIE):** 50 Marks | | |
|---|---|---|
| **Assessment Tools** | **Marks** | **Course Outcomes (COs) addressed** |
| Lab Test-I | 10 | CO1, CO2 |
| Lab Test-II | 10 | CO3 |
| Weekly Evaluation+Lab Record | 30 | - |
| **The Final CIE out of 50 Marks = Marks of Lab Record + Marks scored in Lab Test-I + Marks scored in Lab Test-II** | | |
| **Semester End Examination (SEE)** | 50 | CO1, CO2, CO3 |

| ABILITY ENHANCEMENT COURSE - IV | |
|---|---|
| **Course Code: CIAEC49** | **Credits: 1:0:0** |
| **Pre – requisites: Nil** | **Contact Hours: 14L** |
| **Course Coordinator: Mr. Anil** | |

Ability Enhancement Courses (AEC) are the generic skill courses which are basic and needed by all to pursue any career. These courses are designed to help students enhance their skills in communication, language, and personality development. They also promote a deeper understanding of subjects like social sciences and ethics, culture and human behaviour, human rights and the law.

Every student shall register for AEC course under the supervision of his/her proctor. For III, IV & V semester, the student shall select the Ability Enhancement Course online such that the selected course does not overlap with any professional core/ elective course offered by the parent department of the student. After selection, the registration of the course has to be done by the student at his/her parent department.

# ADDITIONAL MATHEMATICS - II

| | |
|---|---|
| **Course Code: AM41** | **Credits: 0:0:0** |
| **Pre – requisites: Nil** | **Contact Hours: 42** |
| **Course Coordinator: Dr. Veena B N** | |

## Course Contents

### Unit I

**Differential Calculus- I:** Partial differentiation, Euler's theorem, total differential coefficient, differentiation of composite and implicit functions.

- Pedagogy / Course delivery tools:Chalk and talk
- Online tools: Use of open source software's to demonstrate methods and solve problems on interpolation
- Links: https://nptel.ac.in/courses/111/105/111105121/
- Impartus recording: https://a.impartus.com/ilc/#/course/107625/1030

### Unit II

**Differential Calculus- II:** Jacobian and Properties. Taylor's theorem for function of two variables, maxima and minima for functions of two variables.

- Pedagogy / Course delivery tools: Chalk and talk
- Online tools: Use of open source software's to demonstrate methods and solve problems on numerical differentiation and integration.
- Links: https://nptel.ac.in/courses/111/105/111105121/
- Impartus recording: https://a.impartus.com/ilc/#/course/107625/1030
  https://a.impartus.com/ilc/#/course/59742/295

### Unit III

**Vector Integration:** Line integrals, surface integrals and volume integrals. Green's theorem, Stokes' and Gauss divergence theorem (without proof) and problems, orthogonal curvilinear coordinates.

- Pedagogy / Course delivery tools: Chalk and talk
- Links: https://nptel.ac.in/courses/111/105/111105134/
- Impartus recording: https://a.impartus.com/ilc/#/course/619570/1030

### Unit IV

**Higher Order Differential Equations**: Higher order linear differential equations, method of variation of parameters, Cauchy's and Legendre's homogeneous differential equations.

- Pedagogy / Course delivery tools: Chalk and talk

- Links:https://nptel.ac.in/courses/111/105/111105121/
- Impartus recording: https://a.impartus.com/ilc/#/course/96127/452
  https://a.impartus.com/ilc/#/course/59742/295

## Unit V

**Probability:** Introduction. Sample space and events. Axioms of probability. Addition and multiplication theorems. Conditional probability- illustrative examples. Bayes theorem – examples.

- Pedagogy / Course delivery tools: Chalk and talk
- Links: https://nptel.ac.in/courses/111/107/111107119/
- https://nptel.ac.in/courses/111/107/111107119/
- Impartus recording: https://a.impartus.com/ilc/#/course/283623/703

**Text Books:**

1. **B.S. Grewal** – Higher Engineering Mathematics, Khanna Publishers, 44th edition, 2017.
2. **Erwin Kreyszig** – Advanced Engineering Mathematics – Wiley Publication, 10th Edition, 2015.

**Reference Books:**

1. **H. K. Dass** – Higher Engineering Mathematics – S Chand Publications, 1998
2. **B. V. Ramana** – Engineering Mathematics – Tata McGraw-Hill Publishing Co. Ltd., New Delhi, 2008.

**Course Outcomes (COs):**

At the end of the course the student will be able to

1. To carryout differentiation of function of several variables. (PO-1,2)
2. Solve the problems related to Jacobians, the extreme values of a function and Taylors series. (PO-1,2)
3. Exhibit the interdependence of line, surface and volume integrals using integral theorems. (PO-1,2)
4. Find the solution of second and higher order ODEs with constant and variable coefficients. (PO-1,2)
5. Solve the problems on conditional probability and Baye's theorem. (PO-1,2)

**Course Assessment and Evaluation:**

| **Continuous Internal Evaluation (CIE):** 50 Marks | | |
|---|---|---|
| **Assessment Tool** | **Marks** | **Course outcomes addressed** |
| Internal test-I | 30 | CO1, CO2, CO3 |
| Internal test-II | 30 | CO3, CO4, CO5 |
| Average of the two internal tests shall be taken for 30 marks. | | |
| **Other components** | **Marks** | **Course outcomes addressed** |
| Quiz | 10 | CO1, CO2, CO3 |
| Assignment | 10 | CO3, CO4, CO5 |