



RAMAIAH
Institute of Technology

CURRICULUM

**Outcome Based Education
(Academic Year 2022 – 2023)**

**Computer Science and Engineering
(ARTIFICIAL INTELLIGENCE & MACHINE LEARNING)
and
Computer Science and Engineering
(CYBER SECURITY)**

**IV SEMESTER B.E.
Computer Science and Engineering
(AI & ML)**

RAMAIAH INSTITUTE OF TECHNOLOGY
(Autonomous Institute, Affiliated to VTU)
Bangalore – 560054.

SCHEME OF TEACHING IV SEMESTER

Sl. No.	Subject Code	Subject	Teaching Department	Category	Credits				Total contact hours /week
					L	T	P	Total	
1	CI41	Numerical Techniques and Probability Models	Mathematics	BSC	2	1	0	3	4
2	CI42	Data Communication and Networking (Integrated)	CSE (AI&ML)	IPCC	2	0	1	3	4
3	CI43	Design and Analysis of Algorithms	CSE (AI&ML)	PCC	2	1	0	3	3
4	CI44	Introduction to Artificial Intelligence	CSE (AI&ML)	PCC	3	0	0	3	3
5	CI45	Operating System	CSE (AI&ML)	PCC	3	0	0	3	3
6	CIL46	Embedded Systems Laboratory	CSE (AI&ML)	PCC	0	0	1	1	2
7	CIL47	Algorithms Laboratory	CSE (AI&ML)	PCC	0	0	1	1	2
8	CIL48	Web Technologies Laboratory	CSE (AI&ML)	PCC	0	0	1	1	2
9	HS492	Constitution of India & Professional Ethics	Humanities	HSMC	1	0	0	1	1
10	AEC410	Ability Enhancement Course – IV	Any Dept	AEC	1	0	0	1	1
11	INT411	Inter/ Intra Institutional Internship	CSE (AI&ML)	INT	0	0	2	2	-
				Total				22	25
12	AM41	Additional Mathematics II *	Mathematics	NCMC	0	0	0	0	-

IV SEMESTER

NUMERICAL TECHNIQUES AND PROBABILITY MODELS	
Course Code: CI41	Credits: 2:1:0
Pre – requisites: Calculus and Basic Probability	Contact Hours: 28L+14T
Course Coordinator: Dr. Govindaraju M V and Dr. R Suresh Babu	

Unit I

Finite Differences and Interpolation: Forward and backward differences, Interpolation, Newton-Gregory forward and backward interpolation formulae, Lagrange's interpolation formula and Newton's divided difference interpolation formula (no proof).

Numerical Differentiation and Numerical Integration: Derivatives using Newton-Gregory forward and backward interpolation formulae, Newton-Cotes quadrature formula, Trapezoidal rule, Simpson's $1/3^{\text{rd}}$ rule and Simpson's $3/8^{\text{th}}$ rule.

- Pedagogy/Course delivery tools: Chalk and talk, PowerPoint Presentation, Videos
- Links: <https://nptel.ac.in/courses/111/105/111105134/>
<https://nptel.ac.in/courses/111/106/111106101/>
- 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

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, PowerPoint 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 III

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 IV

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 : ∞ /FIFO), when $\lambda_n = \lambda$ and $\mu_n = \mu (\lambda < \mu)$, Performance measures of the model, Single server Poisson queuing model with finite capacity (M/M/S : N/FIFO), Performance measures of the model, Multiple server Poisson queuing model with infinite capacity (M/M/S : ∞ /FIFO), when $\lambda_n = \lambda$ for all $n, (\lambda < S\mu)$, 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, PowerPoint 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 V

Sampling and Statistical Inference: Sampling distributions, Concepts of standard error and confidence interval, Central Limit Theorem, Type I and Type II errors, Level of significance, One tailed and two tailed tests, Z-test: for single mean, for single proportion, for difference between means, Student's t –test: for single mean, for difference between two means, F – test: for equality of two variances, Chi-square test: for goodness of fit, for independence of attributes.

- 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/>

Suggested Learning Resources

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.

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 -4th 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. Find functional values, derivatives, areas and volumes numerically from a given data. (PO-1, 2 & PSO-2, 3)
2. 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)
3. Find parameters of Continuous Probability distributions and calculate the marginal and conditional distributions of bivariate random variables. (PO-1, 2 & PSO-2, 3)

4. Predict future events using Markov chain and in queuing models. (PO-1, 2 & PSO-2, 3)
5. Choose an appropriate test of significance and make inference about the population from a sample. (PO-1, 2 & 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, CO3
Internal Test-II CIE-II)	30	CO3, CO4, CO5
Average of the two CIE shall be taken for 30 marks		
Other Components		
Quiz	10	CO1, CO2, CO3
Assignment	10	CO3, CO4, CO5
The Final CIE out of 50 Marks = Average of two CIE tests for 30 Marks+ Marks scored in Quiz +Marks scored in Assignment		
Semester End Examination (SEE)		
Course End Examination (Answer One full question from each Unit- Internal Choice)	100	CO1, CO2, CO3 CO4, CO5

DATA COMMUNICATION AND NETWORKING (INTEGRATED)

Course Code: CI42	Credits: 2:0:1
Pre – requisites: Nil	Contact Hours: 28L+14P
Course Coordinator: Dr. Thippeswamy M N	

Unit I

Introduction: Overview of the internet- Networks, Network Types, Switching and the Internet, Data Communications. **Networks Model:** Protocol Layering, TCP/IP Protocol suite, The OSI model. **Introduction to Physical Layer:** Data and Signals. **Transmission Media:** Guided Media, Unguided Media: Wireless.

(Text book: Chapter 1.1, 1.2, 1.3, Remaining topics: Ref 1)

- 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

Introduction to Data-Link Layer: Introduction, Link-Layer Addressing. **Data Link Control (DLC):** Data-link layer protocols, HDLC, PPP, framing, flow and error control, error detection and correction. **Media Access Control (MAC):** random access, controlled access and channelization, Wired LANs.

(Chapter 5.1 – 5.5)

- 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

Network Layer: Network-Layer Services, Packet Switching, Network-Layer Performance, IPv4 Addresses, Class-full and Classless addressing (CIDR), Forwarding of IP Packets, Internet Protocol (IP), ICMPv4, IPv6 addressing.

(Chapter 4.1, 4.2, 4.5)

- 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

Unicast Routing: Introduction: general idea, least-cost routing, Routing algorithms, Distance-Vector Routing, Link-State Routing, Path-Vector Routing, **Unicast Routing Protocols:** Internet Structure, Routing Information Protocol (RIP), Open Shortest Path First (OSPF), Border Gateway Protocol Version 4 (BGP4), Introduction to Multicast routing (Chapter 4.3, 4.4, 4.5)

- 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

Transport Layer: Introduction, Transport-Layer Protocols (Stop and wait, Go back N, Selective repeat, Bi-directional), User Datagram Protocol, Transmission Control Protocol. **Application Layer:** Client-Server programming using sockets APIs. (Chapter 3.1-3.4, 2.1, 2.3, 2.5)

- 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>

Suggested Learning Resources

Text Books:

1. Behrouz A. Forouzan, Data Communication and Networking, 5th Edition Tata Mc Graw-Hill

Reference Books:

1. Behrouz A. Forouzan and Firouz Mosharraf: Computer Networks: A top down approach, Special Indian Edition, Tata Mc Graw-Hill.2012.
2. William Stallings: Data and Computer Communication, 8th Edition, Pearson Education, 2007.

3. Larry L. Peterson and Bruce S. Davie: Computer Networks – A Systems Approach, 4th edition, Elsevier, 2007.
4. Alberto Leon-Garcia and Indra Widjaja, “Communication Networks Fundamental Concepts and Key Architectures”, 2nd Edition, Mc Graw-Hill Education

Course Outcomes (COs):

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

1. Differentiate between different types of network topologies and data transmission techniques. (PO-1, 2, 3, 4,10, PSO-1,2).
2. Illustrate sliding window and access control protocols of data link layer (PO-1, 2, 3, 4,10, PSO-1,2).
3. Solve problems of IP addressing and routing using various routing protocols and algorithms. (PO-1, 2, 3, 4,10, PSO1,2).
4. Differentiate between connection oriented and connection less services of transport layer (PO-1, 2, 3, 4,10, PSO1,2).
5. Describe the various application layer protocols used by TCP/IP reference mode (PO-1, 2, 3, 4,10, PSO1,2).

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
Lab Record	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 Lab Record		
Semester End Examination (SEE)		
Course End Examination (Answer One full question from each Unit- Internal Choice)	100	CO1, CO2, CO3, CO4, CO5

DESIGN AND ANALYSIS OF ALGORITHMS

Course Code: CI43	Credits: 2:1:0
Pre – requisites: Nil	Contact Hours: 28L+14T
Course Coordinator: Dr. Sini Anna Alex	

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, $O(nk)$ Time, Beyond Polynomial Time. Some Representative Problems, A First Problem: Stable Matching.

- 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: The Problem, Designing the Algorithm, Directed Acyclic Graphs and Topological Ordering, The Merge sort Algorithm.

- 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

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, Designing and Analyzing the Algorithm, Shortest Paths in a Graph: The Problem,

Designing the Algorithm, Analyzing the Algorithm, The Minimum Spanning Tree Problem: The Problem, Designing Algorithms, Analyzing the Algorithms, Huffman Codes and Data Compression.

- 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: Designing a Recursive Algorithm, Subset Sums and Knapsacks: Adding a Variable: The Problem, Designing the Algorithm, Shortest Paths in a Graph: The Problem, Designing the Algorithm, The Maximum-Flow Problem.

- 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, 2012, Pearson education.

Reference Books:

1. Introduction to Algorithms, H., Cormen, Charles E. Leiserson, Ronal L. Rivest, Clifford Stein Thomas, 3rd Edition, 2009, MIT press.
2. 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 works and analyse complexity of divide and conquer 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		
Tutorial Assignment 1	10	CO1, CO2, CO3
Tutorial Assignment 2	10	CO4, CO5
The Final CIE out of 50 Marks = Average of two CIE tests for 30 Marks+ Marks scored in Quiz +Marks scored in Assignment		
Semester End Examination (SEE)		
Course End Examination (Answer One full question from each Unit- Internal Choice)	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. Siddesh G M	

Course Contents

Unit I

Introduction: Why study AI? What is AI? The Turing test. 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. Autonomy, Environment and agent design, Structure of Agents, Agent types. **Uninformed Search:** Depth-first, Breadth-first, Uniform-cost, Depth-limited, Iterative deepening. **Informed search:** Best-first, A* search, Heuristics, Hill climbing, Problem of local extrema.

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

Unit II

Game Playing: The minimax algorithm, Resource limitations, Alpha-beta pruning, Constraint satisfaction, Node, arc, path, and k-consistency, Backtracking search, Local search using min-conflicts.

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

Unit III

Agents that reason logically 1: Knowledge -based agents, Logic and representation, Propositional (Boolean) logic. **Agents that reason logically 2:** Inference in propositional logic, Syntax, Semantics, Examples.

- Pedagogy/Course delivery tools: Chalk and talk, PowerPoint Presentation, Videos
- 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, Linear planning using a goal stack, Means-ends analysis, Non linear planning strategies, learning plan.

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

Unit V

Knowledge Representation, Expert system Approaches to knowledge representation, knowledge representation using semantic network, Knowledge representation using Frames. Expert system: introduction phases, architecture ES versus Traditional system.

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

Suggested Learning Resources

Text Books:

1. Saroj Kaushik, Artificial Intelligence, Cengage learning, 2014.
2. Artificial Intelligence-A Modern Approach, Stuart J. Russell and Peter Norvig, Pearson 3rd Edition, Eleventh Impression 2018.

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
3. Laurene Fausett, "Fundamentals of Neural Networks", Pearson Education, 2004.
4. Simon Haykin, "Neural Networks- A comprehensive foundation", Pearson Education, 2003.
5. S. Rajasekharan and G. A. Vijayalakshmi pai, "Neural Networks, Fuzzy logic, Genetic algorithms: synthesis and applications", PHI Publication, 2004.

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 Quiz +Marks scored in Assignment		
Semester End Examination (SEE)		
Course End Examination (Answer One full question from each Unit- Internal Choice)	100	CO1, CO2, CO3, CO4, CO5

OPERATING SYSTEM

Course Code: CI45	Credits: 3:0:0
Pre – requisites: Nil	Contact Hours: 42L
Course Coordinator: Akshatha G C	

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 Dhamdhare 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.
2. Apply different scheduling algorithms for Process/Memory/Disk Management
3. Describe Process management and need for controlled access to computing resources by co-operative processes.
4. Apply deadlock detection and prevention algorithms to solve the given problem
5. Illustrate memory management strategies and operating system principles for achieving protection and security.

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	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 Quiz +Marks scored in Assignment		
Semester End Examination (SEE)		
Course End Examination (Answer One full question from each Unit- Internal Choice)	100	CO1, CO2, CO3 CO4, CO5

EMBEDDED SYSTEMS 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)		
Course End Examination (One full question from the Lab Question Bank, Programs will be coded using C and executed)	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

Sl. No.	List of Programs
1.	Asymptotic bounds and functions
2.	Sorting and searching algorithms with Brute Force technique
3.	Stable matching algorithm
4.	Breadth first search
5.	Depth first search
6.	Merge sort algorithm
7.	Quick sort algorithm
8.	Prim's and Kruskal algorithm
9.	Dijkstra's algorithm
10.	Dynamic Programming approach
11.	Knapsack problem & Subset sum problem
12.	Travelling Salesman Problem

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	-
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)		
Course End Examination (One full question from the Lab Question Bank, Programs will be coded using C and executed)	50	CO1, CO2, CO3

WEB TECHNOLOGIES LABORATORY

Course Code: CIL48	Credits: 0:0:1
Pre – requisites: Nil	Contact Hours: 14P
Course Coordinator: Dr. Thippeswamy M N	

Course Contents

Sl.No	List of programs
1.	<p>Design the following static web pages required for an online book store web site.</p> <ol style="list-style-type: none"> 1) HOME PAGE: The static home page must contain three frames. 2) LOGIN PAGE 3) CATALOGUE PAGE: The catalogue page should contain the details of all the books available.
2.	<p>a) Write JavaScript to validate the following fields of the Registration page.</p> <ol style="list-style-type: none"> 1. First Name (Name should contains alphabets and the length should not be less than 6 characters). 2. Password (Password should not be less than 6 characters length). 3. E-mail id (should not contain any invalid and must follow the standard pattern name@domain.com) 4. Mobile Number (Phone number should contain 10) <p>b) Develop and demonstrate the usage of inline, internal and external style sheet using CSS.</p>
3.	<p>Develop and demonstrate JavaScript with POP-UP boxes and functions for the following problems:</p> <ol style="list-style-type: none"> a) Input: Click on Display Date button using onclick() function Output: Display date in the textbox b) Input: A number n obtained using prompt Output: Factorial of n number using alert c) Input: A number n obtained using prompt Output: A multiplication table of numbers from 1 to 10 of n using alert d) Input: A number n obtained using prompt and add another number using confirm Output: Sum of the entire n numbers using alert.
4.	<p>Write an HTML page that contains a selection box with a list of 5 countries. When the user selects a country, its capital should be printed next in the list. Add CSS to customize the properties of the font of the capital (color, bold and font size).</p>

5.	Write an HTML page including any required JavaScript that takes a number from text field in the range of 0 to 999 and shows it in words. It should not accept four and above digits, alphabets and special characters.
6.	Create an XML document that contains 10 users information. Write a Java Program, which takes User Id as input and returns the user details by taking the user information from XML document using DOM parser or SAX parser.
7.	Implement the following web applications using (a) Servlets (b) JSP A web application that takes a name as input and on submit it shows a hello page where name is taken from the request. It shows the start time at the right top corner of the page and provides a logout button. On clicking this button, it should show a logout page with Thank You message with the duration of usage (hint: Use session to store name and time).
8.	Create modern, scalable and high-speed Web Applications with Node.js a) Installing Packages (npm) b) Working with APIs (Calls)
9.	Write a program to design a simple calculator using (a) JavaScript, Servlet and (b) JSP.
10.	Implement the web applications using React. a. Hooks (use State and use Effect) b. Components (Functional and Class Components) c. Render Props and State Management (Redux) d. Forms
11.	Advanced - a. Blogging Website with backend b. Portfolio Website using React c. Builder Book Open-source web app to write and host documentation or sell books. Built with React, Material-UI, Next, Express, Mongoose, MongoDB d. Counter App A small shopping cart example e. Social Media App
12.	Styling and Styled Component in React JS a. Material UI b. Tailwind CSS

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)		
Course End Examination (One full question from the Lab Question Bank, Programs will be coded using C and executed)	50	CO1, CO2, CO3

CONSTITUTION OF INDIA AND PROFESSIONAL ETHICS	
Course Code: HS492	Credits: 1:0:0
Pre – requisites: Nil	Contact Hours: 14L
Course Coordinator: Mrs. Kanya Kumari S	

Course Content

Unit I

Introduction to the Constitution of India

Meaning and Significances of the Constitution, making of the Indian Constitution and its salient features, Preamble of the Constitution, Fundamental Rights and relevant cases.

- Pedagogy/Course delivery tools: Chalk and Talk, power point presentation

Unit II

Relevance of Directive Principles of State Policy -part-IV

Fundamental Duties & their significance. Special constitutional provisions for the betterment of Women, children and backward classes in India.

- Pedagogy/Course delivery tools: Chalk and Talk, power point presentation

Unit III

Union executive and State executive

President of India, Vice President, Prime Minister & Council of Ministers. The Union Legislature, Compositions & the functions of Parliament and the Supreme court of India -composition & Jurisdictions

State executive-Governor, Chief Minister& council of Ministers, State legislature-composition & functions of legislative assembly& legislative council and State Judiciary.

- Pedagogy/Course delivery tools: Chalk and Talk, power point presentation

Unit IV

Local self-Governments, Emergency provisions, Electoral process & Major Constitutional Amendments

Local Self Governments- Panchayath Raj system, Emergency provisions, election commission of India & Electoral process, Amendment procedure and Major Constitutional amendments.

- Pedagogy/Course delivery tools: Chalk and Talk, power point presentation

Unit V

Human Rights and Professional Ethics

Human Rights - meaning and significances of Human Rights. Universal Declaration of Human Rights (UDHR) protection of Human Rights in Indian Context. Scope and Aim of Ethics. Responsibility of Engineers, impediment to Responsibility.

- Pedagogy/Course delivery tools: Chalk and Talk, power point presentation

Text Books:

1. A Primer on Constitution of India & Professional ethics, VTU Publication-2007.

Reference Books:

1. Durga Das Basu,- ‘ Introduction to Constitution of India’ - 19th /20th edition 2001
2. M.V.Pylee.- ‘ An Introduction to Constitution of India, 4th edition, 2008
3. Dr. K. R. Phaneesh,- ‘Constitution of India & Professional ethics’ –Sudha publication, Tenth revised edition 2018.

Course outcomes (COs):

At the end of the course students will be able to

1. Identify the fundamental principles of Indian constitution. (PO-12)
2. Examine various provisions of the Directive principles of state policies and fundamental duties. (PO-6, PO-12)
3. Understand the powers & functions of executive, Legislature and judicial system at the center and state level. (PO-6, PO-12)
4. Identify the role of government. (PO-12)
5. Understand about basic Human rights in India (PO-6, PO-8, PO-12)

Course Assessment and Evaluation:

Continuous Internal Evaluation (CIE): 50 marks		
Assessment tool	Marks	Course outcome attained
Internal test-I	30	CO1, CO2, CO3
Internal test-II	30	CO4, CO5
Average of the two internal tests will be taken for 30 marks.		
Other components		
Assignment	10	CO1, CO2
quiz	10	CO3, CO4, CO5
Semester end examination (SEE)	100	CO1, CO2, CO3, CO4, CO5

ABILITY ENHANCEMENT COURSE - IV	
Course Code: AEC410	Credits: 1:0:0
Pre – requisites: Nil	Contact Hours: 14L
Course Coordinator: Dr. Rama Shivakiran Reddy	

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	

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