

RAMAIAH

Institute of Technology

CURRICULUM

for the Academic year 2022 – 2023

**Department of Computer Science and Engineering
(ARTIFICIAL INTELLIGENCE & MACHINE LEARNING)**

and

**Computer Science and Engineering (CYBER
SECURITY)**

III & IV SEMESTER

B.E

RAMAIAH INSTITUTE OF TECHNOLOGY

(Autonomous Institute, Affiliated to VTU)

Bangalore – 560054.

About the Institute

Dr. M. S. Ramaiah a philanthropist, founded 'Gokula Education Foundation' in 1962 with an objective of serving the society. M S Ramaiah Institute of Technology (MSRIT) was established under the aegis of this foundation in the same year, creating a landmark in technical education in India. MSRIT offers 17 UG programs and 15 PG programs. All these programs are approved by AICTE. All eligible UG and PG programs are accredited by National Board of Accreditation (NBA). The institute is accredited with '**A+**' grade by NAAC in March 2021 for 5 years. University Grants Commission (UGC) & Visvesvaraya Technological University (VTU) have conferred Autonomous Status to MSRIT for both UG and PG Programs since 2007. The institute is a participant to the Technical Education Quality Improvement Program (TEQIP), an initiative of the Government of India. The institute has 380 competent faculty out of which 60% are doctorates. Some of the distinguished features of MSRIT are: State of the art laboratories, individual computing facility for all faculty members, all research departments active with sponsored funded projects and more than 300 scholars pursuing Ph.D. To promote research culture, the institute has established Centre of Excellence for Imaging Technologies, Centre for Advanced Materials Technology, Centre for Antennas and Radio Frequency systems (CARFS), Center for Cyber Physical Systems & Schneider Centre of Excellence. **M S Ramaiah Institute of Technology has obtained "Scimago Institutions Rankings" All India Rank 65 & world ranking 578 for the year 2020.**

The Entrepreneurship Development Cell (EDC) and Section 8 company "Ramaiah Evolute" have been set up on campus to incubate startups. **M S Ramaiah Institute of Technology secured All India Rank 8th for the year 2020 for Atal Ranking of Institutions on Innovation Achievements (ARIIA), by MoE, Govt. of India.** MSRIT has a strong Placement and Training department with a committed team, a good Mentoring/Proctorial system, a fully equipped Sports department, large air-conditioned library with good collection of book volumes and subscription to International and National Journals. The Digital Library subscribes to online e-journals from Elsevier Science Direct, IEEE, Taylor & Francis, Springer Link, etc. MSRIT is a member of DELNET, CMTI and VTU E-Library Consortium. MSRIT has a modern auditorium and several hi-tech conference halls with video conferencing facilities. The institute has excellent hostel facilities for boys and girls. MSRIT Alumni have distinguished themselves by occupying high positions in India and abroad and are in touch with the institute through an active Alumni Association.

As per the National Institutional Ranking Framework (NIRF), MoE, Government of India, M S Ramaiah Institute of Technology has achieved 65th rank among 1143 top Engineering institutions of India for the year 2021 and is 1st amongst the Engineering colleges affiliated to VTU, Karnataka.

About the Department

Year of Establishment	2021
Names of the Programme offered	UG: B.E. in Computer Science and Engineering (Artificial Intelligence & Machine Learning)

The Department of Computer Science and Engineering (Artificial Intelligence & Machine Learning) has eminent professor and faculty with the doctorate degree. The faculty has been publishing research papers in refereed journals and in conference proceedings. The department has the state of the art laboratories and class rooms. The department conducts Technical seminars, workshops and hackathons regularly for students. The department encourages the students to conduct and participate in extra- curricular/sports activities. The department conducts courses with more of hands- on sessions and encourages students to take up MOOC based online courses in NPTEL, IITBombayX, Coursera, Udacity, Udemy and edX.

VISION OF THE INSTITUTE

To be an Institution of International Eminence, renowned for imparting quality technical education, cutting edge research and innovation to meet global socio-economic needs

MISSION OF THE INSTITUTE

MSRIT shall meet the global socio-economic needs through

1. Imparting quality technical education by nurturing a conducive learning environment through continuous improvement and customization
2. Establishing research clusters in emerging areas in collaboration with globally reputed organizations
3. Establishing innovative skills development, techno-entrepreneurial activities, and consultancy for socio-economic needs

QUALITY POLICY

We at M. S. Ramaiah Institute of Technology strive to deliver comprehensive, continually enhanced, global quality technical and management education through an established Quality Management System complemented by the synergistic interaction of the stake holders concerned

VISION OF THE DEPARTMENT

To provide quality education, inculcate professionalism, and enhance problem solving and coding, innovative design skills in Computer Science and Engineering especially in the domain of AI & ML and Cyber Security with a focus to produce professionally competent and socially sensitive engineers capable of working in a global environment.

MISSION OF THE DEPARTMENT

To pursue excellence in Academics, Research and Innovation by:

1. Enabling creative and dynamic learning environments to impart quality technical education through continuously improving curriculum and pedagogy techniques.
2. Collaborating with the industry, academia and society for strengthening design thinking, research, innovation, and entrepreneurship ecosystem.
3. Encouraging extra and co-curricular activities to nurture their leadership qualities with a sense of commitment and accountability and inculcate values and ethics.

PROGRAM EDUCATIONAL OBJECTIVES (PEOs):

A B.E in Computer Science & Engineering (Artificial Intelligence and Machine Learning) graduates of Ramaiah Institute of Technology:

PEO1: Excel in professional career by acquiring knowledge in basic sciences and Computer Science and Engineering, Artificial Intelligence & Machine Learning principles and contribute to the profession as an excellent employee, or as an entrepreneur.

PEO2: Capable of pursuing higher education and research.

PEO3: Adapt to technological advancements in multidisciplinary environments by engaging in lifelong learning with leadership qualities, professional ethics and soft skills.

PROGRAM OUTCOMES (POs):

The Outcomes of the Bachelor of Engineering in Computer Science & Engineering (Artificial Intelligence and Machine Learning) Programme are as follows:

PO1: Engineering knowledge: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.

PO2: Problem analysis: Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.

PO3: Design/development of solutions: Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.

PO4: Conduct investigations of complex problems: Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.

PO5: Modern tool usage: Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations.

PO6: The engineer and society: Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice.

PO7: Environment and sustainability: Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.

PO8: Ethics: Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.

PO9: Individual and teamwork: Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.

PO10: Communication: Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.

PO11: Project management and finance: Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.

PO12: Life-long learning: Recognize the need for and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.

PROGRAM SPECIFIC OUTCOMES (PSOs):

PSO1: Ability to understand and identify problems/opportunities where CSE, AI and ML concepts can be applied and to identify the right AI and ML techniques in such contexts.

PSO2: Ability to perform the data engineering, designing, developing and testing the AI and ML solutions that include both hardware and software.

PSO3: Ability to be aware of technical solutions that are following ethical aspects aligning with social responsibilities both at designing and developmental phases of applications.

B.E. in Computer Science and Engineering (AI & ML)
Scheme of Teaching and Examination 2022-23
(Effective from the academic year 2021-22)

III SEMESTER									
Sl. No.	Subject Code	Subject	Teaching Department	Category	Credits				Total contact hours /week
					L	T	P	Total	
1	CI31	Linear Algebra & Integral Transforms	Mathematics	BSC	2	1	0	3	4
2	CI32	Data Base Management Systems (Integrated)	CSE(AI&ML)	IPCC	2	0	1	3	4
3	CI33	Data Structures	CSE(AI&ML)	PCC	3	0	0	3	3
4	CI34	Computer organization and Architecture	CSE(AI&ML)	PCC	3	0	0	3	3
5	CI35	Discrete Mathematical Structures	CSE(AI&ML) / Mathematics	PCC	2	1	0	3	3
6	CIL36	Data Structures Laboratory	CSE(AI&ML)	PCC	0	0	1	1	2
7	CIL37	OOPS Laboratory	CSE(AI&ML)	PCC	0	0	1	1	2
8	UHV38	Universal Human Value Course	CSE(AI&ML)	UHV	2	0	0	2	2
9	HS391/ HS491	Kannada (Kali / Manasu)	Humanities	HSMC	1	0	0	1	1
10	AEC310	Ability Enhancement Course-III	Any Dept	AEC	1	0	0	1	1
Total								21	25
11	PE83	Physical Education		NCMC	All students have to register compulsorily for any one of the courses with the concerned coordinator (Yoga Teacher/ Physical Education Director/ NSS Coordinator) in the beginning of the III semester. Attending the registered course from III to VIII semesters. Qualifying is mandatory for the award of the degree.				
	YO83	Yoga							
	NS83	NSS							
12	AM31	Additional Mathematics - I *	Mathematics	NCMC	0	0	0	0	3

B.E. in Computer Science and Engineering (AI & ML)
Scheme of Teaching and Examination 2022-23
(Effective from the academic year 2021-22)

IV SEMESTER

Sl. No.	Subject Code	Subject	Teaching Department	Category	Credits				Total contact hours /week
					L	T	P	Total	
1	CI41	Numerical Analysis, Probability and Statistical Methods	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/ HS392	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	-

Linear Algebra & Laplace Transforms	
Course Code: CI31	Credits: 2:1:0
Pre-requisites: Calculus and Basics of Linear Algebra	Contact Hours: 28L+14T
Course Coordinator/s: Dr. Govindaraju M V and Dr. R Suresh Babu	

Course Contents:

Unit I

Laplace Transforms: Definition, transforms of elementary functions, properties of Laplace transforms, existence conditions, transform of derivatives, integrals, multiplication by t^n , division by t , evaluation of integrals by Laplace transforms. Transform of Periodic function.

- Pedagogy/Course delivery tools: Chalk and talk, Power Point Presentation, Videos
- Links: <https://nptel.ac.in/courses/111/105/111105134/>
<https://nptel.ac.in/courses/111/105/111105035/>
- Impartus recording: <https://a.impartus.com/ilc/#/course/119640/593>
<https://a.impartus.com/ilc/#/course/59742/295>

Unit II

Application of Laplace Transforms: Unit-step function, Unit-impulse function. Inverse transforms, Convolution Theorem, Solution of linear differential equations and Simultaneous linear differential equations using Laplace transforms. Engineering applications.

- Pedagogy/Course delivery tools: Chalk and talk, Power Point Presentation, Videos
- Links: <https://nptel.ac.in/courses/111/105/111105134/>
<https://nptel.ac.in/courses/111/105/111105035/>
- Impartus recording: <https://a.impartus.com/ilc/#/course/119640/593>
<https://a.impartus.com/ilc/#/course/59742/295>

Unit III

Linear Transformation: Linear combination and span, Linearly independent and dependent vectors, Basis and Dimension, Linear transformations, Composition of matrix transformations, Rotation about the origin, Dilation, Contraction and Reflection, Kernel and Range, Change of basis.

- 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/111/102/111102152/>
- Impartus recording: <https://a.impartus.com/ilc/#/course/621524/1030>
<https://a.impartus.com/ilc/#/course/619570/1030>

Unit IV

Vector Space: Vector Spaces, The Null space of A, Solving $Ax = 0$ and $Rx = 0$, The Complete Solution to $Ax = b$, Dimensions of the Four Subspaces, Orthogonality of the Four Subspaces, Projections. Orthonormal Bases and Gram-Schmidt Method, QR-Factorization, Least-Squares Approximations.

- Pedagogy/Course delivery tools: Chalk and talk, PowerPoint Presentation, Videos
- Links: <https://nptel.ac.in/courses/111/105/111105035/>
<https://nptel.ac.in/courses/111/102/111102152/>
- Impartus recording: <https://a.impartus.com/ilc/#/course/621524/1030>
<https://a.impartus.com/ilc/#/course/619570/1030>

Unit V

Applications of Eigenvalue Decomposition: Introduction to Eigenvalues and Eigenvectors, Similarity and Diagonalization. Symmetric Matrices, Complex Matrices, Hermitian and Unitary Matrices, Positive Definite Matrices, The singular value decomposition (SVD), Principal Component Analysis (PCA), Applications to Linear Recurrence Relations, Markov Chains, Quadratic Forms and Conic Sections.

- 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/111/102/111102152/>
- Impartus recording: <https://a.impartus.com/ilc/#/course/621524/1030>
<https://a.impartus.com/ilc/#/course/619570/1030>

Suggested Learning Resources

Text Books:

1. B S Grewal - Higher Engineering Mathematics - Khanna Publishers – 44th edition, 2017.
2. David C. Lay, Steven R. Lay and Judi J. Mc. Donald – Linear Algebra and its Applications, Pearson, 5th edition, 2015.
3. Gilbert Strang, Linear Algebra and its Applications, 5th Edition (2016).

Reference Books:

1. Peter V. O'Neil – Advanced Engineering Mathematics – Cengage learning, 7th edition, 2011.
2. Gareth Williams – Linear Algebra with Applications, Jones and Bartlett Press, 9th edition, 2017.
3. Erwin Kreyszig - Advanced Engineering Mathematics-Wiley-India publishers - 10th edition, 2015.

Course Outcomes (COs)

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

1. Evaluate Laplace Transforms of given function and understand their properties (PO-1, 2 & PSO-2, 3)
2. Obtain inverse Laplace transforms and use it to solve system of ODE's (PO-1, 2 & PSO-2, 3)
3. Obtain matrix of linear transformation. (PO-1, 2 & PSO-2, 3)
4. Solve the system of equations by Least-Squares method. (PO-1, 2 & PSO-2, 3)
5. Obtain eigenvalue decomposition of a matrix and use it to study the concepts of SVD and PCA. (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, and CO3
Internal Test-II (CIE-II)	30	CO4, and CO5
Average of the two CIE shall be taken for 30 marks		
Other Components		
Quiz -I	10	CO1, CO2 and CO3
Assignment	10	CO3,CO4, and CO5
The Final CIE out of 50 Marks = Average of two CIE tests for 30 Marks+ Marks scored in Quiz-I +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 and CO5

Data Base Management Systems (Integrated)	
Course Code: CI32	Credits: 2:0:1
Pre-requisites: Nil	Contact Hours: 28L+14P
Course Coordinator/s: Dr. Sini Anna Alex	

Course Contents:

Unit I

Introduction: Characteristics of Database approach, Actors on the Scene, Workers behind the scene, Advantages of using DBMS approach, Data models, schemas and instances, Three-schema architecture and data independence, Database languages and interfaces, the database system environment, Entity-Relationship Model: Conceptual Database using high level Conceptual data models for Database Design, A Sample Database Application, Entity types, Entity sets Attributes and Keys Relationship types, Relationship Sets, Roles and Structural Constraints Weak Entity Types.

- Pedagogy/Course delivery tools: ➤ Chalk and talk, PowerPoint Presentation, Videos
- Links: ➤ <https://nptel.ac.in/courses/106105175>
➤ <https://nptel.ac.in/courses/106106220>

Unit II

Relational Database Design Using ER- to-Relational Mapping, Relational Model and Relational Algebra: Relational Model Concepts, Relational Model Constraints and Relational Database Schema Update Operations, Transactions and Dealing with Constraint violations, Unary Relational operations, Relational Algebra Operations from Set Theory, Binary Relational Operations, JOIN and DIVISION, Additional Relational Operations, Examples of Queries in Relational Algebra.

- Pedagogy/Course delivery tools: ➤ Chalk and talk, PowerPoint Presentation, Videos
- Links: ➤ <https://nptel.ac.in/courses/106105175>
➤ <https://nptel.ac.in/courses/106106220>

Unit III

Introduction to SQL: Overview of the SQL Query Language, SQL Data Definition, Basic structure of SQL Queries, Additional Basic Operations, Null values, Aggregate Functions, nested Sub queries, Modification of the Database, Join Expressions, Views, Integrity Constraints, SQL Data Types and Schemas.

- Pedagogy/Course delivery tools: ➤ Chalk and talk, PowerPoint Presentation, Videos
- Links: ➤ <https://nptel.ac.in/courses/106105175>
➤ <https://nptel.ac.in/courses/106106220>

Unit IV

Database Design: Informal Design Guidelines for Relation Schemas, Functional Dependencies, Inference Rules, Equivalence and Minimal Cover, Normal Forms based on Primary Keys, First Normal Form, General Definitions of 2nd and 3rd Normal Forms, Boyce Codd Normal Form, Properties of Relational Decomposition, Algorithms for relational database schema design.

- Pedagogy/Course delivery tools: ➤ Chalk and talk, PowerPoint Presentation, Videos
- Links: ➤ <https://nptel.ac.in/courses/106105175>
➤ <https://nptel.ac.in/courses/106106220>

Unit V

Transaction Management: Transaction Concept, a Simple Transaction Model, Transaction Atomicity and Durability, Serializability, Transaction Isolation and Atomicity, Transaction Isolation Levels. Concurrency Control: Lock-Based Protocols, Deadlock Handling. Recovery System: Failure Classification, Recovery and Atomicity, Recovery Algorithm.

- Pedagogy/Course delivery tools: ➤ Chalk and talk, PowerPoint Presentation, Videos
- Links: ➤ <https://nptel.ac.in/courses/106105175>
➤ <https://nptel.ac.in/courses/106106220>

Suggested Learning Resources

Text Books:

1. Fundamentals of Database Systems, Ramez Elmasri and Shamkant B. Navathe, 7th Edition, Pearson, 2016.
2. Data base System Concepts, Silberschatz, Korth and Sudharshan, 7th Edition, Mc-GrawHill, 2021.

Reference Books:

1. An Introduction to Database Systems, C.J. Date, A. Kannan, S. Swamynatham, 8th Edition, Pearson education, 2009.
2. Database Management Systems, Raghu Ramakrishnan and Johannes Gehrke, 3rd Edition, McGraw-Hill, 2003.

Course Outcomes (COs):

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

1. Design entity-relationship diagrams to represent simple database applications and convert to Relational model (PO-2, 3, 4, 5, PSO-2)
2. Construct relational algebraic expressions for queries using the concepts of relational database theory (PO-1, 2, 4, PSO-2)
3. Formulate using SQL, solutions to a broad range of query and data update problems (PO-2,3,4,5, PSO-2)
4. Apply Normalization to improve database design (PO-1, 2, PSO-2)
5. Interpret the basic issues of transaction processing, concurrency control and recovery techniques (PO-3,4, PSO-2)

Course Assessment and Evaluation:

Continuous Internal Evaluation: 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
Assignment	10	C01,C02,C03
Course Project	10	C01,C02, C03, C04,C05
Semester End Examination:	100	C01,C02,C03,C04,C05

Data Structures	
Course Code: CI33	Credits: 3:0:0
Pre-requisites: Basic Programming	Contact Hours: 42L
Course Coordinator/s: Dr. Siddesh G M	

Course Contents:

UNIT-I

Basic Concepts: Pointers and Dynamic Memory Allocation: Introduction, Dynamic Memory Allocation, allocating a Block of Memory: Malloc, allocating a Multiple Blocks of Memory: Calloc, Releasing the Used Space: Free, Altering the size of Block: Realloc, Algorithm Specification, Data Abstraction. Arrays and Structures: Arrays, Dynamically Allocated Arrays, Structures and Unions, Sparse Matrices, Representation of Multidimensional Arrays.

- Pedagogy/Course delivery tools: ➤ Chalk and talk, PowerPoint Presentation, Videos
- Links: ➤ <https://www.digimat.in/nptel/courses/video/106105151/L17.html>
- <https://www.digimat.in/nptel/courses/video/106105151/L18.html>

UNIT-II

Stacks: Introduction to Stacks, Array Representation of Stacks, Operations on a Stack, Applications of Stacks: Implementing Parentheses Checker, Evaluation of Arithmetic Expressions, Recursion.

- Pedagogy/Course delivery tools: ➤ Chalk and talk, PowerPoint Presentation, Videos
- Links: ➤ <https://nptel.ac.in/courses/106106127>
- <https://nptel.ac.in/courses/106103069>

UNIT-III

Queues: Introduction to Queues, Array Representation of Queues, Types of Queues, Circular Queues, Deques, Priority Queues, Multiple Queues, Applications of Queues.

- Pedagogy/Course delivery tools: ➤ Chalk and talk, PowerPoint Presentation, Videos
- Links: ➤ <https://www.youtube.com/watch?v=zWg7U00EAoE&list=PLBF3763F2E1C572F>
- <https://nptel.ac.in/courses/106103069>

UNIT-IV

Linked Lists: Introduction, Singly Linked Lists, Circular Linked Lists, Doubly Linked Lists, Circular Doubly Linked Lists, Linked Representation of Stack, Linked Representation of Queues.

- Pedagogy/Course delivery tools: ➤ Chalk and talk, PowerPoint Presentation, Videos
- Links: ➤ <https://www.youtube.com/watch?v=zWg7U00EAoE&list=PLBF3763F2E1C572F>
➤ <https://nptel.ac.in/courses/106103069>

UNIT-V

Trees: Introduction, Types of Trees, creating a Binary Tree from a General Tree, Traversing a Binary Tree, Applications of Trees

- Pedagogy/Course delivery tools: ➤ Chalk and talk, PowerPoint Presentation, Videos
- Links: ➤ <https://www.youtube.com/watch?v=zWg7U00EAoE&list=PLBF3763F2E1C572F>
➤ <https://nptel.ac.in/courses/106103069>

Suggested Learning Resources

Text Books:

1. Data Structures using C, Reema Thareja, Second edition, Oxford press, 2014.

Reference Books:

1. Fundamentals of Data Structures in C, Horowitz, Sahani, Anderson, Freed, Second edition, 2014
2. Data Structures using C, Yedidyah Langsam & Moshe J. Augenstein, Aaron M. Tanenbaum Second Edition, Pearson Education, 2017.

Course Outcomes:

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

1. Illustrate arrays, pointers and structures with programming solutions for real world problems. (PO-1,2,3,4,5, PSO-1,2)
2. Demonstrate the concepts of Stack, types of queues and its various operations. (PO-1,2,3, PSO-1,2)
3. Describe the concepts of Linked list and its applications. (PO-1,2,3,4,5,PSO-1,2)
4. Demonstrate the concepts of binary trees and perform tree traversal. (PO-1,2,3,PSO-2)
5. Apply appropriate data structures to solve real-world problems efficiently.(PO-1,2,3,4,5,PSO-2,3)

Course Assessment and Evaluation:

Continuous Internal Evaluation: 50 Marks		
Assessment Tool	Marks	Course outcomes addressed
Internal test-I	30	C01, C02, C03
Internal test-II	30	C03, C04, C05
Average of the two internal tests shall be taken for 30 marks.		
Other components	Marks	Course outcomes addressed
Programming Assignment	10	C01, C02, C03
Case Study	10	C03, C04, C05
Semester End Examination:	100	C01, C02, C03, C04, C05

Computer Organization & Architecture	
Course Code: CI34	Credits: 3:0:0
Pre-requisites: Nil	Contact Hours: 42L
Course Coordinator/s: Dr. Mohana Kumar S	

Course Contents:

UNIT I

Fundamentals of Digital Logic and Basic Structure of Computers: Boolean Algebra, Logic Gates, Combinational Circuits: Adders, Mux, De-Mux, Sequential Circuits: Flip-Flops (SR, JK & D), Counters: synchronous and asynchronous Counter, Traditional Classes of Computing Applications and their Characteristics, layers of software, From a High-Level Language to the Language of Hardware, the organization of a computer, Technologies for Building Processors and Memory, performance of computers, the power wall, Amdahl's Law.

- Pedagogy/Course delivery tools: ➤ Chalk and talk, PowerPoint Presentation, Videos
- Links: ➤ <https://nptel.ac.in/courses/106105163>
➤ <https://nptel.ac.in/courses/108105113>

UNIT II

Instructions: Instruction set, Addressing Modes, Assembly Language, Representing Instructions in the Computer, Logical Operations, Instructions for Making Decisions, Supporting Procedures in Computer Hardware, Translating and Starting a Program, **Arithmetic:** Addition and Subtraction, Design of Fast Adders, Multiplication, First version of the multiplication hardware, division, A Division Algorithm and Hardware, Floating Point.

- Pedagogy/Course delivery tools: ➤ Chalk and talk, PowerPoint Presentation, Videos
- Links: ➤ <https://nptel.ac.in/courses/106105163>

UNIT III

Large and Fast: Exploiting Memory Hierarchy: Memory Technologies, Semiconductor RAM Memories, Read-only Memories, Direct Memory Access, The Basics of Caches, Measuring and Improving Cache Performance, Virtual memory, Dependable Memory Hierarchy.

- Pedagogy/Course delivery tools: ➤ Chalk and talk, PowerPoint Presentation, Videos
- Links: ➤ <https://nptel.ac.in/courses/106105163>

UNIT IV

Processor, Graphics and Computing GPUs: Instruction Execution, Hardware Components, Instruction Fetch and Execution Steps, Control Signals, Hardwired Control, CISC-Style Processors, GPU system architectures, Programming GPUs, introduction to the CUDA Paradigm, Multiprocessor Architecture, Multicore processor.

- Pedagogy/Course delivery tools: ➤ Chalk and talk, PowerPoint Presentation, Videos
- Links: ➤ <https://nptel.ac.in/courses/106105220>

UNIT V

Parallel Processors from Client to Cloud: The Difficulty of Creating Parallel Processing Programs, SISD, MIMD, SIMD, SPMD, and Vector, Hardware Multithreading, Multicore and Other Shared Memory Multiprocessors, Introduction to Graphics Processing Units, Clusters, Warehouse Scale Computers, and Other Message Passing Multiprocessors, Introduction to Multiprocessor Network Topologies.

- Pedagogy/Course delivery tools: ➤ Chalk and talk, PowerPoint Presentation, Videos
- Links: ➤ <https://www.geeksforgeeks.org/computer-architecture-flynn-taxonomy/>

Suggested Learning Resources

Text Books:

1. Computer Organization and Design, David A. Patterson, John L. Hennessy: M.K Publishers, 5th edition, 2014
2. Computer Organization, Carl Hamacher, Zvonko Vranesic, Safwat Zaky, 5th Edition, TM
3. Digital design. Mano, M. Morris. Pearson Education, 6th Edition 2002.

Reference Books:

1. Computer Organization & Architecture, William Stallings, 7th Edition, PHI, 2006

Course Outcomes:

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

1. Understand the general concepts in digital logic design, including logic elements, and their use in combinational and sequential logic circuit design and Basic Structure of Computers. (PO-1,2,3, PSO-1)
2. Describe addressing modes, instruction formats and program control statements. (PO-1,2,3, PSO-1)

3. Demonstrate computer architecture concepts related to design of modern processors, memories and I/Os. (PO-1,2,3, PSO-1)
4. Understand computer arithmetic formulate and solve problems, understand the performance requirements of systems. (PO-1,2,3, PSO-1)
5. Interpret performance of different pipelined processors.(PO-1,2,3, PSO-1)

Course Assessment and Evaluation:

Continuous Internal Evaluation: 50 Marks		
Assessment Tool	Marks	Course outcomes addressed
Internal test-I	30	C01,C02,C03
Internal test-II	30	C03,C04,C05
Average of the two internal tests shall be taken for 30 marks.		
Other components	Marks	Course outcomes addressed
Seminar	10	C01,C02,C03
Simulation Tool Based Assignment	10	C03,C04,C05
Semester End Examination:	100	C01,C02,C03,C04,C05

Discrete Mathematical Structures	
Course Code: CI35	Credits: 2:1:0
Pre-requisites: Basic Mathematics	Contact Hours: 28L+14T
Course Coordinator/s: Dr. Govindaraju M V and Dr. S H C V Subba Bhatta	

Course Contents:

Unit I

Introduction to Logic. Propositional Logic, Truth Tables, and Quantifiers, Mathematical Proofs. Infinite Sets, Well-Ordering. Countable and Uncountable Sets, Cantor's Diagonalization. Mathematical Induction - Weak and Strong Induction.

- Pedagogy/Course delivery tools: ➤ Chalk and talk, Power Point Presentation, Videos
- Links: ➤ <https://nptel.ac.in/courses/106106183>
- <https://nptel.ac.in/courses/106108227>

Unit II

Relations, Equivalence Relations. Functions, Bijections. Binary Relations. Boolean Algebra, Posets and Lattices, Hasse Diagrams.

- Pedagogy/Course delivery tools: ➤ Chalk and talk, Power Point Presentation, Videos
- Links: ➤ <https://nptel.ac.in/courses/106106183>
- <https://nptel.ac.in/courses/106108227>

Unit III

Counting, Sum and Product rule, Principle of Inclusion Exclusion. Pigeon Hole Principle, Counting by Bijections. Double Counting. Linear Recurrence Relations - Methods of solutions. Generating Functions. Permutations and Counting.

- Pedagogy/Course delivery tools: ➤ Chalk and talk, Power Point Presentation, Videos
- Links: ➤ <https://nptel.ac.in/courses/106106183>
- <https://nptel.ac.in/courses/106108227>

Unit IV

Graph Theory: Introduction to Graph Theory- Definitions, Sub Graphs, Complements, and Graph Isomorphism, Euler's Trails and Circuits, Hamilton Paths and Cycles. Planar Graphs, Euler's Theorem, Graph Coloring.

- Pedagogy/Course delivery tools: ➤ Chalk and talk, Power Point Presentation, Videos
- Links: ➤ <https://nptel.ac.in/courses/106106183>
- <https://nptel.ac.in/courses/106108227>

Unit V

Abstract Algebra: Binary Operations, Semi Groups, Monoid, Submonoid Groups, Subgroups, Isomorphism, Homomorphism, Euler's phi function, Fermat's Little theorem.

- Pedagogy/Course delivery tools: ➤ Chalk and talk, Power Point Presentation, Videos
- Links: ➤ <https://nptel.ac.in/courses/106106183>
- <https://nptel.ac.in/courses/106108227>

Suggested Learning Resources

Text Books:

1. Kenneth Rossen, Discrete Mathematics and its Application, 7th Edition, McGraw-Hill, 2011.
2. Thomas Koshy: Discrete Mathematics with Applications. 1st Edition, Elsevier Science, 2012.
3. B. Kolman, R.C. Busby, S.C. Ross, Discrete Mathematical Structures, Pearson Education India; 6th edition , 2015.

Reference Books:

1. R.P. Grimaldi, B.V. Ramana, Discrete and Combinatorial Mathematics: An Applied Introduction, 5th Edition, Pearson, 2008.
2. Elements of Discrete Mathematics, C. L Liu, McGraw-Hill Inc, 1985. Applied Combinatorics, Alan Tucker, 2007.
3. Huth, M . and Ryan, M ., " Logic in Computer Science: Modeling and Reasoning About Systems", Cambridge University Press. 2005.
4. Douglas B. West, Introduction to Graph Theory, Second Edition, Prentice- Hall.

Course Outcomes:

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

1. Understand the notion of mathematical logic & proofs and be able to apply them in problem solving. (PO-1,2,4, PSO-2,3)
2. Solve problems which involve discrete data structures such as relations and discrete functions (PO-1,2,4,5,10, PSO-2)
3. Apply basic counting techniques and combinatorics in the context of discrete probability. (PO-1,4,5,10, PSO-2)
4. Demonstrate knowledge of fundamental concepts in graphs, (PO-1,2, 5,10, PSO-2)
5. Demonstrate knowledge of trees and its properties using various modeling techniques. (PO-1, 2, 5, 10, PSO-2)

Course Assessment and Evaluation:

Continuous Internal Evaluation: 50 Marks		
Assessment Tool	Marks	Course outcomes addressed
Internal test-I	30	C01,C02,C03
Internal test-II	30	C03,C04,C05
Average of the two internal tests shall be taken for 30 marks.		
Other components	Marks	Course outcomes addressed
Quiz	10	C01,C02,C03
Assignment	10	C03,C04,C05
Semester End Examination:	100	C01,C02,C03,C04,C05

Data Structures Laboratory	
Course Code: CIL36	Credits: 0:0:1
Pre-requisites: Basic Programming	Contact Hours: 14P
Course Coordinator/s: Dr. Siddesh G M	

Course Contents:

Sl No	List of Programs
1.	Design, Develop and Implement a menu driven Program in C for the following array operations. a) Creating an array of N Integer Elements b) Display of array Elements with Suitable Headings c) Inserting an Element (ELEM) at a given valid Position (POS) d) Deleting an Element at a given valid Position(POS) e) Exit. Support the program with functions for each of the above operations.
2.	Define an EMPLOYEE structure with members Emp_name, Emp-id, Dept-name and Salary. Read and display data of N employees. Employees may belong to different departments. Write a function to find total salary of employees of a specified department. Use the concept of pointer to structure and allocate the memory dynamically to EMPLOYEE instances
3.	STACK of Integers (Array Implementation of Stack with maximum size MAX) a) Push an Element on to Stack b) Pop an Element from Stack c) Demonstrate how Stack can be used to check Palindrome d) Demonstrate Overflow and Underflow situations on Stack e) Display the status of Stack f) Exit Support the program with appropriate functions for each of the above operations
4.	Write a C program to convert and print a given valid parenthesized infix arithmetic expression to postfix expression. The expression consists of single character operands and binary operators + - * /. Apply the concept of stack data structure to solve this problem.
5.	Write a C program to evaluate a valid postfix expression using stack. Assume that the postfix expression is read as a single line consisting of non-negative single digit operands and binary operators. The operators are + - * and /.
6.	Write recursive functions for the following and demonstrate their use. a) Binary Search b) Tower of Hanoi problem.
7.	A Call center phone system has to hold the phone calls from customers and provide service based on the arrival time of the calls. Write a C program to simulate this system using appropriate data structure. Program should have options to add and remove the phone calls in appropriate order for their service.

8.	Write a C program to simulate the working of a circular Queue of integers. Represent circular queue element as a structure and use array of structures as your implementation method. Start and end of the circular queue must be identified by an empty array element.
9.	Write a program to create a singly linked list that maintains a list of names in alphabetical order. Implement the following operations on the list. a. Insert a new name b. Delete a specified name
10.	Write a C program to maintain a stack of integers using linked implementation method.
11.	Write a C program to support the following operations on a doubly linked list. a) Insert a new node to the left of the node whose key value is read as an input. b) Delete a node with given data, if it is found otherwise display appropriate error message.
12.	Write a C program a) To construct a binary tree of integers. b) To traverse the tree using inorder, preorder and postorder traversal methods

Suggested Learning Resources

Reference Books:

1. Data Structures using C, Reema Thareja, Second edition, Oxford press, 2014.
2. Fundamentals of Data Structures in C, Horowitz, Sahani, Anderson, Freed, Second edition, 2014
3. Data Structures using C, Yedidyah Langsam & Moshe J. Augenstein, Aaron M. Tanenbaum Second Edition, Pearson Education, 2017.

Course Outcomes:

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

1. Simulate stack and queue operations and implement its applications. (PO-1,2,3,4,5, PSO-2,3)
2. Develop C programs on linked list and its variations. (PO-1,2,3,4,5, PSO-2,3)
3. Construct C programs on Binary tree and its applications. (PO-1,2,3,4,5, PSO-2,3)

Course Assessment and Evaluation:

Parameter	Marks
CIE Test	20
Lab Record Writing + Viva+ program execution	30
Total	50
Final Exam will be conducted for 50 marks (SEE)	

Object Oriented Programming Laboratory	
Course Code: CIL37	Credits: 0:0:1
Pre-requisites: C Programming	Contact Hours: 14P
Course Coordinator/s: Akshata G C	

Course Contents:

1. Introduction to Object-Oriented Programming
2. Primitive Data type and Operators
3. Control Statements and Arrays
4. Classes, objects, static variables
5. Constructors and deconstructs
6. Dynamic Memory Allocation
7. Polymorphism
8. Inheritance
9. Templates
10. Exception handling
11. File Handling

***Note: Practical sessions will be based on the contents.**

Suggested Learning Resources

Reference Books:

1. The Complete Reference C++, Herbert Schildt, 4th Edition, TMH, 2005.
2. C++ Primer, Stanley B. Lippman, Josee Lajoie, Barbara E. Moo, 4th Edition, Addison Wesley, 2005.
3. Object-Oriented Programming with C++, Sourav Sahay, Oxford University Press, 2006.

Course Outcomes:

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

1. Develop C++ programs using object-oriented concepts and dynamic memory allocation. (PO-2,3,5, PSO-2,3)
2. Apply the knowledge of compile time and runtime polymorphism. (PO-2,3,5,PSO-2,3)
3. Develop C++ programs using inheritance, templates and exception handling for the given problem. (PO-2,3,5, PSO-2,3)

Course Assessment and Evaluation:

Parameter	Marks
CIE Test	20
Lab Record Writing + Viva+ program execution	30
Total	50
Final Exam will be conducted for 50 marks (SEE)	

Universal Human Values	
Course Code: UHV38	Credits: 2:0:0
Pre-requisites: Nil	Contact Hours: 28L
Course Coordinator/s: Dr. Mohana Kumar S	

Course Objectives

This introductory course input is intended

- To help the students appreciate the essential complementarity between 'VALUES' and 'SKILLS' to ensure sustained happiness and prosperity, which are the core aspirations of all human beings
- To facilitate the development of a Holistic perspective among students towards life and profession as well as towards happiness and prosperity based on a correct understanding of the Human reality and the rest of Existence. Such a holistic perspective forms the basis of Universal Human Values and movement towards value-based living in a natural way
- To highlight plausible implications of such a Holistic understanding in terms of ethical human conduct, trustful and mutually fulfilling human behavior and mutually enriching interaction with Nature

Thus, this course is intended to provide a much needed orientational input in value education to the young enquiring minds.

Unit I

Introduction - Need, Basic Guidelines, Content and Process for Value Education

1. Understanding the need, basic guidelines, content and process for Value Education
 2. Self-Exploration-what is it? - its content and process; 'Natural Acceptance' and Experiential Validation- as the mechanism for self-exploration
 3. Continuous Happiness and Prosperity- A look at basic Human Aspirations
 4. Right understanding, Relationship and Physical Facilities- the basic requirements for fulfillment of aspirations of every human being with their correct priority
 5. Understanding Happiness and Prosperity correctly- A critical appraisal of the current scenario
 6. Method to fulfill the above human aspirations: understanding and living in harmony at various levels
- Pedagogy / Course delivery tools: Chalk and talk, Power point presentation, Videos.
 - Lab component / Practical Topics: Survey/polls for self-exploration
 - Links: Holistic Development and Role of Education: <https://youtu.be/sGZtTPe-lhQ>

Unit II

Understanding Harmony in the Human Being - Harmony in Myself!

1. Understanding human being as a co-existence of the sentient 'I' and the material 'Body'
2. Understanding the needs of Self ('I') and 'Body' - Sukh and Suvidha
3. Understanding the Body as an instrument of 'I' (I being the doer, seer and enjoyer)
4. Understanding the characteristics and activities of 'I' and harmony in 'I'
5. Understanding the harmony of I with the Body: Sanyam and Swasthya; correct appraisal of Physical needs, meaning of Prosperity in detail
6. Programs to ensure Sanyam and Swasthya
 - Practice Exercises and Case Studies will be taken up in Practice Sessions.

Pedagogy / Course delivery tools: Chalk and talk, Power point presentation, Videos.

Lab component / Practical Topics: Survey and polls for self-exploration

Links: Harmony in Human Being- Self and Body <https://youtu.be/0ERSMkRPQBM>

Links: Harmony in Human Being- Self <https://youtu.be/83oGJ4oDeIg>

Links: Harmony between Self and Body Prosperity https://youtu.be/aJ_BU2OgpKs

Unit III

Understanding Harmony in the Family and Society- Harmony in Human- Human Relationship

1. Understanding Harmony in the family – the basic unit of human interaction
2. Understanding values in human-human relationship; meaning of Nyaya and program for its fulfillment to ensure Ubhay-tripti;
Trust (Vishwas) and Respect (Samman) as the foundational values of relationship
3. Understanding the meaning of Vishwas; Difference between intention and competence
4. Understanding the meaning of Samman, Difference between respect and differentiation; the other salient values in relationship
5. Understanding the harmony in the society (society being an extension of family):
Samadhan, Samridhi, Abhay, Sah-astitva as comprehensive Human Goals
6. Visualizing a universal harmonious order in society- Undivided Society (Akhand Samaj),
Universal Order (Sarvabhaum Vyawastha)- from family to world family!
 - Practice Exercises and Case Studies will be taken up in Practice Sessions.

Pedagogy / Course delivery tools: Chalk and talk, Power point presentation, Videos.

Lab component / Practical Topics: Survey and polls for self-exploration

Links: Harmony in Family- Trust <https://youtu.be/F2KVVW4WNnS8>

Links: Harmony in family- Respect https://youtu.be/iLqNRPuv0_8

Links: Harmony in family- Other Feeling Justice <https://youtu.be/TcYJB7reKnM>

Links: Harmony in the Society <https://youtu.be/BkWgFinrnPw>

Unit IV

Understanding Harmony in the Nature and Existence - Whole existence as Co-existence

1. Understanding the harmony in the Nature
2. Interconnectedness and mutual fulfillment among the four orders of nature- recyclability and self-regulation in nature
3. Understanding Existence as Co-existence (*Sah-astitva*) of mutually interacting units in all-pervasive space
4. Holistic perception of harmony at all levels of existence

Practice Exercises and Case Studies will be taken up in Practice Sessions.

Pedagogy / Course delivery tools: Chalk and talk, Power point presentation, Videos.

Lab component / Practical Topics: Survey and polls for self-exploration

Links: Harmony in Nature: https://youtu.be/K1Jpd_ojydw

Links: Harmony in Existence https://youtu.be/mormUeZ_RUE

Unit V

Implications of the above Holistic Understanding of Harmony on Professional Ethics

1. Natural acceptance of human values
2. Definitiveness of Ethical Human Conduct
3. Basis for Humanistic Education, Humanistic Constitution and Humanistic Universal Order
4. Competence in professional ethics:
 - a) Ability to utilize the professional competence for augmenting universal human order
 - b) Ability to identify the scope and characteristics of people-friendly and eco- friendly production systems,
 - c) Ability to identify and develop appropriate technologies and management patterns for above production systems.
5. Case studies of typical holistic technologies, management models and production systems
6. Strategy for transition from the present state to Universal Human Order:
 - a) At the level of individual: as socially and ecologically responsible engineers, technologists and managers
 - b) At the level of society: as mutually enriching institutions and organizations

Pedagogy / Course delivery tools: Chalk and talk, Power point presentation, Videos.

Lab component / Practical Topics: Survey and polls for self-exploration

Suggested Learning Resources:

Text Books:

1. R.R Gaur, R Sangal, G P Bagaria, A foundation course in Human Values and professional Ethics, Excel books, New Delhi, 2010, ISBN 978-8-174-46781-2

Reference Books:

1. B L Bajpai, 2004, *Indian Ethos and Modern Management*, New Royal Book Co., Lucknow. Reprinted 2008.
2. PL Dhar, RR Gaur, 1990, *Science and Humanism*, Commonwealth Publishers.
3. Sussan George, 1976, *How the Other Half Dies*, Penguin Press. Reprinted 1986, 1991
4. Ivan Illich, 1974, *Energy & Equity*, The Trinity Press, Worcester, and HarperCollins, USA
5. Donella H. Meadows, Dennis L. Meadows, Jorgen Randers, William W. Behrens III, 1972, *limits to Growth*, Club of Rome's Report, Universe Books.
6. Subhas Palekar, 2000, *How to practice Natural Farming*, Pracheen(Vaidik) Krishi Tantra Shodh, Amravati.
7. A Nagraj, 1998, *Jeevan Vidya ek Parichay*, Divya Path Sansthan, Amarkantak.
8. E.F. Schumacher, 1973, *Small is Beautiful: a study of economics as if people mattered*, Blond & Briggs, Britain.
9. A.N. Tripathy, 2003, *Human Values*, New Age International Publishers.

Web links and Video Lectures (e-Resources):

1. https://www.youtube.com/channel/UCQxWr5QB_eZUnwxSwxXEkQw
2. <https://www.youtube.com/watch?v=P4vjfE-YnVk&list=PLWDeKF97v9SP7wSlapZcQRrT7OH0ZlGC4>

Course

handouts:

https://drive.google.com/drive/folders/1zioX_4L2fCNX4Agw282PN86pcZZT30sr?usp=sharing

Presentation slides: https://drive.google.com/drive/folders/1rMUKh1s0HPRBlpp_b1mpS-duNRcwS6YH?usp=sharing

Course Outcomes:

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

CO	Description	CO-PO mapping
CO 1	Apprehend the need of Value Education over Human aspirations	PO-6
CO 2	Assimilate Harmony over the physical needs and to overcome the self-needs for a prosperous life.	PO-6
CO 3	Recognize the need of Harmony in the Family and Society for a better World.	PO-6,
CO 4	Explain the need of mutual understanding for Holistic Harmony in all the Levels of Human Existence.	PO-6
CO 5	Explain the Holistic understanding of Harmony and Professional Ethics at Individual Level and Society.	PO-6,8

Course Assessment and Evaluation :

Continuous Internal Evaluation (CIE)		
Assessment Tool	Marks	Course outcomes addressed
Internal test-I	30	C01, C02, C03
Internal test-II	30	C03, C04, C05
Average of the two internal tests will be taken for 30 marks.		
Other components	Marks	Course outcomes addressed
<ul style="list-style-type: none">• Assignment• Quiz• Presentation• Model / mini project• Any other	20 (10 + 10)	C01, C02, C03, C04, C05
Semester End Examination (SEE)		
Course end examination (Answer any one question from each unit – Internal choice)	100	C01, C02, C03, C04, C05

Kannada Kali	
Course Code: HS391/491	Credits: 1:0:0
Pre-requisites: Nil	Contact Hours: 14L
Course Coordinator/s: Mrs. Kanya Kumari S	

Unit I

(Parichaya) – Introduction: Kannada Bhashe - About Kannada Language, Eight Kannada Authors – Jnanapeeta Awardies, Introduction to Kannada Language, Karnataka State and Literature.

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

Unit II

Kannada PadagaLu mattu Vaakyagalu. Kannada Words and Sentences, naamapadagaLu – Sarva namapadagaLu – (Nouns -Pronouns) and it's usage in Kannada Kannada namavisheshanagaLu - (Adjectives-Interrogatives)

kriyapadagaLu,kriya visheshaNagaLu- (verb-adverb)

Sambhashaneyalli Prashnarthaka padagalu –vaakyagaLu mattu kriyapadagaLu- visheshaNagaLu (Kannada- Interrogative words & Sentences and verb-adverb in Conversation)

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

Unit III

Kannada Bhasheyalli Sambhashanegalu- Conversations in Kannada - Samanya Sambhashaneyalli Kannadada Padagalu mattu Vaakyagalu. (Kannada Words and Sentences in General Conversation with activities) sambhashaNe: (Conversation With Friends- Teachers, between Friends) (Conversation in Shop, Hostel, Market, Bus and Train) Shabdakosha: Vocabulary – chaTuvaTike: Exercises, Vicharaneya / Bedikeya vakyagalu(Enquiry /Request sentences in Conversation) Sambhashane Conversation with House Owner and Roommate Shabdakosha – Vocabulary - Exercises to test their knowledge of understanding the Language.

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

Unit IV

Kannada padagaLu (eakavachana,bahuvachanagaLu,virudda padagaLu dina nityadalli baLasuva padagaLu mattu sankya vyavaste, Sambhashaneyalli Eakavachana mattu Bhahuvachana- (Singular and Plural nouns) Conversation- Sambhashaneyalli Linga rupagaLu- Genders in Conversation, Viruddha padagalu /Viroadarthaka padagalu (Antonyms) Asamanjasa Uchcharane (Inappropriate Pronunciation),

Sankhya Vyavasthe(Numbers system) -Samaya /Kalakke Sambhandhisida padhagalu (Words Relating to time) – Dikkugalige sambhadisida padhagalu (Words Relating to Directions) Aaharakke sambandisida padagaLu (Names connected with food) Manavana shareerada bhagagalu / Angagalu (Parts of the Human body) Manava Sambhandhada da padhagalu(Terms Relating to Human Relationship) Manavana Bhavanegalige sambandisida Padagalu (Words Relating to Human’s feelings and Emotions) Vaasada staLakke sambhandisidanthaha padhagalu (Words Relating to place of leaving)

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

Unit V

Kannada akshara maale(Kannada alphabets and their practices with pronunciations) swara aksharagaLu –vyanjanaksharagaLu- gunitaksharagaLu, tantragnana mattu Aadaita padagaLu- Technical and administrative worlds in Kannada,

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

Suggested Learning Resources

Text Book:

1. Dr. L Thimmesh., Prof. Keshava muurthy, ‘BaLake kannada’ prasarangaa, VTU,2020

Reference Books:

1. Smt. KanyaKumari.S –‘Kannada Kali ’ Kinnari publications’ First edition, Bengaluru,2022
2. Lingadevaru Halemane – ‘Kannada Kali’, Prasaranga kannada University Hampi, 6rd Edition. 2019

Course Outcomes (COs):

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

1. Develop vocabulary (PO 10)
2. Identify the basic Kannada language skill(PO 10)
3. Develop listening & speaking skill in Kannada language. (PO 6,12)
4. Enrich language skill. (PO 12)
5. Apply Kannada language skill for various purpose (PO 12)

Course Assessment and Evaluation:

Continuous Internal Evaluation: 50 marks		
Assessment tool	Marks	Course outcome attained
Internal test-1	30	CO1, CO2 & CO3

Internal test-1I	30	C04 & C05
Average of the two internal tests will be taken for 30 marks		
Other components		
Assignment	10	C01, C02
Quiz	10	C03, C04 & C05
Semester end examination:	100	C01, C02 , C03, C04 & C05

Course Name: ಕನ್ನಡ ಮನಸು	
Course code:	Course Credits :1:0:0
Pre-requisites: NIL	Contact hours: 14L
Program: B.E(Common to all the Branches)	Semester: III/IV
Course coordinator: Mrs. KanyaKumari.S	

ಘಟಕ - ೧ (Unit-1)

ಲೇಖನಗಳು (Articles)- ಕಾವ್ಯಭಾಗ (poetry)

ಕನ್ನಡ ಭಾಷೆ ನಾಡು - ನುಡಿ

ಕರ್ನಾಟಕ ಸಂಸ್ಕೃತಿ

ಆಡಳಿತ ಭಾಷೆಯಾಗಿ ಕನ್ನಡ

ವಚನಗಳು-ಅಕ್ಕಮಹಾದೇವಿ-ಬಸವಣ್ಣ-ಅಲ್ಲಮಪ್ರಭು

➤ Pedagogy/Course delivery tools:	Chalk and Talk, power point presentation
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ಘಟಕ - ೨ (Unit-2)

ಕೀರ್ತನೆ ಮತ್ತು ತತ್ವಪದಗಳು

ಪುರಂದರ ದಾಸರು ಮತ್ತು ಕನಕದಾಸರ ಪದಗಳು

ಶಿಶುನಾಥ ಶರೀಫರು ಮಹಾಂತ ಶಿವಯೋಗಿಗಳ ಪದಗಳು

ಜನಪದ ಗೀತೆ

➤ Pedagogy/Course delivery tools:	Chalk and Talk, power point presentation
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ಘಟಕ - 3 (Unit-3)

ಆಧುನಿಕ ಕಾವ್ಯಗಳು

ಮಂಕುತಿಮ್ಮನ ಕಗ್ಗ

ಕುರುಡು ಕಾಂಚಾಣ

ಚೋಮನ ಮಕ್ಕಳ ಹಾಡು

➤ Pedagogy/Course delivery tools:	Chalk and Talk, power point presentation
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ಘಟಕ - 4 (Unit-4)

ತಾಂತ್ರಿಕ ಧುರೀಣರು(ವೃತ್ತಿ ಪರಿಚಯ) ಕಥೆ-ಪ್ರವಾಸ ಕಥನ

ಡಾ.ಸರ್.ಎಂ.ವಿಶ್ವೇಶ್ವರಯ್ಯ- ವೃತ್ತಿ ಮತ್ತು ಐತಿಹ್ಯ- ಎ,ಎನ್.ಮೂರ್ತಿರಾಯರು

ಯುಗಾದಿ -ವಸುಧೇಂದ್ರ

ಮೆಗಾನ್ ಎಂಬ ಗಿರಿಜನ ಪರ್ವತ -ಪಿ.ಜಿ.ಬೋರಲಿಂಗಯ್ಯ

➤ Pedagogy/Course delivery tools:	Chalk and Talk, power point presentation
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ಘಟಕ- 5 (Unit-5)

ಕರಕುಶಲ ಕಲೆಗಳು ತಾಂತ್ರಿಕ ವಿಜ್ಞಾನ (technical science)

ಕರಕುಶಲ ಕಲೆಗಳು ಮತ್ತು ಪರಂಪರೆ ವಿಜ್ಞಾನ- ಕರಿಗೌಡ ಬೇಟೆನ ಹಳ್ಳಿ

ಕಂಫ್ಯೂಟರ್ ಹಾಗೂ ಮಾಹಿತಿ ತಂತ್ರಜ್ಞಾನ-

ಕೆ ಮತ್ತು ಬಿ ಬರಹ ತಂತ್ರಾಂಶಗಳು ಮತ್ತು .ಕಂಫ್ಯೂಟರ್ ಮುಖಾಂತರ ಕನ್ನಡ ಟೈಪಿಂಗ್

ತಾಂತ್ರಿಕ ಪದಕೋಶ ತಾಂತ್ರಿಕ ಹಾಗೂ ಪಾರಿಭಾಷಿಕ ಕನ್ನಡ ಪದಗಳು

➤ Pedagogy/Course delivery tools:	Chalk and Talk, power point presentation
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ಪಠ್ಯ ಪುಸ್ತಕ (text book):

ಸಾಂಸ್ಕೃತಿಕ ಕನ್ನಡ

ಸಂಪಾದಕರು :

ಡಾ.ಪಿ.ಜಿ, ಬೋರಲಿಂಗಯ್ಯ -ವಿಶ್ರಾಂತ ಕುಲಪತಿಗಳು, ಕನ್ನಡ ವಿಶ್ವವಿದ್ಯಾಲಯ ,ಹಂಪಿ,ಪ್ರಸಾರಂಗ ವಿಶ್ವೇಶ್ವರಯ್ಯತಾಂತ್ರಿಕ

ವಿಶ್ವವಿದ್ಯಾಲಯ,ಬೆಳಗಾವಿ,ಪ್ರಥಮ ಮುದ್ರಣ-2020

ಮೂರಕ ಪಠ್ಯ (reference book)ಕನ್ನಡ ಮನಸು, ಪ್ರಸಾರಂಗ - ಕನ್ನಡ ವಿಶ್ವವಿದ್ಯಾಲಯ-ಹಂಪಿ,ಆರನೇಮುದ್ರಣ 2016

ಕನ್ನಡ ಕಲಿಕೆಯ ಉದ್ದೇಶಗಳು:

- ಸಾಂಸ್ಕೃತಿಕ ಕನ್ನಡದ ಬೊತೆಗೆ ಶ್ರಿಯಾತ್ಮಕ, ಸಾಹಿತ್ಯ ಮತ್ತು ಸಂಸ್ಕೃತಿ ಮತ್ತು ನಾಡು-ನುಡಿಯ ಪರಿಚಯ ಮಾಡಿಕೊಡುವುದು(PO6)
- ಕನ್ನಡ ಭಾಷೆಯ ವ್ಯಾಕರಣ, ಭಾಷಾರಚನೆ ಯ ನಿಯಮಗಳನ್ನು ಪರಿಚಯಿಸುವುದು (PO10)
- ಕನ್ನಡ ಭಾಷಾಬರಹದಲ್ಲಿ ಕಂಡು ಬರುವ ದೋಷಗಳು ಮತ್ತು ಅವುಗಳ ನಿವಾರಣೆ(PO10)
- ಸಾಮಾನ್ಯ ಅರ್ಜಿಗಳು , ಸರ್ಕಾರಿ ಹಾಗೂ ಸರ್ಕಾರಿ ಪತ್ರವ್ಯವಹಾರದ ಬಗ್ಗೆ ಅರಿವು ಮೂಡಿಸುವುದು(PO12)
- ಭಾಷಾಂತರ ಮತ್ತು ಪ್ರಬಂಧ ರಚನೆ ಬಗ್ಗೆ ಅರಿವು ಮೂಡಿಸುವುದು
ಕನ್ನಡ ಭಾಷಾಭ್ಯಾಸ, ಸಾಮಾನ್ಯ ಕನ್ನಡ ಹಾಗೂ ಅಡಳಿತ ಕನ್ನಡದ ಪದಗಳ ಪರಿಚಯ ಮಾಡಿಕೊಡುವುದು. (PO12)

Course Assessment and Evaluation:

Continuous Internal Evaluation: 50 marks		
Assessment tool:	Marks	Course outcome attained
Internal test-1	30	C01,C02 & C03
Internal test-1I	30	C04 & C05
AVAREGE OF THE TWO INTERNAL TEST TWO WILL BE TAKEN FOR 30 MARKS		
Other components		
Assignment	10	C01,Co2
quiz	10	C03, C04 & C05
Semester end examination:	100	C01,C02 , C03, C04 & C05

COURSE CONTENT OF 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/s: Dr. Govindaraju M V and Dr. R Suresh Babu	

Course Contents:

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 1/3rd rule and Simpson's 3/8th rule.

- Pedagogy/Course delivery tools: Chalk and talk, Power Point Presentation, Videos
- Links: <https://a.impartus.com/ilc/#/course/96127/452>
<https://a.impartus.com/ilc/#/course/132243/636>
<https://a.impartus.com/ilc/#/course/119635/593>
- Impartus recording: <https://nptel.ac.in/courses/111/105/111105134/>
<https://nptel.ac.in/courses/111/106/111106101/>

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, 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 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 $\mu = \mu$ ($\lambda < \mu$) n , 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, 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 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, Power Point 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:

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 and CO3
Internal Test-II (CIE-II)	30	CO3, CO4, and CO5
Average of the two CIE shall be taken for 30 marks		
Other Components		
Quiz	10	CO1, CO2, and CO3
Assignment	10	CO3, CO4 and 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 and CO5

Data Communication and Networking (Integrated)	
Course Code: CI42	Credits: 2:0:1
Pre-requisites: Nil	Contact Hours: 28L+14P
Course Coordinator/s: Dr. Thippeswamy M N	

Course Contents:

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

Reference Books:

1. Computer Networks: A top down approach, Behrouz A. Forouzan and Firouz Mosharraf, Special Indian Edition, Tata Mc Graw-Hill.2012.
2. Data and Computer Communication, William Stallings, 8th Edition, Pearson Education, 2007.
3. Computer Networks – A Systems Approach, Larry L. Peterson and Bruce S. Davie, 4th edition, Elsevier, 2007.
4. Communication Networks Fundamental Concepts And Key Architectures, Alberto Leon-Garcia and Indra Widjaja, 2nd Edition, Mc Graw-Hill Education

Course Outcomes:

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, and CO5
Average of the two CIE shall be taken for 30 marks		
Other Components		
Lab Test	10	CO1, CO2, CO3, CO4 and CO5
Lab Record	10	CO1, CO2, CO3, CO4 and 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 and CO5

Design and Analysis of Algorithms	
Course Code: CI43	Credits: 2:1:0
Pre-requisites: Basic Programming	Contact Hours: 28L+14T
Course Coordinator/s: 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, $O(nk)$ Time, Beyond Polynomial Time. Some Representative Problems, A First Problem: Stable Matching.

- Pedagogy/Course delivery tools: ➤ Chalk and talk, Power Point 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, Power Point 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 ➤ Chalk and talk, Power Point Presentation, Videos
- delivery tools:
- 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 ➤ Chalk and talk, Power Point Presentation, Videos
- delivery tools:
- 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 ➤ Chalk and talk, Power Point Presentation, Videos
- delivery tools:
- 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:

At the end of the course, the 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 and CO2
Internal Test-II (CIE-II)	30	CO3, CO4, and CO5
Average of the two CIE shall be taken for 30 marks		
Other Components		
Tutorial Assignment 1	10	CO1, CO2, and CO3
Tutorial Assignment 2	10	CO4 and 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 and CO5

Introduction to Artificial Intelligence	
Course Code: CI44	Credits: 3:0:0
Pre-requisites: Nil	Contact Hours: 42L
Course Coordinator/s: 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, Power Point 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, Power Point 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, Power Point 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, Power Point 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 verses Traditional system.

- Pedagogy/Course delivery tools: Chalk and talk, Power Point 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:

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 (COs) addressed
Internal Test-I (CIE-I)	30	CO1 and CO2
Internal Test-II (CIE-II)	30	CO3, CO4, and CO5
Average of the two CIE shall be taken for 30 marks		
Other Components		
Case Study	10	CO1, CO2, and CO3
Assignment	10	CO4 and 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 and CO5

Operating System	
Course Code: CI45	Credits: 3:0:0
Pre-requisites: Nil	Contact Hours: 42L
Course Coordinator/s: 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, Power Point 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, Power Point 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, Power Point 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, Power Point 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, Power Point 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:

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 and CO2
Internal Test-II (CIE-II)	30	CO3, CO4, and CO5
Average of the two CIE shall be taken for 30 marks		
Other Components		
Case study	10	CO1, CO2, and CO3
Assignment	10	CO4 and 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 and CO5

Embedded Systems Laboratory	
Course Code: CIL46	Credits: 0:0:1
Prerequisites: Basic C programming	Total Contact Hours: 14P
Course Coordinator/s: 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.**

Suggested Learning Resources

Reference Books:

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

Course Outcomes:

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.
2. Design embedded systems using Arduino board and Embedded C.
3. Conversant with various Sensors, communication protocols used in Embedded applications.

Course Assessment and Evaluation:

Continuous Internal Evaluation (CIE) : 50 Marks		
Assessment Tools	Marks	Course Outcomes (COs) addressed
Lab Test-I	10	C01 and C02
Lab Test-II	10	C03
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	C01, C02, C03

Algorithms Laboratory	
Course Code: CIL47	Credits: 0:0:1
Pre-requisites: Basic C Programming	Contact Hours: 14P
Course Coordinator/s: 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:

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 and 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
Prerequisites: Basic Programming Database systems	Total Contact Hours: 14P
Hours Course Coordinator/s: Dr. Thippeswamy M N	

Course Contents:

S.No	List of programs
1.	Design the following static web pages required for an online book store web site. 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.	a) Write JavaScript to validate the following fields of the Registration page. 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 b) Develop and demonstrate the usage of inline, internal and external style sheet using CSS.
3.	Develop and demonstrate JavaScript with POP-UP boxes and functions for the following problems: 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.	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).
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 (useState and useEffect) 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. The Complete Book on Angular 4, Nate Murray, Felipe Coury, Ari Lerner and Carlos Taborda, September 2016.
3. Node.js by Example Paperback, Krasimir Tsonev, 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:

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 PSO-2)
2. Create a robust Client-side validation with java script. (PO-1,2,3 PSO-2)
3. Design dynamic data-driven Web sites using MongoDB and Node.js (PO- 1,2,3,5 PSO-2)

Course Assessment and Evaluation:

Continuous Internal Evaluation (CIE) : 50 Marks		
Assessment Tools	Marks	Course Outcomes (COs) addressed
Lab Test-I	10	CO1 and 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