**RAMAIAH**
Institute of Technology

# CURRICULUM

## for the Academic year 2022 – 2023

# COMPUTER SCIENCE AND ENGINEERING

**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 also been conferred autonomous status for Ph.D. program since 2021. 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 65% 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 & Centre for Bio and Energy Materials Innovation. **M S Ramaiah Institute of Technology has obtained "Scimago Institutions Rankings" All India Rank 107 & world ranking 600 for the year 2022.**

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 is recognized by Atal Ranking of Institutions on Innovation Achievements (ARIIA), 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 67th rank among 1249 top Engineering Institutions & 17th Rank for School of Architecture in India for the year 2022 and is 1st amongst the Engineering Colleges affiliated to VTU, Karnataka.**

## About the Department

| Year of Establishment | 1984 |
|---|---|
| Names of the Programmes offered | UG: B.E. in Computer Science and Engineering<br> PG: M.Tech. in Computer Science and Engineering<br>PG: M.Tech. in Computer Networks and Engineering<br>Ph.D<br>M.Sc.(Engg.) by Research |

The Department of Computer Science and Engineering (CSE) has eminent emeritus professors, 15 faculties with the doctorate degree and 15 pursuing the doctoral studies. The faculty has been publishing research papers in refereed journals and in conference proceedings. The department also conducts vocational courses and proficiency courses on fundamental and new programming languages and computer science concepts. These courses are conducted beyond college hours'/summer semester by the faculty of the department. Some of the faculty are involved in institutional level activities and actively involved in interdisciplinary research activities. The department has state of the art laboratories like SAP, IBM Centre of Excellence. Technical seminars, workshops and hackathons are conducted regularly for UG & PG students. The department encourages the students to conduct and participate in extra- curricular/sports activities. The alumni network is very active and regular meeting are conducted by the department. The department is accredited by Nation Board of Accreditation (NBA). The department has MoUs with leading IT Industries like SAP, IBM and HP. The department conducts subjects with more of hands- on sessions and encourages students to take up MOOC based online courses in NPTEL, IITBombayX, Coursera, Udacity 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

- Impartingqualitytechnicaleducationbynurturingaconducivelearningenvironment through continuous improvement andcustomization
- Establishing research clusters in emerging areas in collaboration with globally reputedorganizations
- Establishinginnovative skills development, techno-entrepreneurial activities, and consultancy for socio-economicneeds

## 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 build a strong learning and research environment in the field of Computer Science and Engineering that promotes innovation towards betterment of the society

## MISSION OF THE DEPARTMENT

1. To produce Computer Science graduates who, trained in design and implementation of computational systems through competitive curriculum and research in collaboration with industry and researchorganizations.
2. To educate students in technology competencies by providing professionally committed faculty andstaff.
3. To inculcate strong ethical values, leadership abilities and research capabilities in the minds of students so as to work towards the progress of thesociety.

## PROGRAM EDUCATIONAL OBJECTIVES (PEOs):

A B.E (Computer Science & Engineering) graduate of Ramaiah Institute of Technology should, within three to five years of graduation

**PEO1** Pursue a successful career in the field of Computer Science & Engineering or a related field utilizing his/her education and contribute to the profession as an excellent employee, or as an entrepreneur

**PEO2** Be aware of the developments in the field of Computer Science & Engineering, continuously enhance their knowledge informally or by pursuing graduate studies

**PEO3** Be able to work effectively in multidisciplinary environments and be responsible members / leaders of their communities.

## PROGRAM OUTCOMES (POs):

The Outcomes of the Bachelor of engineering in Computer Science & Engineering Programme are as follows:

**Engineering Graduates must be able to:**

**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:** Understand the principles, architecture and organization of computers, embedded systems, and computer networks.

**PSO2:** Apply mathematical foundations, algorithmic principles, and computer science theory in the modeling and design of computer-based systems that include both hardware and software

**PSO3:** Apply software design and development practices to develop software applications in emerging areas such as IoT, Data Analytics, Social Networks, Cloud and High-Performance Computing.

# SCHEME OF TEACHING

## III SEMESTER

| | | B.E .in Computer Science and Engineering<br>Scheme of Teaching and Examination 2022-23 | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|

**IIISEMESTER**

| Sl. No. | Subject Code | Subject | Teaching Department | Category | Credits | | | | Total contact hours /week |
|---|---|---|---|---|---|---|---|---|---|
| | | | | | L | T | P | Total | |
| 1 | CS31 | Linear Algebra and Laplace Transforms | Mathematics | BSC | 2 | 1 | 0 | 3 | 4 |
| 2 | CS32 | Digital Design and Computer Organization | CSE | IPCC | 2 | 0 | 1 | 3 | 4 |
| 3 | CS33 | Data Structures | CSE | PCC | 3 | 0 | 0 | 3 | 3 |
| 4 | CS34 | Object Oriented Programming | CSE | PCC | 3 | 0 | 0 | 3 | 3 |
| 5 | CS35 | Discrete Mathematical Structures | CSE | PCC | 2 | 1 | 0 | 3 | 4 |
| 6 | CSL36 | Data Structures Laboratory | CSE | PCC | 0 | 0 | 1 | 1 | 2 |
| 7 | CSL37 | Object Oriented Programming Laboratory | CSE | PCC | 0 | 0 | 1 | 1 | 2 |
| 8 | UHV38 | Universal Human Value Course | CSE | UHV | 2 | 0 | 0 | 2 | 2 |
| 9 | HS39/ HS49 | Kannada ( Kali / Manasu) / Constitution of India & Professional Ethics | Humanities | HSMC | 1 | 0 | 0 | 1 | 1 |
| 10 | AEC310 | Ability Enhancement Course- III | CSE | AEC | 1 | 0 | 0 | 1 | 1 |
| | | | | **Total** | | | | **21** | **26** |
| 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 * | | NCMC | 0 | 0 | 0 | 0 | 3 |

# IV SEMESTER

| | | **B.E. in Computer Science and Engineering** <br> **SchemeofTeachingandExamination2022-23** | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|

**IVSEMESTER**

| Sl. No. | Subject Code | Subject | Teaching Department | Category | Credits | | | | Total contact hours /week |
|---|---|---|---|---|---|---|---|---|---|
| | | | | | L | T | P | Total | |
| 1 | CS41 | Numerical Techniques and Probability Models | Mathematics | BSC | 2 | 1 | 0 | 3 | 4 |
| 2 | CS42 | Microcontrollers and IoT | CSE | IPCC | 2 | 0 | 1 | 3 | 4 |
| 3 | CS43 | Design and Analysis of Algorithms | CSE | PCC | 3 | 0 | 0 | 3 | 3 |
| 4 | CS44 | Data Communication and Networking | CSE | PCC | 3 | 0 | 0 | 3 | 3 |
| 5 | CS45 | Finite Automata and Formal Languages | CSE | PCC | 2 | 1 | 0 | 3 | 4 |
| 6 | CSL46 | Design and Analysis of Algorithms Laboratory | CSE | PCC | 0 | 0 | 1 | 1 | 2 |
| 7 | CSL47 | Data Communication and Networking Laboratory | CSE | PCC | 0 | 0 | 1 | 1 | 2 |
| 8 | CSL48 | Python Programming Laboratory | CSE | PCC | 0 | 0 | 1 | 1 | 2 |
| 9 | HS49/ HS39 | Kannada ( Kali / Manasu) / Constitution of India & Professional Ethics | Humanities | HSMC | 1 | 0 | 0 | 1 | 1 |
| 10 | AEC410 | Ability Enhancement Course - IV | CSE | AEC | 1 | 0 | 0 | 1 | 1 |
| 11 | INT411 | Inter/ Intra Institutional Internship | | INT | 0 | 0 | 2 | 2 | - |
| | | | | **Total** | | | | **22** | **26** |
| 12 | AM41 | Additional Mathematics II * | Mathematics | NCMC | 0 | 0 | 0 | 0 | - |

| Linear Algebra & Laplace Transforms | |
|---|---|
| **Course Code: CS31**<br>**Pre-requisites: Calculus and Basics of Linear Algebra**<br>**Course Coordinator: Dr. Govindaraju M V and Dr. R Suresh Babu** | **Credits: 2:1:0**<br>**Contact Hours: 28L + 14T** |

## 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
- Links:

  ➤ Chalk and talk, PowerPoint Presentation, Videos
  ➤ 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:** Introduction to vector spaces, 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
- Links:

  ➤ Chalk and talk, Power Point Presentation ,Videos
  ➤ 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, 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 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

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

| DIGITAL DESIGN AND COMPUTER ORGANIZATION | |
|---|---|
| **Course Code: CS32** | **Credits:2:0:1** |
| **Pre-requisites: Nil** | **Contact Hours:28+14** |
| **Course Coordinator: Chandrika Prasad** | |

## Course Contents

### Unit I
**(6 Lectures)**

Synthesis of logic circuits with SOP and POS, K-map, Strategy for minimization, Minimization of SOP and POS forms, incompletely specified functions. Tabular method for minimization of Boolean functions, Combinational circuits: Half adder, full adder (realization using NAND gates), multiplexers, decoders, encoders and code converters. Introduction to VHDL

| | |
|---|---|
| • Pedagogy/ Course delivery tools | ➢ Chalk and talk, Power point presentation, Videos |
| • Links | ➢ https://nptel.ac.in/courses/117105078 |
| • Lab Component / PracticalTopics | ➢ Implement Half and Full Adder in VHDL <br> ➢ Implement 8:1 MUX in VHDL |

### Unit II
**(6 Lectures)**

Basic latch, gated SR latch, gated D latch, T FF, JK FF, truth table, characteristics equation and excitation tables of all the four types of FFs. Registers: Shift registers, parallel access registers. Study of asynchronous counters: Up, down counters. Study of synchronous sequential circuits: Design of a counter using sequential circuits approach using different FFs for different modulo values and design of random counters

| | |
|---|---|
| • Pedagogy/ Course delivery tools | ➢ Chalk and talk, Power point presentation, Videos |
| • Links | ➢ https://nptel.ac.in/courses/117105078 |
| • Lab Component / Practical Topics | ➢ Design a JK flip-flop (with preset and clear) in VHDL <br><br> ➢ Design and develop the VHDL code for mod 8 up counter |

### Unit III
**Introduction to functional units and addressing modes (5 Lectures)**

Functional units, bus structures, performance, **Overflow in integer arithmetic**: Numbers, Arithmetic operations and characters, Memory locations and addresses, Memory operations, instructions and instruction sequencing, Addressing modes, Encoding of machine instructions.

| | |
|---|---|
| • Pedagogy/ Course delivery tools | ➢ Chalk and talk, Power point presentation, Videos |
| • Links | ➢ https://nptel.ac.in/courses/117105078 |

| | |
|---|---|
| • Lab Component / PracticalTopics | ➢ Instruction execution using Marie simulator<br>➢ Execution of Assembly language programs using ARMSim simulator |

## Unit IV

### Processor (6 Lectures)

**Arithmetic unit:** Multiplication of two numbers, A signed operand multiplication, Booth algorithm, Bit pair recoding and CSA, IEEE standard for floating point numbers. **The Processor:** Fundamental concepts, Execution of complete instruction, Multiple bus organization, **Pipelining**: Basic concepts, Data hazards, Instruction hazards.

| | |
|---|---|
| • Pedagogy/ Course delivery tools | ➢ Chalk and talk, Power point presentation, Videos |
| • Links | ➢ https://nptel.ac.in/courses/117105078 |
| • Lab Component / PracticalTopics | ➢ ALU design using Logisim and Pipelining demonstration using CPU-OS Simulator |

## Unit V
### Memory and I/O Units (5 Lectures)

**Memory unit:** Basic concepts, Cache mapping techniques, **Input Output Unit:** Accessing I/O devices, **Interrupts**: Interrupt hardware, Enabling and disabling of interrupts, handling multiple devices, Controlling device requests.

| | |
|---|---|
| • Pedagogy/ Course delivery tools | ➢ Chalk and talk, Power point presentation, Videos |
| • Links | ➢ https://nptel.ac.in/courses/117105078 |
| • Lab Component / Practical Topics | ➢ Memory operation using Logisim simulator |

## Suggested Learning Resources

**Text Books:**

1. Stephen Brown, Zvonko Vranesic: Fundamentals of Digital Logic Design with VHDL, Tata McGrawHill, 3rd Edition, 2012.
2. C Hamacher, Z Vranesic, S Zaky: Computer Organization, Tata McGraw Hill, 5th Edition, 2018.

## Reference Books:

1. David A. Patterson, John L. Hennessy: Computer Organization and Design, M.K Publishers, 4th edition, 2010

## Course Outcomes (COs):

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

1. Describe the working of various digital combinational circuits and apply various techniques to minimizeBoolean functions. (PO-1,2,PSO-2)
2. Examinethecharacteristicsofflipflopsanddesignasynchronousandsynchronoussequentialcircuits.(PO1, PO-2,5,PSO-2)

3.  Describe basic functional units, instruction sequencing and various addressing modes. (PO1,PO2, PO5,PSO2)
4.  Appraise different techniques used to perform multiplication and describe the organization of processing unit & pipelining. (PO1, PO2, PO3, PO5, PSO2)
5.  Illustrate cache memory mapping techniques, data transfer between the devices using interrupts and direct memory access mechanism (PO1, PO2, PO3,PO5,PSO2)

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 will be taken for 30 marks | | |
| Other Components | | |
| Quiz -I | 10 | CO1 and CO2 |
| Simulation based learning | 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 Quiz-II | | |
| Semester End Examination (SEE) | | |
| Course End Examination (Answer One full question from each Unit-Internal Choice) | 100 | CO1, CO2, CO3 CO4 and CO5 |

| **DATA STRUCTURES** | |
|---|---|

| **Course Code: CS33** | **Credits: 3:0:0** |
|---|---|
| **Pre-requisites: Nil** | **Contact Hours: 42L** |
| **Course Coordinator: Dr. Parkavi A** | |

## Course    Contents

### Unit I (8 Lectures)

**Basic Concepts:** Pointers and Dynamic Memory Allocation, Algorithm Specification, Data Abstraction. Arrays and Structures: Arrays, Dynamically Allocated Arrays, Structures and Unions, Polynomials, Sparse Matrices, Representation of Multidimensional Arrays, Strings.

- Pedagogy/ Course delivery tools
  - ➢ Chalk and talk, Power point presentation, Videos

- Lab Component / Practical Topics
  - ➢ Usage of Pointers, Structures, Implementing Polynomials, Sparse Matrices

- Links
  - ➢ https://www.youtube.com/watch?v=55laZ7_F24&amp;list=PLBlnK6fEyqRj oG6aJ4FvFU1tlXbjLBiOP

### Unit II (8 Lectures)

**Stacks and Queues:** Stacks, Stacks Using Dynamic Arrays, Queues, Circular Queues Using Dynamic Arrays, Evaluation of Expressions, Multiple Stacks and Queues.

- Pedagogy/ Course delivery tools
  - ➢ Chalk and talk, Power point presentation, Videos

- Lab Component / Practical Topics
  - ➢ Variations of Stacks and Queues

- Links
  - ➢ https://www.youtube.com/watch?v=rS-ZKTqwi90
  - ➢ https://www.youtube.com/watch?v=poNr0Z4PcM

### Unit III (9 Lectures)

**Linked Lists:** Singly Linked lists and Chains, Representing Chains in C, Linked Stacks and Queues, Polynomials, Additional List operations, Sparse Matrices, Doubly Linked Lists.

- Pedagogy/ Course delivery tools
  - ➢ Chalk and talk, Power point presentation, Videos

- Lab Component / Practical Topics
  - ➢ Variations of Linked Lists and their Applications

- Links
  - ➢ https://www.youtube.com/watch?v=R9PTBwOzce o

### Unit IV (8 Lectures)

**Trees:** Introduction, Binary Trees, Binary Tree Traversals, Additional Binary Tree Operations, Threaded Binary Trees, Heaps, Binary Search Trees, Selection Trees, Forests, Representation of Disjoint Sets, Counting Binary Trees.

|   |   |
|---|---|
| • Pedagogy/ Course delivery tools | ➢ Chalk and talk, Power point presentation, Videos |
| • Lab Component / Practical Topics | ➢ Binary Trees |
| • Links | ➢ https://www.youtube.com/watch?v=oSWTXtMglKE |

### Unit 5 (9 Lectures)

**Graphs:** The Graph Abstract Data Type, Elementary Graph Operations. Priority Queues: Single- and Double-Ended Priority Queues, Leftist Trees. Efficient Binary Search Trees: AVL Trees.

|   |   |
|---|---|
| • Pedagogy/ Course delivery tools | ➢ Chalk and talk, Power point presentation, Videos |
| • Lab Component / Practical Topics | ➢ Graph Operations and traversals. |
| • Links | ➢ https://www.youtube.com/watch?v=gXgEDyodOJU |

Suggested Learning Resources

**Text Books:**
1. Horowitz, Sahni, Anderson - Freed: Fundamentals of Data Structures in C, 2nd Edition, Universities Press, 2008.

Reference Books:
1. Narasimha Karumanchi: Data Structures And Algorithms Made Easy: Data Structures And Algorithmic Puzzles, Career monk Publications, 5th Edition, 2016
2. Yedidyah, Augenstein, Tannenbaum: Data Structures Using C and C++, 2nd Edition, Pearson Education, 2003.
3. Data Structures, Seynour Lipschutz and GAV Pai, Schaum's Outlines, McGraw Hill, 2008.
4. Richard F. Gilberg and Behrouz A. Forouzan: Data Structures- A Pseudocode Approach with C, Cengage Learning,2005

## Course Outcomes:

At the end of the course, students will be able to:
1. Solve real time problems using concepts of dynamic memory allocation, structures, and strings. (PO-1,2,3,PSO-2)
2. Implement storage and retrieval of ordered data using stacks and queues as well as select appropriate data structures as applied to specified problem definition (PO-1,2,3, PSO-2)
3. Implement dynamic storage, retrieval and search operations of unordered data using linked list and its variants. (PO- 1,2,3, PSO-2)
4. Implement hierarchical based solutions using different tree traversal techniques. (PO-1,2,3, PSO-2)
5. Develop solutions for problems based on graphs. (PO-1,2,3, PSO-2)

Course Assessment and Evaluation

| Continuous Internal Evaluation (CIE) : 50 Marks | | |
|---|---|---|
| **Assessment Tools** | **Marks** | **Course Outcomes (COs) addressed** |
| Internal Test-I (CIE-I) | 30 | CO1, CO2, and CO3 |
| Internal Test-II CIE-II) | 30 | CO3, CO4, and CO5 |
| **Average of the two CIE will be taken for 30 marks** | | |
| **Other Components** | | |
| Programming Competition / Hackathon / Codathon | 20 | CO1, CO2, 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 |

| OBJECT ORIENTED PROGRAMMING | |
|---|---|
| **Course Code: CS34** | **Credits: 3:0:0** |
| **Pre-requisites: C Programming Course** | **Contact Hours: 42L** |
| **Coordinator: Pradeep Kumar** | |

## Course Contents

### Unit I
#### The Object Model and Introduction to Java Programming (8 Lectures)

**The Object Model:** Foundations of the Object Model, Object-Oriented Programming, Object-Oriented Design, Object- Oriented Analysis. Elements of the Object Model: Abstraction, Encapsulation, Modularity, Hierarchy, Typing, Concurrency, Persistence Applying the Object Model.

**Introduction to Java Programming:** Java Buzzwords, Overview of Java Data types, Variables, arrays, Control statements.

- Pedagogy/ Course delivery tools
  - ➢ Chalk and talk, Power point presentation, Videos
- Links
  - ➢ https://nptel.ac.in/courses/106105191
- Lab Component / Practical Topics
  - ➢ Java Programs on data types, operators, static methods and arrays

### Unit II
#### Java Programming Fundamentals (9 Lectures)

**Java Programming Fundamentals:** Object-Oriented Programming, The Three OOP Principles, Class Fundamentals, Declaring Objects, Assigning Object Reference Variables, Introducing Methods, Constructors, The this Keyword, Garbage Collection, The finalize( ) Method, Overloading Methods, Using Objects as Parameters, A Closer Look at Argument Passing, Returning Objects, Introducing Access Control, Understanding static, Introducing final, Introducing Nested and Inner Classes.

- Pedagogy/ Course delivery tools
  - ➢ Chalk and talk, Power point presentation, Videos
- Links
  - ➢ https://nptel.ac.in/courses/106105191
- Lab Component / Practical Topics
  - ➢ Java Programs on classes, constructors, method overloading, method overriding and nested classes

### Unit III
#### Inheritance, Packages & Interfaces (9 Lectures)

**Inheritance, Packages & Interfaces:** Inheritance Basics, Using super, Creating a Multilevel Hierarchy, When Constructors Are Called, Method Overriding, Dynamic Method Dispatch, Using Abstract Classes, Using final with Inheritance, Packages, Access Protection, Importing Packages, Interfaces, String and String Buffer Handling.

| | |
|---|---|
| • Pedagogy/<br>Course delivery tools | ➢ Chalk and talk, Power point presentation, Videos |
| • Links | ➢ https://nptel.ac.in/courses/106105191 |
| • Lab Component /<br>Practical Topics | ➢ Java Programs on Inheritance, abstract classes, packages, interfaces and string methods |

## Unit IV
### Exception Handling & Multithreaded Programming (8 Lectures)

**Exception Handling:** Exception-Handling Fundamentals, Exception Classes, Exception Types, Uncaught Exceptions, Using try and catch, Multiple catch clauses, Nested try Statements, throw, throws, finally.

**Multithreaded Programming:** Java Thread Classes, The Java Thread Model, The Main Thread, Creating a Thread, Creating Multiple Threads, Using is Alive() and join(), Thread Priorities, Synchronization, Suspending, Resuming and Stopping Threads.

| | |
|---|---|
| • Pedagogy/<br>Course delivery tools | ➢ Chalk and talk, Power point presentation, Videos |
| • Links | ➢ https://nptel.ac.in/courses/106105191 |
| • Lab Component /<br>Practical Topics | ➢ Java Programs on Exception handling and Multithreaded programming |

## Unit V
### Event Handling, Swings & Lambda Expressions (8 Lectures)

**Event Handling:** Two Event Handling Mechanisms, The Delegation Event Model, Event Classes, Sources of Events, Event Listener Interfaces, Using the Delegation Event Model, Adapter Classes, Inner Classes.
Swing: Introducing Swing.
**Lambda Expressions:** Fundamentals, Block Lambda expressions, Passing Lambda Expressions as Argument, Lambda Expressions and Exceptions, Method References.

| | |
|---|---|
| • Pedagogy/<br>Course delivery tools | ➢ Chalk and talk, Power point presentation, Videos |
| • Links | ➢ https://nptel.ac.in/courses/106105191 |
| • Lab Component /<br>Practical Topics | ➢ Java Programs on GUI programming, event handling and lambda expressions |

Suggested Learning Resources

**Text Books:**

1. Object-Oriented Analysis And Design With applications, Grady Booch, Robert A Maksimchuk, Michael W Eagle, Bobbi J Young, 3rd Edition, 2013, Pearson Education, ISBN :97881317228793.
2. The Complete Reference-Java, Herbert Schildt, 12<sup>th</sup> Edition, 2021, TMH Publications, ISBN: 9781260463415.

**Reference Books:**

1. Head First Java, Kathy Sierra and Bert Bates, 2nd Edition, 2014, Oreilly Publication , ISBN :978817366602

**Course Outcomes (COs):**

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

1. Examine the fundamental elements of object model and identify classes and objects for object oriented programming. (PO-2,3,5PSO-3)
2. Explore the OOP principles and basic constructs of Java language. (PO-2,3,5PSO-3)
3. Develop java programs using inheritance, interfaces and packages. (PO-2,3,5PSO-3)
4. Explore the exception handling mechanism and thread synchronization. (PO-2,3,5PSO-3)
5. Design the GUI application using swings and handle the interactions. (PO-2,3,5PSO3)

**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 will be taken for 30 marks** | | |
| **Other Components** | | |
| Quiz –I | 10 | CO1,CO2, and CO3 |
| Quiz –II | 10 | 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 Quiz-II** | | |
| **Semester End Examination (SEE)** | | |
| Course End Examination (Answer One full question from each Unit-Internal Choice) | 100 | CO1, CO2, CO3 CO4 and CO5 |

| DISCRETE MATHEMATICAL STRUCTURES | |
|---|---|
| **Course Code: CS35** | **Credits: 2:1:0** |
| **Pre-requisites: NIL** | **Contact Hours: 28L+14T** |
| **Course Coordinator: Dr. Geetha J** | |

## Course Contents

### Unit I
**Logics and Proofs (9 Lectures)**

**Logics and Proofs**: The laws of Logic, Logical implication, Rules of inference, Quantifiers, Proofs of theorems.

- Pedagogy/ Course delivery tools
  - ➢ Chalk and talk, Power point presentation, Videos
- Links
  - ➢ https://onlinecourses.nptel.ac.in/noc22_cs123

### Unit II
**Relations (8 Lectures)**

**Relations**: Relations, Properties of relations, Computer Recognition- Zero-one Matrices and directed Graphs, Equivalence Relations and partitions. POSETS, Hasse Diagrams, Lattices.

- Pedagogy/ Course delivery tools
  - ➢ Chalk and talk, Power point presentation, Videos
- Links
  - ➢ https://onlinecourses.nptel.ac.in/noc22_cs123

### Unit III
**Combinatorics (8 Lectures)**

**Combinatorics:** Fundamentals of counting, permutation, combination, Combination with repetition, Binomial Coefficient, Principle of inclusion and exclusion, Pigeon hole principle. The Principle of Inclusion and Exclusion: The Principle of Inclusion and Exclusion, Generalizations of the Principle, Derangements – Nothing is in its Right Place, Rook Polynomials.

- Pedagogy/ Course delivery tools
  - ➢ Chalk and talk, Power point presentation, Videos
- Links
  - ➢ https://onlinecourses.nptel.ac.in/noc22_cs123

### Unit IV
**Graph Theory (9 Lectures)**

**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://onlinecourses.nptel.ac.in/noc22_cs123

## Unit V
### Applications of Graphs and Trees (8 Lectures)

**Applications of Graphs and Trees:** Network flow problems, flows and source/sink cuts, Ford Fulkerson algorithm, Max- flow min-cut theorem, Definitions, Properties, and Examples, Routed Trees, Trees and Sorting, Weighted Trees and Prefix Codes. Applications of Graphs and Trees.

- Pedagogy/ Course delivery tools
  - ➢ Chalk and talk, Power point presentation, Videos
- Links
  - ➢ https://onlinecourses.nptel.ac.in/noc22_cs123

## Suggested Learning Resources

**Text Books:**

1. Ralph P. Grimaldi: Discrete and Combinatorial mathematics, 5th Edition, PHI/ Pearson Education, 2015.
2. Kenneth H. Rosen: Discrete Mathematics and its Applications, 7th Edition, McGraw Hill publications.
3. Douglas B. West, Introduction to Graph Theory, Second Edition, Prentice-Hall.

Reference Book:

**1.**

## Course Outcomes (COs):

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

Course Assessment and Evaluation

| Continuous Internal Evaluation (CIE) : 50 Marks | | |
|---|---|---|
| **Assessment Tools** | **Marks** | **Course Outcomes (COs) addressed** |
| Internal Test-I (CIE-I) | 30 | CO1,CO2, and CO3 |
| Internal Test-II CIE-II) | 30 | CO4, and CO5 |
| **Average of the two CIE will be taken for 30 marks** | | |
| **Other Components** | | |
| Quiz –I | 10 | CO1,CO2, and CO3 |
| Quiz –II | 10 | 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 Quiz-II** | | |
| **Semester End Examination (SEE)** | | |
| Course End Examination (Answer One full question from each Unit- Internal Choice) | 100 | CO1, CO2, CO3 CO4 and CO5 |

## Data Structures Laboratory

**Course Code: CSL36**
**Pre-requisites: C Programming Course**
**Coordinator: Dr. Sangeetha J**

**Credits: 0 : 0 :1**
**Contact Hours: 14P**

Course Contents

| Sl. No. | Topics Covered |
|---------|----------------|
| 1. | Illustrating Pointers for data operations |
| 2. | Examining Dynamic memory allocations |
| 3. | Managing Structures in applications |
| 4. | Organizing Stacks in programs |
| 5. | Constructing Queues for applications |
| 6. | Implement circular queues |
| 7. | Implement Multiple stacks and queues |
| 8. | Usage of doubly linked list in applications |
| 9. | Setting up Linked lists for data set operations |
| 10. | Binary Tree traversals |
| 11. | Graphs representation and traversals |
| 12. | Developing applications to solve Graph based problems |

**Note: Each Lab Session is of two hours duration/week**

### Suggested Learning Resources

**Text Books:**
**1.** Horowitz, Sahni, Anderson-Freed: Fundamentals of Data Structures in C, 2nd Edition, Universities Press, 2008**.**

Reference Books:
1. Narasimha Karumanchi: Data Structures And Algorithms Made Easy: Data Structures And Algorithmic Puzzles, Career monk Publications, 5th Edition, 2016
2. Yedidyah, Augenstein, Tannenbaum: Data Structures Using C and C++, 2nd Edition, Pearson Education, 2003.
3. Data Structures, Seynour Lipschutz and GAV Pai, Schaum's Outlines, McGraw Hill, 2008.
4. Richard F. Gilberg and Behrouz A. Forouzan: Data Structures- A Pseudocode Approach with C, Cengage Learning,2005

**Course Outcomes (COs):**

At the end of the course, the students will be able to:
1. Develop programming solutions for real time problems using dynamic memory allocation, structures, and strings. (PO-1,2,3,PSO-2)
2. Develop programming solutions for real time applications using stack, Queues and linked lists (PO-1,2,3, PSO-2)
3. Designhierarchicalbasedprogrammingsolutionsusingdifferenttreetraversaltechniquesandgraphtheory(PO-1,2,3,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 |

## OBJECT ORIENTED PROGRAMMING LABORATORY

**Course Code: CSL37**                                            **Credits: 0:0:1**
**Pre-requisites: C Programming Course**                          **Contact Hours: 14P**
**Coordinator: Pramod Sunagar**

Course Contents

| Sl. No. | Topics Covered |
|---------|----------------|
| 1. | Primitive Data type and Operators |
| 2. | Control Statements and Arrays |
| 3. | Classes, objects, static variables |
| 4. | Method overloading, method overriding |
| 5. | Dynamic method dispatch, abstract classes |
| 6. | Inheritance |
| 7. | Interfaces & Packages |
| 8. | String handling |
| 9. | Exception Handling |
| 10. | Multi-threading |
| 11. | Synchronizing the threads |
| 12. | Event Handling |
| 13. | Programs on Swings |
| 14. | Lambda Expressions |

**Note: Each Lab Session is of two hours duration/week**


**Suggested Learning Resources**

**Reference Books/ Web Links:**

1. The Complete Reference - Java, Herbert Schildt, 12th Edition, 2021, TMH Publications, ISBN: 9781260463415.
2. Head First Java, Kathy Sierra and Bert Bates, 3rd Edition, 2022, O'Reilly Publication, ISBN:9781491910771


## Course Outcomes (COs):

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

1. Develop Java applications using OOP principles. (PO-2,3,5PSO-3)
2. Design real world applications using multi-threading and exception handling mechanism. (PO-2,3,5PSO-3)
3. Develop interactive GUI applications using Swings. (PO-2,3,5PSO-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 |

| Universal Human Value Course |
|---|

**Course Code**:UHV38**Credits:** 2:0:0          **Pre-requisites:** Nil

C**ontact Hours**: 28L

**Course Coordinators:** Department Faculty

# Course Objectives

**This introductory course input is intended**

- To help the students appreciate the essential complementarily 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 toward 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.

# Course contents

| **UNIT –I: Course Introduction - Need, Basic Guidelines, Content and Process for Value Education (6 Lectures)** | |
|---|---|
| 1. Understanding the need, basic guidelines, content and process for Value Education | |
| 2. Self-Exploration–what is it? – it's 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: <br> • Lab component / Practical Topics: <br> • Links: Holistic Development and Role of Education | ➢ Chalk and talk, PowerPoint presentation, Videos. <br> ➢ Survey/polls for self-exploration <br> ➢ https://youtu.be/sGZtTPe-lhQ |

| **UNIT—II: Understanding Harmony in the Human Being - Harmony in Myself!** <br> **(6 Lectures)** |
|---|
| 1. Understanding human beings 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, the 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:<br>• Lab component / Practical Topics:<br>• Links: Harmony in Human Being-Self and Body<br>• Links: Harmony in Human Being-Self<br>• Links: Harmony between Self and Body Prosperity | ➢ Chalk and talk, PowerPoint presentation, Videos.<br>➢ Survey and polls for self-exploration<br>➢ **https://youtu.be/0ERSMkRPQBM**<br><br>➢ **https://youtu.be/83oGJ4oDeIg**<br><br>➢ **https://youtu.be/aJ_BU2OgpKs** |

**UNIT—III: Understanding Harmony in the Family and Society- Harmony in Human- Human Relationship                                                                                          (6 Lectures)**

1. *Understanding Harmony in the family – the basic unit of human interaction.*
2. Understanding values in a human-human relationship; the meaning of Nyaya and the 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*, the Difference between respect and differentiation; the other salient values in the relationship.
5. Understanding the harmony in the society (society being an extension of the family): *Samadhan, Samridhi, Abhay, Sah-astitva* as comprehensive Human Goals.
6. Visualizing a universal harmonious order in society- Undivided Society (*AkhandSamaj),* 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:<br>• Lab component / Practical Topics:<br>• Links: Harmony in Family- Trust<br>• Links: Harmony in family- Respect<br>• Links: Harmony in family- Other Feeling Justice<br> • Links: Harmony in the Society | ➢ Chalk and talk, Power point presentation, Videos.<br>➢ Survey and polls for self-exploration<br>➢ https://youtu.be/F2KVW4WNnS8<br>➢ https://youtu.be/iLqNRPuv0_8<br>➢ https://youtu.be/TcYJB7reKnM<br>➢ https://youtu.be/BkWgFinrnPw |

**UNIT—IV: Understanding Harmony in the Nature and Existence - Whole existence as Co-existence (4 Lectures)**

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:<br>  Lab component / Practical Topics:<br>• Links: Harmony in Nature<br>• Links: Harmony in Existence | ➢ Chalk and talk, PowerPoint presentation, Videos.<br>➢ Survey and polls for self-exploration<br>➢ https://youtu.be/K1Jpd_ojydw<br>➢ https://youtu.be/mormUeZ_RUE |

**UNIT –V: Implications of the above Holistic Understanding of Harmony on Professional Ethics                                                                                          (6 Lectures)**

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: <br> • Lab component / Practical Topics: | ➢ Chalk and talk, Power point presentation, Videos. <br> ➢ 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. Reprinted2008.
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 Vidyaek 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
3. Course handouts: https://drive.google.com/drive/folders/1zioX_4L2fCNX4Agw282PN86pcZZT3Osr?usp=sharing

| **Kannada kali** |
| --- |
| **Course Code**:HS391**Credits:** 1:0:0      **Pre-requisites:** Nil<br>C**ontact Hours**: 14L<br>**Course Coordinators:** Mrs. KanyaKumari.S |

## Unit: I

**(Parichaya)** - **Introduction**
Kannada Bhashe - About Kannada Language, Eight Kannada Authors – Jnanpith 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**
Naama padagaLu – Sarvanama padagaLu– (Nouns -Pronouns) and its usage in Kannada

      Kannada nama visheshanagaLu - (Adjectives-Interrogatives)

kriyapadagaLu, kriyavisheshaNagaLu- (verb-adverb)
SambhashaneyalliPrashnarthakapadagalu –vaakyagaLumattukriyapadagaLu- visheshaNagaLu (Kannada-Interrogative words & Sentences and verb-adverb in Conversation)

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

## Unit: III.

**Kannada BhasheyalliSambhashanegalu- Conversations in Kannada**
SamanyaSambhashaneyalliKannadadaPadagalumattuVaakyagalu**.**
(Kannada Words and Sentencesin General Conversation with activities)
sambhashaNe: (Conversation with Friends- Teachers, between Friends)

 (Conversation in Shop, Hostel, Market, Bus and Train)
Shabdakosha**:** Vocabulary– chaTuvaTike: Exercises
Vicharaneya / Bedikeyavakyagalu (Enquiry /Request sentences in Conversation)
Sambhashane Conversation with House Owner and Room mate
Shabdakosha– Vocabulary- Exercises to test their knowledge of understanding the Language.

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

Kannada padagaLu

(eakavachana,bahuvachanagaLu,viruddapadagaLudinanityadallibaLasuvapadagaLumattusankyavyavaste

SambhashaneyalliEakavachanamattuBhahuvachana-    (Singular    and    Plural    nouns)    Conversation-
SambhashaneyalliLingarupagaLu- Genders inConversation
Viruddhapadagalu /Virodarthakapadagalu (Antonyms)AsamanjasaUchcharane(Inappropriate Pronunciation)
SankhyaVyavasthe(Numbers  system)-Samaya /KalakkeSambhandhisidapadhagalu(Words  Relating  to  time)–
Dikkugaligesambhadisidapadhagalu (Words Relatingto Directions)
AaharakkesambandisidapadagaLu(Names connected with food)

Manavanashareeradabhagagalu / Angagalu (Parts of the Human body) ManavaSambhandhada da
padhagalu(Terms Relating to Human Relationship)
ManavanaBhavanegaligesambandisidaPadagalu(Words Relating to Human's feelings andEmotions)
VaasadastaLakkesambhandisidanthahapadhagalu (Words Relating to place of leaving)

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

**Kannada aksharamaale(Kannada alphabets and their practices with pronunciations)**
swaraaksharagaLu –vyanjanaksharagaLu- gunitaksharagaLu, tantragnanamattuAaDalitapadagaLu-Technical and
administrative worlds in Kannada

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

**Text Book:**

Dr.L.Thimmesh., Prof.  Keshavamuurthy, 'BaLakekannada' prasarangaa, VTU,2020

**Reference Books:**

1. Smt. KanyaKumari.S–'Kannada Kali ' Kinnari publications' First edition, Bengaluru,2022
2. LingadevaruHalemane – 'Kannada Kali', Prasarangakannada University Hampi, 6rd Edition. 2019

**Course out comes (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 listing & 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 | CO4 & CO5 |
| avarege of the two internal test two will be taken for 30 marks | | |
| Other components | | |
| Assignment | 10 | CO1,Co2 |
| quiz | 10 | CO3, CO4 & CO5 |
| Semester end examination: | 100 | CO1,Co2 , CO3, CO4 & CO5 |

# ಕನ್ನಡಮನಸು

**Course Code**:HS391**Credits:** 1:0:0        **Pre-requisites:** Nil

**Contact Hours**: 14L

**Course Coordinators: Mrs. Kanya Kumari.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

ಘಟಕ — ೨ (Unit-2)

**ಕೀರ್ತನೆಮತ್ತುತತ್ವಪದಗಳು**

ಪುರಂದರ ದಾಸರು ಮತ್ತು ಕನಕದಾಸರ ಪದಗಳು

ಶಿಶುನಾಳ ಶರೀಫರು ಮಹಾಂತ ಶಿವಯೋಗಿಗಳ ಪದಗಳು

ಜನಪದ ಗೀತೆ

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

ಘಟಕ — ೩ (Unit-3)

**ಆಧುನಿಕ ಕಾವ್ಯಗಳು**

ಮಂಕುತಿಮ್ಮನ ಕಗ್ಗ

ಕುರುಡು ಕಾಂಚಾಣ|

ಚೋಮನ ಮಕ್ಕಳ ಹಾಡು

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

ಘಟಕ -೪ (Unit-4)

**ತಾಂತ್ರಿಕ ಧುರೀಣರು( ವ್ಯಕ್ತಿ ಪರಿಚಯ) ಕಥೆ-ಪ್ರವಾಸ ಕಥನ**

ಡಾ.ಸರ್.ಎಂ.ವಿಶ್ವೇಶ್ವರಯ್ಯ-ವ್ಯಕ್ತಿ ಮತ್ತು ಬತಿಹ್ಯ — ಎ.ಎನ್.ಮೂರ್ತಿರಾಯರು

ಯುಗಾದಿ -ವಸುಧೇಂದ್ರ

ಮೆಗಾನೆ ಎಂಬ ಗಿರಿಜನ ಪರ್ವತ -ಹಿ.ಚಿ.ಬೋರಲಿಂಗಯ್ಯ

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

ಘಟಕ- ೫ (Unit-5)

ಕರಕುಶಲ ಕಲೆಗಳು    ತಾಂತ್ರಿಕ ವಿಜ್ಞಾನ (technical science )

ಕರಕುಶಲ ಕಲೆಗಳು    ಮತ್ತು ಪರಂಪರೆ ವಿಜ್ಞಾನ- ಕರಿಗೌಡ ಬೇಚನ ಹಳ್ಳಿ


ಕಂಪ್ಯೂಟರ್ ಹಾಗು ಮಾಹಿತಿ ತಂತ್ರಜ್ಞಾನ-
ಕೆ  ಮತ್ತು  ಬಿ ಬರಹ ತಂತ್ರಾಂಶಗಳು ಮತ್ತು .ಕಂಪ್ಯೂಟರ್ ಮುಖಾಂತರ ಕನ್ನಡ ಟೈಪಿಂಗ್
ತಾಂತ್ರಿಕ ಪದಕೋಶ ತಾಂತ್ರಿಕ ಹಾಗು ಬಾರಿಭಾಷಿಕ ಕನ್ನಡ ಪದಗಳು


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


ಪಠ್ಯ ಪುಸ್ತಕ (text book):


ಸಾಂಸ್ಕೃತಿಕ ಕನ್ನಡ
ಸಂಪಾದಕರು :
ಡಾ.ಹಿ.ಚಿ, ಬೋರಲಿಂಗಯ್ಯ -ವಿಶ್ರಾಂತ ಕುಲಪತಿಗಳು, ಕನ್ನಡ ವಿಶ್ವವಿದ್ಯಾಲಯ ,ಹಂಪಿ,ಪ್ರಸಾರಂಗ ವಿಶ್ವೇಶ್ವರಯ್ಯತಾಂತ್ರಿಕ
ವಿಶ್ವವಿದ್ಯಾಲಯ,ಬೆಳಗಾವಿ,ಪ್ರಥಮ  ಮುದ್ರಣ-2020
ಪೂರಕ ಪಠ್ಯ (reference book )ಕನ್ನಡ ಮನಸು, ಪ್ರಸಾರಂಗ - ಕನ್ನಡ ವಿಶ್ವವಿದ್ಯಾಲಯ-ಹಂಪಿ,ಆರನೇಮುದ್ರಣ  2016



ಕನ್ನಡಕಲಿಕೆಯಉದ್ದೇಶಗಳು:
- ಸಾಂಸ್ಕೃತಿಕಕನ್ನಡದಜೊತೆಗೆಕ್ರಿಯಾತ್ಮಕ ,ಸಾಹಿತ್ಯ,
  ಸಂಸ್ಕೃತಿಮತ್ತುನಾಡುನುಡಿಯಪರಿಚಯಮಾಡಿಕೊಡುವುದು . (PO6)
- ಕನ್ನಡಭಾಷೆಯವ್ಯಾಕರಣ, ಭಾಷಾರಚನೆಯನಿಯಮಗಳನ್ನುಪರಿಚಯಿಸುವುದು . (PO10)

- ಕನ್ನಡಭಾಷಾಬರಹದಲ್ಲಿಕಂಡುಬರುವದೋಷಗಳು ,ಅವುಗಳನಿವಾರಣೆ. (PO10)
- ಸಾಮಾನ್ಯಅರ್ಜಿಗಳು, ಸರ್ಕಾರಿಹಾಗೂಅರೆಸರ್ಕಾರಿಪತ್ರವ್ಯವಹಾರದಬಗ್ಗೆಅರಿವುಮೂಡಿಸುವುದು .
  (PO12)
- ಭಾಷಾಂತರಮತ್ತುಪ್ರಬಂಧರಚನೆಬಗ್ಗೆಆಸಕ್ತಿಮೂಡಿಸುವುದುಮತ್ತು
  ಕನ್ನಡಭಾಷಾಭ್ಯಾಸ, ಸಾಮಾನ್ಯಕನ್ನಡಹಾಗುಆಡಳಿತಕನ್ನಡದಪದಗಳಪರಿಚಯಮಾಡಿಕೊಡುವುದು
  (PO12)


**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 | CO4 & CO5 |
| AVAREGE OF THE TWO INTERNAL TEST TWO WILL BE TAKEN FOR 30 MARKS | | |
| Other components | | |
| Assignment | 10 | CO1,Co2 |
| quiz | 10 | CO3, CO4 & CO5 |
| | | |
| Semester end examination: | 100 | CO1,Co2 , CO3, CO4 & CO5 |

## ADDITIONAL MATHEMATICS - I

**Course Code**: AM31      **Credits:** 0:0:0      **Pre-requisites:** Nil
**Contact Hours**: 40
**Course Coordinators:** Dr. N. L. Ramesh

### UNIT-I

**Differential Calculus**: Successive differentiation, $n^{th}$ derivatives of some standard functions, Leibnitz theorem, Polar curves. Angle between the radius vector and the tangent, angle between curves, length of the perpendicular from pole to the tangent, pedal equations. Taylor's and Maclaurin's expansions.

### UNIT-II

**Integral Calculus:** Introduction, Reduction formula, Reduction formula for $\int sin^n x\, dx$, Reduction formula for $\int cos^n x\, dx$, Reduction formula for $\int sin^n x cos^m x\, dx$, Evaluation of double and triple integrals.

### UNIT-III

**Vector Algebra**: Scalar and vectors. Vector addition and subtraction. Multiplication of vectors (Dot and Cross products). Scalar and vector triple product-simple problems. Vector functions of a single variable. Derivative of a vector function, geometrical interpretation. Velocity and acceleration.

### UNIT-IV

**Vector Differentiation**: Scalar and vector fields, gradient of a scalar field, directional derivative, divergence of a vector field, solenoidal vector, curl of a vector, irrational vector, Laplace's operator. Vector identities connected with gradient, divergence and curl.

### UNIT-V

**First Order Differential Equations**: Solution of first order and first degree differential equations, variable separable methods, homogeneous equations, linear and Bernoulli's equations, exact differential equations.

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

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

**Course Outcomes (COs):**
At the end of the course, students will be able to-
1. Find the length of the perpendicular from pole to tangent and determine the series expansion of differentiable functions (PO-1, 2)
2. Evaluate multiple integrals (PO-1, 2)
3. Analyze and solve problems related to Vector Algebra. (PO-1, 2)
4. Apply vector differentiation to identify solenoidal and irrotational vectors. (PO-1, 2)
5. Solve the first order and first degree ordinary differential equations. (PO-1, 2)

| Numerical Techniques and Probability Models | |
|---|---|
| **Course Code: CS41** | **Credits: 2:1:0** |
| **Pre-requisites: Calculus and Basic Probability** | **Contact Hours:** |
| **Course Coordinator: Dr. Govindaraju M V and Dr. R Suresh Babu** | **28T+14T** |

## 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 1/3rdruleandSimpson's 3/8thrule.

- 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.

**Discrete 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

**Continuous 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, Power Point 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 : $\infty$ /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 : $\infty$ /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 deliverytools
  - ➢ 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/

### Text Books:
1. B.S.Grewal-Higher Engineering Mathematics-Khanna Publishers–44[th]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 -10[th]edition-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:

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

| Microcontrollers & IOT |
|---|

| | |
|---|---|
| **Course Code: CS42** | **Credits: 2:0:1** |
| **Pre-requisites: Electronics** | **Contact Hours: 28T+14L** |
| **Course Coordinator: Veena.G.S. /Dr. Divakar Harekal** | |

## Course Contents

### Unit - I
### Introduction to Microcontrollers and IOT (5 Lectures)

**Introduction to Cortex M0**: General discussion on Microcontrollers, Cortex-M0 Technical Overview, System Features, implementation Features, Debug Features, Programming model, Operation Modes and States, Architecture, Registers and Special Registers Behaviors of the Application Program Status Register (APSR), Memory System Overview. Introduction to Cortex-M0 Programming, Stack memory operation.

- Pedagogy/ Course delivery tools
  - ➢ Chalk and talk, Power point presentation, Videos

- Lab Component / Practical Topics
  - ➢ Introduction to keil software, Use of simulation

### Unit II
### Instruction Set: Cortex M0 (6 Lectures)

**Instruction Set:** Instruction Set, Instruction Usage Examples, implementation of various structures like loop, switch, functions, and subroutines. Memory System, Exceptions and Interrupts, Interrupt Control and System

- Pedagogy/ Course delivery tools
  - ➢ Chalk and talk, Power point presentation, Videos

- Lab Component / Practical Topics
  - ➢ Introduction to keil software, Use of simulation

### UnitIII
### Smart Objects (6 Lectures)

**Smart Objects**: The "Things" in IoT, Sensors, Actuators, and Smart Objects, Workflow of a Sensor in a typical system, Classification of Sensors, Sampling DAC and ADC conversion. Introduction to Actuators: Workflow of an Actuator in a typical system, Classification of Actuators. Types of Sensors, Interfacing concepts to embedded systems.

- Pedagogy/ Course delivery tools
  - ➢ Chalk and talk, Power point presentation

- Link
  - ➢ https://onlinecourses.nptel.ac.in/noc22_cs53/

- Lab Component / Practical Topics
  - ➢ C-Programming-One and Two-dimensional arrays, character arrays, and strings

<h1 style="text-align:center">Unit IV</h1>
<h3 style="text-align:center">IoT Network and Transport layer handling (5 Lectures)</h3>

IoT Access Technologies. IP as the IoT Network Layer, The Business Case for IP, The need for Optimization Low Bandwidth Wireless Networks: FSK, LoRa modulation basics, LoRaWAN basics. Optimizing IP for IoT: HTTP, AMQP, MQTT and STOMP. Profiles and Compliances, Application Protocols for IoT, the Transport Layer, IoT Application Transport Methods.

| | |
|---|---|
| • Pedagogy/ Course delivery tools | ➢ Power point presentation, Demo of Sensor and actuator utility |
| • Link | ➢ https://onlinecourses.nptel.ac.in/noc22_cs53/ |
| • Lab Component / Practical Topics | ➢ Use of Node MCU and NodeRed |

<h1 style="text-align:center">Unit V</h1>
<h3 style="text-align:center">Programming IoT Physical Devices and Endpoints (6 Lectures)</h3>

Programming IoT Physical Devices and Endpoints – Raspberry Pi: Introduction to Raspberry Pi, About the Raspberry Pi Board: Hardware Layout, Operating Systems on Raspberry Pi, Configuring Raspberry Pi, Programming Raspberry Pi with Python, Connecting Raspberry Pi via SSH, Smart and Connected Cities, An IoT Strategy for Smarter Cities, Smart City IoT Architecture, Smart City Security Architecture, Smart City Use-Case Examples.

| | |
|---|---|
| • Pedagogy/ Course delivery tools | ➢ Power point presentation, Demo using Raspberry pi board and sensors |
| • Link | ➢ https://onlinecourses.nptel.ac.in/noc22_cs53/ |
| • Lab Component / Practical Topics | ➢ Usage of raspberry pi with MQTT , HTTP , Ethernet and Wi-Fi for IoT Projects |

Laboratory Experiments. Tutorial
Sessions (Each Session is of 2 Hours
Duration/Week)

| Session No. | Topics Covered |
|---|---|
| 1. | Study of simple GPIO programs to use the ports. |
| 2. | Study of simple GPIO programs to use the ports. |
| 3. | Study use of interrupts and peripherals like LCD 16x2. |
| 4. | Study use of interrupts and peripherals like Keyboard |
| 5. | Study of ADC programs Keyboard, seven segments. |
| 6. | Study of ADC programs and graphical LCD 128x64. |
| 7. | Study use of PWM |
| 8. | Study of Rasberry Pi features and program to light led using GPIO |
| 9. | Study of Rasberry Pi with SSH |

| 10. | Study use of Timer with interrupt |
|-----|-----------------------------------|
| 11. | Study of Node MCU wireless features. |
| 12. | Study of Node MCU wireless features |
| 13. | Project IOT/ECS |
| 14. | Project IOT/ECS |

<p align="center"><strong>Suggested Learning Resources</strong></p>

**Text Books:**

1. Joseph Yiu, "The Definitive Guide to the ARMCortex-M0",1st edition, Newnes – an imprintt of Elsevier, 2011.
2. Vijay Madisetti and Arshdeep Bahga, "Internet of Things (A Hands-on-Approach)", 1st Edition, VPT, 2014. (ISBN:978-8173719547)
3. Srinivasa K G, Siddesh G.M and HanumanthaRaju R ―Internet of Things, CENGAGE Leaning India, 2017. (ISBN:978-93-868-5895-5).

## Reference Books:

1. Designing the Internet of Things by Adrian McEwen Smart Cities, Software above the level of a single device, Ebooks on IoT by O'Reilly
2. Sentilo middlewarehttp://www.sentilo.io/xwiki/bin/view/Sentilo.About.Product/Whatis
3. Mosquitto broker https://mosquitto.org/
4. Getting started with raspberry pihttps://www.raspberrypi.org/resources/learn/
5. Wired peripheral protocolshttp://www.comm.pub.ro/dicm/C7_Serial_Bus.pdf
6. LoRa Modulationhttp://www.semtech.com/images/datasheet/an1200.22.pdf

## Course Outcomes (COs):

At the end of the course the student should be able to
1. Evaluate microcontroller architecture, (cortexM0 Overview), evaluate operation Modes and States using special purpose registers.(PO-1,2, 3, 4,PSO-1)
2. Evaluate cortex M0 in assembly instructions and be able program in assembly level programs using CMSIS features. (PO-3,4,5,12,PSO-2)
3. Compare and contrast the deployment of smart objects and the technologies to connect them to network. (PO-3,4,5,12,PSO-2)
4. Use of Various network and application protocols for IoT (PO-3,4,5,12, PSO-2)
5. Developing a perspective for IoT Applications in various domains. (PO-3,4,5,12, PSO-2)

## Course Assessment and Evaluation

| **Continuous Internal Evaluation (CIE) : 50 Marks** | | |
|---|---|---|
| **Assessment Tools** | **Marks** | **Course Outcomes (COs) addressed** |
| Internal Test-I (CIE-I) | 30 | CO1,CO2, and CO3 |
| Internal Test-II CIE-II) | 30 | CO4, and CO5 |
| **Average of the two CIE will be taken for 30 marks** | | |
| **Other Components** | | |
| Laboratory Test and Laboratory datasheet evaluation | 10 | CO1,CO2, and CO3 |
| Quiz | 10 | CO4, and CO5 |
| **The Final CIE out of 50 Marks = Average of two CIE tests for 30 Marks+ Marks scored in Laboratory Test +Marks scored in Quiz** | | |
| **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: CS43** | **Credits: 3:0:0** |
| **Pre-requisites: Data Structures & Programming** **Language** | **Contact Hours: 42L** |
| **Course Coordinator: Pramod Sunagar** | |

## Course Content

### Unit I
**Introduction and Basics of algorithm analysis (8 Lectures)**

**Introduction: Some Representative Problems**. A First Problem: Stable Matching, Five Representative Problems. **Basics of Algorithm Analysis**: Computational Tractability, Asymptotic Order of Growth, Implementing the Stable Matching Algorithm Using Lists and Arrays, A Survey of Common Running Times. (T1: Chapter 1 & 2). Mathematical Analysis of Non-recursive and Recursive Algorithms. (T2: Chapter 2)

- Pedagogy/ Course delivery tools
  - ➢ Chalk and talk, Power point presentation, Videos
- Link
  - ➢ https://nptel.ac.in/courses/106106131
- Lab Component / Practical Topics
  - ➢ Asymptotic notation, computing running time of the algorithms

### Unit II
**Graphs & Divide and Conquer (8 Lectures)**

**Graphs:** Graph Connectivity and Graph Traversal: Breadth-First Search, Exploring a Connected Component, Depth-First Search, Implementing Graph Traversal Using Queues and Stacks, Testing Bipartiteness: An Application of Breadth-First Search, Connectivity in Directed Graphs, Directed Acyclic Graphs and Topological Ordering (T1: Chapter3).

**Divide and Conquer**: A First Recurrence: The Merge sort Algorithm, Counting Inversions (T1: Chapter 5), Quick sort (T2: Chapter 5).

- Pedagogy/ Course delivery tools
  - ➢ Chalk and talk, Power point presentation, Videos
- Link
  - ➢ https://nptel.ac.in/courses/106106131
- Lab Component / Practical Topics
  - ➢ Programs on BFS, DFS, Merge sort, Counting inversion, Quicksort

## Unit III
### Greedy Algorithms (9 Lectures)

**Greedy Algorithms**: Interval Scheduling: The Greedy Algorithm Stays Ahead, Scheduling to Minimize Lateness: An Exchange Argument, Optimal Caching: A more Complex Exchange Argument, Shortest Paths in a Graph, The Minimum Spanning Tree Problem, Prims & Kruskal algorithms, Huffman Codes and Data Compression (T1: Chapter4).

- Pedagogy/
  Course delivery tools
  - ➢ Chalk and talk, Power point presentation, Videos

- Link
  - ➢ https://nptel.ac.in/courses/106106131

- Lab Component /
  Practical Topics
  - ➢ Programs on Prims, Kruskal, Dijkstra's algorithms

## Unit IV
### Dynamic Programming (9 Lectures)

**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 and the Ford-Fulkerson Algorithm: The problem, Designing the Algorithm, Survey Design: The problem, Designing the Algorithm, Analyzing the Algorithm, Airline Scheduling: The problem, Designing the Algorithm, Analyzing the Algorithm (T1: Chapter 6 & 7).

- Pedagogy/
  Course delivery tools
  - ➢ Chalk and talk, Power point presentation, Videos

- Link
  - ➢ https://nptel.ac.in/courses/106106131

- Lab Component /
  Practical Topics
  - ➢ Programs on Weighted interval scheduling, Knapsack, Subset sum and Belman ford algorithm

## Unit V
### NP and Computational Intractability (8 Lectures)

**NP and Computational Intractability**: Polynomial-Time Reductions A First Reduction: Independent Set and Vertex Cover, Reducing to a More General Case: Vertex Cover to Set Cover, NP-Complete Problems: Circuit Satisfiability: A First NP-Complete Problem, General Strategy for Proving New Problems NP-Complete, Sequencing Problems: The Traveling Salesman Problem, The Hamiltonian Cycle Problem (T1: Chapter 8). Backtracking: n-Queens Problem (T2: Chapter 12)

- Pedagogy/
  Course delivery tools
  - ➢ Chalk and talk, Power point presentation, Videos

- Link
  - ➢ https://nptel.ac.in/courses/106106131

- Lab Component /
  Practical Topics
  - ➢ Programs on Traveling salesman problem and n-Queens problem

**Suggested Learning Resources**

**Text Books:**

1. Jon Kleinberg and Eva Tardos: Algorithm Design, Pearson, 1st Edition (2013).
2. Anany Levitin: Introduction to the Design & Analysis of Algorithms, 3rd Edition, Pearson Education, 2012. ISBN:9780132316811

Reference Books:

1. Ellis Horowitz, Sartaj Sahni and S Rajasekaran: Fundamentals of Computer Algorithms, 2nd Edition, Universities Press, 2017. ISBN: 9788173716126

Video Lectures (e-Resources)

1. https://a.impartus.com/ilc/#/course/270273/452

**Course Outcomes (COs):**

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

1. Define the basic concepts and analyze worst-case running times of algorithms using asymptotic analysis. (PO- 1, 2, 3, 4, 12PSO-2)
2. Illustrate the design techniques for graph traversal and analyze their complexity. (PO-1, 2, 3, 4, 12PSO-2)
3. Illustrate the design techniques for divide and conquer algorithms and analyze their complexity by solving recurrence relations. (PO-1, 2, 3, 4, 12PSO-2)
4. Illustrate Greedy paradigm and Dynamic programming paradigm using representative algorithms. (PO-1, 2, 3, 4, 12PSO-2)
5. Describe the classes P, NP, and NP-Complete and be able to prove that a certain problem is NP-Complete and examine the techniques of proof by contradiction, mathematical induction and recurrence relation, and apply them to prove the correctness of the algorithms. (PO-1, 2, 3, 4, 12PSO-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, and CO3 |
| Internal Test-II CIE-II) | 30 | CO4, and CO5 |
| **Average of the two CIE will be taken for 30 marks** | | |
| **Other Components** | | |
| Quiz -I | 10 | CO1,CO2, and CO3 |
| Quiz -II | 10 | 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 Quiz-II** | | |
| **Semester End Examination (SEE)** | | |
| Course End Examination (Answer One full question from each Unit-Internal Choice) | 100 | CO1, CO2, CO3 CO4 and CO5 |

| Course Code: CS44 | Credits: 3:0:0 |
| --- | --- |
| Pre-requisites: Nil | Contact Hours: 42L |
| Course Coordinator: Dr. Shilpa Chaudhari | |

## Course Contents
### Unit I

Data Communications, Networks, Network Types, Network Models: TCP/IP Protocol Suite, The OSI Model.

**Application Layer**: The Web and HTTP: Overview of HTTP, Non-Persistent and Persistent Connections, HTTP Message Format, User-Server Interaction-Cookies, Web Caching, The Conditional GET. File Transfer- FTP: FTP Commands and Replies, Electronic Mail in the Internet: SMTP, Comparison with HTTP, Mail Access Protocols. DNS—The Internet's Directory Service: Services Provided by DNS, Overview of How DNS Works, DNS Records and Messages, Peer-to Peer Applications: P2P File Distribution.

- Pedagogy /
  Course delivery tools
  - ➢ Chalk and talk, Power point presentation, Videos

- Link
  - ➢ https://nptel.ac.in/courses/106105082
- Lab Component /
  Practical Topics
  - ➢ Wireshark Exercise on HTTP

### Unit II

**Transport layer**: Multiplexing and Demultiplexing, Connectionless Transport-UDP: UDP Segment Structure, UDP Checksum, Go-Back-N, Selective Repeat, Connection-Oriented Transport-TCP: The TCP Connection, TCP Segment Structure, Round-Trip Time Estimation and Timeout, Reliable Data Transfer, Flow Control, TCP Connection Management, TCP congestion control.

- Pedagogy /
  Course delivery tools
  - ➢ Chalk and talk, Power point presentation, Videos

- Link
  - ➢ https://nptel.ac.in/courses/106105082
- Lab Component /
  Practical Topics
  - ➢ Socket Programming

### Unit III

**Network Layer**: Internet Protocol Version 4: IPv4 Addressing, Main and Auxiliary protocols,
**Routing Algorithms**: Distance-Vector (DV) Routing, Link-State Routing, Unicast Routing Protocols: Internet Structure, Routing Information Protocol, Open Shortest Path First.

- Pedagogy /
  Course delivery tools
  - ➢ Chalk and talk, Power point presentation, Videos

- Link
  - ➢ https://onlinecourses.nptel.ac.in/noc22_ee61/preview
- Lab Component /
  Practical Topics
  - ➢ Wireshark Exercise on IP, ICMP, DHCP

### Unit IV

**Data-Link Control**: Framing: Character-Oriented Framing, Bit-Oriented Framing. Error Control: Types of Errors, Block Coding: Error Detection, Hamming Distance, Linear Block Codes: Parity-Check Code. Cyclic Codes: Cyclic Redundancy Check, Point-to-Point Protocol, Media Access Control – Random Access- CSMA, CSMA/CD, CSMA/CA, Controlled access.

- Pedagogy /
  Course delivery tools
  - ➢ Chalk and talk, Power point presentation, Videos

| | |
|---|---|
| • Link | ➢ https://onlinecourses.nptel.ac.in/noc22_ee61/preview |
| • Lab Component / Practical Topics | ➢ Error detection and correction using CRC and Hamming Code. |

**Unit V**

**Local Area Network**: Ethernet: Standard Ethernet, WIFI, IEEE 802.11 project- architecture, MAC sub layer, addressing mechanism.

**Physical layer**: Signals - Analog signals, Digital signals. Signal Impairment -Attenuation and Amplification, Distortion, Data Rate Limits, Performance. Digital Transmission - Digital-to-Digital Conversion, Analog-to-Digital Conversion. Analog Transmission- Digital-to-Analog Conversion, Analog-to-Analog Conversion. Multiplexing: Frequency-Division Multiplexing, Time-Division Multiplexing.

| | |
|---|---|
| • Pedagogy / Course delivery tools | ➢ Chalk and talk, Power point presentation, Videos |
| • Link | ➢ https://onlinecourses.nptel.ac.in/noc22_ee61/preview |
| • Lab Component / Practical Topics | ➢ Multiplexing concepts. |

**Suggested Learning Resources**

**Text Books:**
1. Data Communications and Networking with TCP/IP Protocol Suite, Behrouz A.Forouzan, McGraw Hill, 6th Edition, 2021.
2. James F. Kurose and Keith W. Ross: Computer Networking: A Top-Down Approach, 8th edition, Addison-Wesley, 2021.

**Reference Books:**
1. Data and Computer Communication, William Stallings, 10th Edition, Pearson Education, 2017.
2. Larry L. Peterson and Bruce S Davie: Computer Networks: A Systems Approach, Fifth Edition, Elsevier, 2011.
3. Tanenbaum: Computer Networks, 4th Ed, Pearson Education/PHI, 2018.

**Video Lectures (e-Resources)**
➢ https://a.impartus.com/ilc/#/course/132166/636

**Course Outcomes:**
At the end of the course, the students will be able to:
1. Describe the fundamentals of data communications and various application layer protocols used by TCP/IP reference model. (PO-1, 2, 3, 4, 10, PSO1).
2. Differentiate between connection oriented and connection less services of transport layer (PO-1, 2, 3, 4, 10, PSO1).
3. Solve problems of IP addressing and routing using various routing protocols and algorithms. (PO-1, 2, 3, 4, 10, PSO1).
4. Illustrate error control and media access control protocols of data link layer (PO-1, 2, 3, 4, 10, PSO1).
5. Discuss different types of data transmission techniques. (PO-1, 2, 3, 4, 10, PSO 1).

**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 will be taken for 30 marks** | | |
| **Other Components** | | |
| Quiz -I | 10 | CO1 and CO2 |
| 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 |

| Finite Automata and Formal Languages | |
|---|---|
| **Course Code: CS45** | **Credits: 2:1:0** |
| **Pre-requisites: Nil** | **Contact Hours: 28L+14T** |
| **Course Coordinator:** Dr. Monica R. Mundada | |

Course Contents

## Unit I
### Introduction to Finite Automata (6 Lectures)

**Introduction to Finite Automata:** Structural representations, automata and complexity, the central concepts of automata theory; deterministic finite automata, nondeterministic finite automata, an application of finite automata, finite automata with epsilon transitions.

- Pedagogy/ Course delivery tools
  - ➢ Chalk and talk, Power point presentation
- Link
  - ➢ https://nptel.ac.in/courses/106105196

## Unit II
### Regular Expressions (6 Lectures)

**Regular Expressions:** Finite automata and regular expressions, applications of regular expressions, proving languages not to be regular, closure properties of regular languages, equivalence and minimization of automata.

- Pedagogy/ Course delivery tools
  - ➢ Chalk and talk, Power pointpresentation
- Link
  - ➢ https://nptel.ac.in/courses/106105196

## Unit III
### Context–free grammars (6 Lectures)
**Context–free grammars:** Parse trees, applications, ambiguity in grammars and languages, definition of the pushdown automata, the languages of a PDA, Equivalence of PDA's and CFG's: CFG for PDA

- Pedagogy/ Course delivery tools
  - ➢ Chalk and talk, Power pointpresentation
- Link
  - ➢ https://nptel.ac.in/courses/106105196

## Unit IV
### Deterministic Pushdown Automata (5 Lectures)

**Deterministic Pushdown Automata:** Normal forms for CFGs-eliminating useless symbols, eliminating eplison - production, eliminating unit production, Chomsky Normal form, the pumping lemma for CFGs, Closure properties of CFLs

- Pedagogy/ Course delivery tools
  - ➢ Chalk and talk, Power pointpresentation
- Link
  - ➢ https://nptel.ac.in/courses/106105196

## Unit V
### Turing Machine (5 Lectures)

**The Turing machine:** Notation for Turing Machine, Instantaneous Description for Turing Machine, Transition Diagrams of a Turing Machine, The Language of a Turing Machine, Turing Machines and Halting, Programming techniques for Turing Machines. Extensions to the basic Turing machine.

- Pedagogy/
  Course delivery tools
  - ➢ Chalk and talk, Power pointpresentation
- Link
  - ➢ https://nptel.ac.in/courses/106105196

Tutorial Sessions

**(Each Session is of 2 Hours Duration/Week)**

| Session No. | Topics Covered |
|---|---|
| 1. | Problems on Deterministic Finite Automata |
| 2. | Problems on Non- deterministic Finite Automata |
| 3. | Problems on Conversion from NFA to DFA |
| 4. | Problems on Regular expressions, conversion from RE to FA |
| 5. | Problems on Conversion from FA to RE |
| 6. | Problems on Equivalence and minimization of Automata |
| 7. | Problems on CFG, parse trees, and ambiguity in CFG |
| 8. | Problems on Push down automata |
| 9. | Problems on Conversion from PDA to CFG |
| 10. | Problems on Deterministic PDA |
| 11. | Problems on Chomsky normal form for CFG |
| 12. | Problems on Turing Machines |
| 13. | Problems on Turing Machines variants |
| 14. | Revision |

**Suggested Learning Resources**

**Text Books:**

1. John E. Hopcroft, Rajeev Motwani, Jeffrey D.Ullman: Introduction to Automata Theory, Languages and Computation, 3rd Edition, Pearson Education,2011.

Reference Books:

1. John C Martin: Introduction to Languages and Automata Theory, 3rd Edition, Tata McGraw-Hill,2007.
2. Michael Sipser: Introduction to the Theory of Computation, 3rd Edition, Thompson Course Technology, Boston, MA and Cengage Learning India Pvt.Ltd.,2014.

Video Lectures (e-Resources)

1. https://a.impartus.com/ilc/#/course/81462/295

**Course Outcomes (COs):**

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

1. Demonstratetheprinciplesandconstructionofvariousrepresentationsofregularlanguagesincludingfinite automata and regular expressions. (PO-1, PO-2, PO-3,PSO-2)
2. Prove the various closure and decision properties of regular languages. (PO-1, PO-2,PSO-2)
3. WriteCFGsandPDAscorrespondingtoCFLsanddemonstratetheirequivalence.(PO-1,PO-2,PO-3,PSO- 2)
4. Prove the various closure and decision properties of CFLs.(PO-1, PO-2,PSO-2)
5. Demonstrate the principles and construction of Turing Machine and it's variants.(PO-1, PO-2, PO-3, PSO-2)

Course Assessment and Evaluation

| Continuous Internal Evaluation (CIE) : 50 Marks | | |
|---|---|---|
| **Assessment Tools** | **Marks** | **Course Outcomes (COs) addressed** |
| Internal Test-I (CIE-I) | 30 | CO1 and CO2 |
| Internal Test-II CIE-II) | 30 | CO3, CO4, and CO5 |
| **Average of the two CIE will be taken for 30 marks** | | |
| **Other Components** | | |
| Quiz -I | 10 | CO1 and CO2 |
| Quiz -II | 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 Quiz-II** | | |
| **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 LAB

**Course Code: CSL46**
**Pre-requisites: Data Structures& Java Programming**
**Course Coordinator: Pramod Sunagar**

**Credits: 0:0:1**
**Contact Hours: 14P**

Course Contents

| Sl. No. | Topics Covered |
|---------|----------------|
| 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. | Counting inversion algorithm |
| 8. | Quick sort algorithm |
| 9. | Prim's and Kruskal algorithm |
| 10. | Dijkstra's algorithm |
| 11. | Weighted interval scheduling with Dynamic Programming approach |
| 12. | Knapsack problem & Subset sum problem |
| 13. | Belman Ford algorithm |
| 14. | Branch and Bound Techniques |

**Suggested Learning Resources**

**Reference Books/ Web Links:**

1. Algorithm Design - Jon Kleinberg and Eva Tardos, Pearson, 1st Edition(2013).
2. Anany Levitin: Introduction to the Design & Analysis of Algorithms, 3rd Edition, Pearson Education, 2012. ISBN:9780132316811

**Course Outcomes (COs):**

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

1. Define the basic concepts and analyze worst-case running times of algorithms using asymptotic analysis. (PO-1,4,10PSO-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-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 |

## Data Communication and Networking Laboratory

**Course Code: CSL47**
**Pre-requisites: Data Communication and Networking**
**Course Coordinator: Dr. Shilpa Chaudhari**

**Credits: 0:0:1**
**Contact Hours: 14P**

Course Contents

| Sl. No. | Topics Covered |
|---------|----------------|
| | **Cycle I** |
| 1. | Trace Hypertext Transfer Protocol using packet sniffer and packet analyser. |
| 2. | Trace Domain Name Server using packet sniffer and packet analyser. |
| 3. | Trace Internet Protocol and Internet Control Message Protocol using packet sniffer and packet analyser. |
| 4. | Trace Dynamic Host Configuration Protocol using packet sniffer and packet analyser. |
| 5. | Write a program for error detection using CRC-CCITT(16-bits). |
| 6. | Write a program to find the shortest path between vertices using bellman-ford algorithm. |
| 7. | Write a program for congestion control using leaky bucket algorithm. |
| | **Cycle II** |
| 8. | Using TCP/IP sockets, write a client – server program where the client send the file name and the server send back the contents of the requested file if present. |
| 9. | Write a program for Time Division Multiplexing Simulator. Show how the time division multiplexing technique works. |
| 10. | Design and simulate a wired network with duplex links between 'n' nodes with CDR over UDP. Set the queue size vary the bandwidth and find the number of packets dropped. |
| 11. | Design and simulate a four node point-to-point network, and connect the links as follows: n0-n2, n1-n2 and n2-n3. Apply TCP agent between n0-n3 and UDP agent between n1-n3. Apply relevant applications over TCP and UDP agents by changing the parameters and determine the number of packets sent by TCP/UDP. |
| 12. | Design and simulate simple Extended Service Set with transmitting nodes in wireless LAN and determine the performance with respect to transmission of Packets. |
| 13. | Design and simulate infrastructure less network, generate two traffic flows between nodes and analyse its performance. |
| 14. | Design a wired network with 'n' nodes to observe the performance of two TCP variants (Reno and Tahoe). Simulate the designed network and observe the network performance. |

**Note: Each Lab Session is of two hours' duration/week**

**Suggested Learning Resources**

**Reference Books/ Web Links:**

1. James F. Kurose and Keith W. Ross: Computer Networking: A Top-Down Approach, 5th edition, Addison-Wesley, 2009.
2. W. Richard Stevens, BillFenner,AndrewM.Rudoff:UnixNetworkprogramming,ThesocketsnetworkingAPI, Addison-Wesley Professional,2004
3. Wireshark, "Wireshark", 2021https://www.wireshark.org/
4. Ns-3, "ns-3manual," 2022 https://www.nsnam.org/docs/manual/html/index.html

## Course Outcomes (COs):

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

1. Analyse the performance of various application layer protocols using packet sniffer and packet analyser. (PO-1,2, 3, 4,5,PSO-1)
2. Develop an understanding of computer networking basics using programming languages like C/C++/Java / Python. (PO-1, 2, 3,4, 5,PSO-1)
3. Design and simulate the network scenarios using NS3. (PO-1, 2, 3, 4, 5,PSO-1)

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 | CO2 and 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 |

## PYTHON PROGRAMMING LABORATORY

**Course Code: CSL48**
**Pre-requisites: Nil**
**Course Coordinator: Pramod Sunagar**

**Credits: 0:0:1**
**Contact Hours: 14P**

Course Contents

| Sl. No. | Topics Covered |
|---------|----------------|
| 1. | Python Basics |
| 2. | Control Structures |
| 3. | Functions |
| 4. | Strings, lists, list comprehensions |
| 5. | Tuples and Dictionaries |
| 6. | Modules and packages |
| 7. | Object Oriented Concepts |
| 8. | Regular Expression |
| 9. | Programs on File I/O |
| 10. | Exceptions |
| 11. | GUI/Network Programming |
| 12. | Python for Data Science |
| 13. | Numpy and Pandas |
| 14. | Data wrangling Application |

**Note: Each Lab Session is of two hours duration/week**

**Suggested Learning Resources**

**Reference Books/ Web Links:**

1. Mark Lutz: Learning Python, 5th Edition, Orielly Publications 2013. ISBN978-1-4493-5573-9
2. John Zelle: Python Programming: An Introduction to Computer Science, 2nd Edition. 2009 ISBN 978-1-8879-0299-1
3. Paul Barry, Head First Python, O'Reilly Publication, 2nd Edition 2016. ISBN978-1-4919-1953-8
4. Python for Data Analysis : Data Wrangling with Pandas, NumPy, and IPython by WesMcKinny, O'Reilly Media, 2nd Edition2017. ISBN978-9-3521-3641-4

**Course Outcomes (COs):**

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

1. Use internal and external Python libraries, data structures, functions inherent to Python in-order to handle data. (PO-1, 2, 3,5 PSO-2,3)
2. Develop real-world applications using oops, files and exception handling provided by python (PO-1, 2, 3, 5 PSO-2,3)
3. Apply Python as a scripting language to analyze huge datasets, apply data science related statistics on datasets (PO-1, 2, 3,5 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 |

| Constitution of India and  Professional Ethics |
|---|
| **Course Code**:     HS492          **Credits:** 1:0:0          **Pre-requisites:** Nil |
| **Contact Hours**: 14L |
| **Course Coordinators: Mrs. Kanya Kumari.S** |

## UNIT-1
**Introduction to the Constitution of India**
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 in India.

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

## UNIT- III
**Union executive and State executive**
The organs of government -Union executive- the 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.  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
**Professional Ethics and Human Rights**
Scope and aim of engineering ethics, Responsibility of engineers, impediments to Responsibility
Human rights –meaning and significances of Human Rights, role of U N O in the protection and promotion of Human Rights. Universal Declaration of Human Rights (UDHR) protection of Human Rights in the Indian Context.

> ➢ 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:**

At the end of the course students will be able to

1. Identify the fundamental principles of Indian constitution.(PO12)
2. Examine various provisions of the Directive principles of state policies and fundamental duties. (PO6,PO12)
3. Understand the powers & functions of executive, Legislature and judicial system at the center and state level. ( PO6, PO12)
4. Identify the role of government. (PO12)
5. Understand about basic Human rights in India (PO6, PO12)

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 | CO4 & CO5 |
| AVAREGE OF THE TWO INTERNAL TEST TWO WILL BE TAKEN FOR 30 MARKS | | |
| Other components | | |
| Assignment | 10 | CO1,Co2 |
| quiz | 10 | CO3, CO4 & CO5 |
| | | |
| Semester end examination: | 100 | CO1,Co2 , CO3, CO4 & CO5 |

# ADDITIONAL MATHEMATICS – II

| | | |
|---|---|---|
| **Course Code**: AM41 | **Credits:** 0:0:0 | **Pre-requisites:** Nil |

**Contact Hours**: 40

**Course Coordinators: Dr. N. L. Ramesh**

## Course content:

### UNIT-I

**Differential calculus:** Partial differentiation, Euler's theorem, total differential coefficient, differentiation of composite and implicit functions, Jacobian and Properties. Taylor's theorem for function of two variables, maxima and minima for functions of two variables.

### UNIT-II

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

### UNIT-III

**Laplace transforms:** Definitions, Laplace transforms of elementary functions, derivatives and integrals, periodic function, unit step function, inverse transforms, applications of Laplace transforms to solve differential equations.

### UNIT-IV

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

### UNIT-V

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

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

**Course Outcomes (COs):**
At the end of the course, students will be able to -
1. Find Jacobian, extreme values and power series expansion of a function. (PO-1, 2)
2. Exhibit the interdependence of line, surface and volume integrals using integral theorems. (PO-1, 2)
3. Use the concept of Laplace transforms to solve initial and boundary value problems (PO-1, 2)
4. Solve Linear differential equations with constant and variable coefficients (PO-1, 2)
5. Demonstrate the understanding of axioms and rules of probability to solve problems. (PO-1, 2)