Vision: This Mathematics and Computing program is designed to cultivate leaders who will spearhead research, development, and innovation in cutting-edge disciplines and next-generation technologies, which demand extensive proficiency in Mathematics, Computer Science, Machine Learning, and Data Science.

Mission: The mission of the Integrated M.Sc. Mathematics and Computing course could be to equip students with a comprehensive understanding of both mathematical principles and computational techniques, fostering their ability to tackle complex real-world problems at the intersection of mathematics, computer science, and data analysis. Through rigorous academic training and practical experiences, the program aims to cultivate innovative thinkers and skilled professionals who can contribute effectively to research, development, and innovation in diverse fields such as artificial intelligence, cryptography, optimization, and scientific computing.

Program Outcomes

After completing the Integrated M.Sc., Mathematics and Computing course, the students will get proficiency in

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<th>S.No.</th>
<th>Program Outcomes</th>
</tr>
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<tbody>
<tr>
<td>1</td>
<td><strong>Knowledge in Mathematics and Computer Science:</strong> Understand the basic concepts, fundamental principles and the scientific theories related to Mathematics and Computer Science.</td>
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<tr>
<td>2</td>
<td><strong>Abstract thinking:</strong> Ability to comprehend and grasp abstract concepts leading to various advanced theories in Mathematics, Statistics, and Computer Science.</td>
</tr>
<tr>
<td>3</td>
<td><strong>Modeling and Problem Solving:</strong> Ability to model and solve problems by identifying and employing appropriate existing theories and methods.</td>
</tr>
<tr>
<td>4</td>
<td><strong>Advanced Theories and Methods:</strong> Understand advanced theories and methods to design solutions for complex problems in Mathematics and Computer Science.</td>
</tr>
<tr>
<td>5</td>
<td><strong>Applications in Engineering and Sciences:</strong> Recognize the role of mathematical sciences and apply them to solve real-life problems in various fields of Engineering and Science.</td>
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<tr>
<td>6</td>
<td><strong>Modern Software Tool Usage:</strong> Acquire skills in handling scientific tools for problem-solving and solution analysis.</td>
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<td>7</td>
<td><strong>Environment and Sustainability:</strong> Understand the significance of preserving the environment for sustainable development.</td>
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<td><strong>Ethics</strong>: Embrace ethical, moral, and social values in personal and social life, leading to a highly cultured and civilized personality. Continuously enhance knowledge and skills in Mathematics and Computer Science for constructive activities, demonstrating the highest standards of professional ethics.</td>
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<tr>
<td>---</td>
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<tr>
<td>9</td>
<td><strong>Individual and Teamwork</strong>: Function effectively as an individual and as a member or leader in diverse teams and multidisciplinary settings.</td>
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<tr>
<td>10</td>
<td><strong>Communication</strong>: Develop various communication skills such as reading, listening, and speaking to express ideas and views clearly and effectively.</td>
</tr>
<tr>
<td>11</td>
<td><strong>Project Management and Research</strong>: Demonstrate knowledge and understanding of scientific and management principles, applying them to one’s work as a member/leader in a team to manage projects and multidisciplinary research environments. Utilize research-based knowledge to analyze and solve advanced problems in Mathematics and Computing.</td>
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<td>12</td>
<td><strong>Lifelong Learning</strong>: Recognize the need for and possess the preparation and ability to engage in independent and lifelong learning in the broadest context of technological change.</td>
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<td>13</td>
<td><strong>Vertical Growth</strong>: Students have the option to pursue higher studies either in mathematics or in computer-related subjects.</td>
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## Curriculum (2024 on wards)

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**Total Credits: 222**
### Elective Courses

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<td>Measure Theory</td>
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<td>3 24CSC535 Predictive Analytics 2 0 2 3</td>
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Elective courses can be taken from online courses, industry electives and other B.Tech / M.Tech/ M. Sc programmes.

@ code for live in Lab
## Table 3 New names for Amrita Value Programmes I & II for UG programmes

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<td>Kerala Mural Art and Painting</td>
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<td>22AVP218</td>
<td>Yoga Therapy and Lessons</td>
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<td>Introduction to Traditional Indian Systems of Medicine</td>
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## Open Electives UG

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<td>21OEL256</td>
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<td>21OEL257</td>
<td>Introduction to Event Management</td>
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<td>21OEL258</td>
<td>Introduction to Media</td>
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<td>21OEL259</td>
<td>Introduction to Right to Information Act</td>
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<td>Macro Economics</td>
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<td>Negotiation and Counselling</td>
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<td>New Literatures</td>
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<td>Non-Profit Organization</td>
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<td>Personal Effectiveness</td>
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<td>Perspectives in Astrophysics and Cosmology</td>
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<td>21OEL274</td>
<td>Principles of Public Relations</td>
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<td>21OEL275</td>
<td>Science, Society and Culture</td>
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<td>21OEL276</td>
<td>Statistical Analysis</td>
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<td>21OEL277</td>
<td>Teamwork and Collaboration</td>
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<td>21OEL278</td>
<td>The Message of Bhagwad Gita</td>
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<td>Understanding Travel and Tourism</td>
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<td>21OEL280</td>
<td>Videography</td>
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<td>21OEL281</td>
<td>Vistas of English Literature</td>
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<td>21OEL282</td>
<td>Web-Designing Techniques</td>
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<td>21OEL283</td>
<td>Organic Farming</td>
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<tr>
<td>21OEL284</td>
<td>Basic Legal Awareness on Protection of Women and Rights</td>
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<td>21OEL285</td>
<td>Ritual Performances of Kerala</td>
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<td>21OEL286</td>
<td>Documenting Social Issues</td>
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<td>21OEL287</td>
<td>Fabrication of Advanced Solar Cell</td>
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<td>Basic Concepts of X-ray Diffraction</td>
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<td>21OEL289</td>
<td>Introduction to FORTRAN and GNUPLOT</td>
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<td>21OEL290</td>
<td>Introduction to Porous Materials</td>
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<td>J</td>
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<tr>
<td>21OEL291</td>
<td>Forensic Science</td>
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<td>J</td>
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<tr>
<td>21OEL292</td>
<td>Introduction to solar Physics</td>
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<td>Course Type</td>
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<td>CA marks</td>
<td>End Semester marks</td>
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<td>60</td>
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</table>
Semester – 1

24ENG101 English I 2002

Objectives:

To help students obtain an ability to communicate fluently in English; to enable and enhance the students' skills in listening, speaking, reading, and writing; to impart an aesthetic sense and enhance creativity

<table>
<thead>
<tr>
<th>Cos</th>
<th>Course Outcomes</th>
</tr>
</thead>
<tbody>
<tr>
<td>CO 1</td>
<td>Demonstrate competence in the mechanics of writing</td>
</tr>
<tr>
<td>CO 2</td>
<td>Summarise audio and written texts to convey messages effectively</td>
</tr>
<tr>
<td>CO 3</td>
<td>Apply mechanics of writing and AI tools to draft academic and professional documents</td>
</tr>
<tr>
<td>CO 4</td>
<td>Organise ideas and thoughts for clear written and oral communication</td>
</tr>
<tr>
<td>CO 5</td>
<td>Critically evaluate literary texts</td>
</tr>
</tbody>
</table>

Unit I

Mechanics of writing - Parts of speech – use of prepositions, adjectives, adverbs and determiners – word order – collocation – concord (Subject-Verb, Pronoun-Antecedent) – kinds and patterns of sentences

Unit II

Tenses - Modal auxiliaries - Reported speech - Active and Passive Voice - Phrasal Verbs - Linkers/ Discourse Markers - Question Tags

Unit III

Pre-writing techniques - Paragraph writing – Cohesion – Development – types: definition, comparison, classification, contrast, cause and effect - Essay writing: Descriptive and Narrative - Introduction to the use of Gen AI in writing (AI tools, Do’s and Don’ts while using AI, how to write prompts, etc.)

Unit IV

Listening comprehension (3 pieces – Do Schools kill creativity? By Sir Ken Robinson, Steve Jobs’ 2005 Stanford Commencement Address, India Questions Dr Abdul Kalam- Aired August 2007) -
Reading Comprehension – Skimming and Scanning- Inference and Deduction – Reading different kinds of material – Speaking: Narration of incidents / stories / anecdotes.

Unit V

Shashi Tharoor – “‘Kindly Adjust’ to Our English
A. G. Gardiner – “A Fellow Traveller”
Ruskin Bond – “The Eyes Have It”
Mrinal Pande – “Girls”
W. H. Auden – “Unknown Citizen”
W H Davies - “Leisure”

References:
1. Murphy, Raymond, *Murphy’s English Grammar*, CUP, 2004
2. Syamala, V. *Speak English in Four Easy Steps*, Improve English Foundation Trivandrum: 2006
4. The Week - June 03, 2018, LAST WORD; https://www.theweek.in/columns/shashi-tharoor/2018/05/25/kindly-adjust-to-our-english.html?fbclid=IwAR3IhtdXqvuV4ySECn9S7SA6HmCEYISyd1QHi3BlwKgiNKKwdkeSg3qWP-U/
7. Mrinal Pande – *Stepping Out*; Penguin India; 2003
8. W H Auden – *Another Time*; Random House Pub; 1940
10. Sir Ken Robinson – “Do schools kill creativity?”; https://go.ted.com/6WoC
12. India Questions Dr Abdul Kalam (aired: August 2007). https://youtu.be/erg3CmVm6M4?si=YudsxXZOFY1do91C

21HIN101

HINDI I

Unit-1
a) Introduction to Hindi Language, other Indian Language’s, Official Language, link Language Technical terminology..
b) Hindi alphabet: ParibhashaAurBhed.
c) Shabda: ParibhashaAurBhed, RoopantharkiDrishti se
d) Sangya -ParibhashaAurBhed, SangyakeRoopanthal-ling, vachan, karak
e) Sarvanaam- ParibhashaAurBhed.

Unit-2
a) Common errors and error corrections in Parts of Speech – with emphasis on use of pronouns, Adjective and verb in different tenses – gender & number
b) Conversations, Interviews, Short speeches.

Unit -3
a) Letter writing – Paribhasha Aur Bhed, Avedanpatra (request letter) & Practice
b) Translation – Paribhasha Aur Bhed, English to Hindi

Unit -4
Poem:

a) Maithilisharangupth: sakhi vemujsekahakarjaate
b) Suryakanthtripatinirala : Priyatam
c) Mahadevivarma - adhikaar
d) Shiyaramsharangupth: ekphoolkichah

Unit -5
Kahani
a) Kafan - Premchand ,
b) Rajasth kan ki Ek Gaav kee theerthyatra - Beeshmasahni
c) Raychandrabhai: By Mahatma Gandhi - Sathya ke prayog
d) Rajani - Mannu Bhandari

21KAN101 KANNADA I 2002

a) To enable the students to acquire basic skills in functional language.
b) To develop independent reading skills and reading for appreciating literary works.
c) To analyse language in context to gain an understanding of vocabulary, spelling, punctuation and speech

UNIT – 1

a) Railway Nildanadalli – K. S. Narasimha Swamy
b) Amma, Aachara Mattu Naanu – K. S. Nisar Ahamad
c) Kerege Haara – Janapada
d) Simhaavalokana – H.S. Shivapra kash

UNIT – 2

a) Mouni - Sethuram
b) Meenakshi Maneya Mestru - Kuvempu
c) Dhanwantri Chikitse - Kuvempu

UNIT – 3

a) Sukha – H.G Sannaguddayya
b) Mobile Thenkara Jen Nonagala Jhenkara – Nagesh Hegade
UNIT – 4

Language structure

a) Usage of punctuation marks
b) Introduction to words (right usage)
c) Reading skills
d) Sentence formation (simple & complex)
e) Translation - English to Kannada

References:

1. Kannada Samskruti Kosha – Dr. Chi. C Linganna
2. Kannada Sanna Kathegalu – G H Nayak
3. Lekhana Kale – N. Prahlad Rao
4. Kannada Sahithya Charithre – R. Sri Mugali

21MAL101 Malayalam I 2002

Unit 1


Unit 2


Unit 3

Short stories from period 1/2/3: Poovanpazham-VaikaomMuhammedBasheer - Literary & Cultural figures of Kerala and about their literary contributions.

Unit 4

Literary Criticism: Bharatha Paryadanam-Vyasante Chiri – Itihasa studies-Kuttikrishna Mararu - Outline of literary Criticism in Malayalam Literature - Introduction to Kuttikrishna Mararu & his outlook towards literature & life.

Unit 5

writing; RadioSpeech; f. Script/Feature/Script Writing; NewsEditing; h. Advertising; i. Editing; j. Editorial Writing; k. Critical appreciation of literary works
(Any one or two as an assignment).

21SAN101               SANSKRIT I              2 0 0 2
To familiarize students with Sanskrit language and literature.
To read and understand Sanskrit verses and sentences.
Self-study of Sanskrit texts and to practice communication in Sanskrit.
To help the students imbibe values of life and Indian traditions propounded by the scriptures.
To be able to speak in Sanskrit.

Module I
Introduction to Sanskrit language, Devanagari script - Vowels and consonants, pronunciation, classification of consonants, conjunct consonants, words – nouns and verbs, cases – introduction, numbers, Pronouns, communicating time in Sanskrit. Practical classes in spoken Sanskrit. (7 hours)

Module II
Verbs- Singular, Dual and plural — First person, Second person, Third person. Tenses – Past, Present and future – Atmanepadi and parasmaipadi-karthariprayoga. (8hrs)

Module III
Words for communication and moral stories. (4 hrs)

Module IV
Chanakya Neethi first chapter (first 15 Shlokas) (6 hrs)

Module V
Translation of simple sentences from Sanskrit to English and vice versa (5hrs)

24MAT105              CALCULUS               3 1 0 4

Differentiation: The Derivative as a Function – Differentiation Rules – The Derivative as a Rate of Change – Derivatives of Trigonometric Functions – The ChainRule and Parametric Equations – Implicit Differentiation – Linearization and Differentials.Chapter 2- Sec: 2.1 to 2.7 and Chapter 3- Sec: 3.1 to 3.6, 3.7, SelfStudy - Sec: 3.7.

Application of Derivatives: Extreme values of Functions – The Mean Value Theorem – Monotonic Functions and the First Derivative Test – Concavity and Curve Sketching – Intermediate Forms and L’ Hospital’s Rule – Anti Derivatives. Chapter 4- Sec: 4.1 to 4.4, 4.6 to 4.8, SelfStudy - Sec: 4.5
Chapter 5- Sec: 5.1 to 5.6

Chapter 8: 8.1 to 8.5, 8.7, 8.8, SelfStudy - Sec: 8.6

Chapter 6 – Sec: 6.1 to 6.7

TEXT BOOK:

REFERENCE BOOKS:

24MAT106 Discrete Mathematics 3 1 0 4

Logic, Mathematical Reasoning and Counting: Logic, Prepositional Equivalence, Predicate and Quantifiers, Theorem Proving, Functions, Mathematical Induction. Recursive Definitions, Recursive Algorithms, Basics of Counting, Pigeonhole Principle, Permutation and Combinations. (Sections: 1.1 -1.3, 1.5 -1.7, 2.3, 4.1 - 4.4, 5.1 - 5.3 and 5.5)

Relations and Their Properties: Representing Relations, Closure of Relations, Partial Ordering, Equivalence Relations and partitions. (Sections: 7.1, 7.3 - 7.6)

Advanced Counting Techniques and Relations: Recurrence Relations, Solving Recurrence Relations, Generating Functions, Solutions of Homogeneous Recurrence Relations, Divide and Conquer Relations, Inclusion-Exclusion. (Sections: 6.1 - 6.6)
**Graph Theory:** Introduction to Graphs, Graph Operations, Graph and Matrices, Graph Isomorphism, Connectivity, Euler and Hamilton Paths, Shortest Path Problem, Planar Graph, Graph Colorings and Chromatic Polynomials. (Sections: 8.1 - 8.8)

**TEXT BOOK:**


**REFERENCES:**


24PHY103 Physics 3 0 0 3

**Objective of the course**

The objective of the course is to make students understand how physics is applied to the phenomena observed in the real world. The course also aims in enhancing the problem-solving skills using techniques that require mathematical skills, conceptual and mathematical models. At the end of the course students will be able to:

**CO1**: understand basic physics associated with kinematics in 1, 2, & 3 dimensions, explain the meaning of conservation (energy & Momentum) and use it to compare the changes occurring during collision of two objects

**CO2**: apply Newton’s law of universal gravitation to find the gravitational force between two masses, use Kepler's law of harmonies to make calculations regarding the radius and period of orbits of planets.

**CO3**: Understand rigid bodies, draw clear and appropriate free body diagrams. determine the mass moments and products of inertia for arbitrary rigid bodies, analyse the motion of rotating systems, calculate the inertia tensor for simple objects

**CO4**: understand Variance & invariance, check invariance of different laws of Physics under Galilean transformations & explain the meaning and significance of the postulate of Special Relativity.

**CO5**: understand the fundamentals of the mechanics of continuous systems, solve problems based on principle of least action and write Lagrangian for mechanical system in terms of generalised coordinates

Skills Acquired: Develops logical skills in applying and analysing problems in mechanics

**Unit –I: Force, Energy, Momentum & Collisions**  (8 Hr)
Learning objectives
After completing this chapter, student will be able to
LO1- solve problems based on Newton's laws of motion.
LO2- identify types of mechanical energy possessed by an object.
LO3 - predict whether an object's total mechanical energy would be conserved or not conserved based upon the types of forces which are doing work upon the object.
LO4 - apply the principles of energy conservation to a various of physical situations.
LO5- determine the momentum of total system and to state what momentum conservation is.
LO6- apply the principle of momentum conservation to solve collision problems.

One-, two- and three-dimensional motion under forces – Energy and momentum conservation- collision in one and two dimensions.

Unit-II: Gravitation & Kepler’s laws (10 Hr)

Learning objectives
After completing this chapter, student will be able to
LO1- calculate the gravitational force experienced by two objects.
LO2- Relate Kepler’s laws to Newton’s universal law of gravitation
LO3- solve problems based on the concept of gravitational potential energy
LO4- apply Kepler’s law to find the characteristics of orbit
Newton’s laws- Gravitation- Central force motion and application to planetary motion- Kepler’s laws

Unit-III: Rotational dynamics (10 Hr)

Learning objectives
After completing this chapter, student will be able to
LO1- construct appropriate free-body diagrams and solve problems in two-dimensional rigid-body dynamics.
LO2- Apply appropriate mathematical equations to solve problems based on torque and moment of inertia.
LO3- Understand the inertia matrix and the principal moments and principal directions at any point in a rigid body or system of particles
Rotational motion of a rigid body, Potential energy, Euler’s angles-Euler’s Equation-Moment of inertia tensor

Unit- IV: Special Theory of relativity (7 Hr)

Learning objectives
After completing this chapter, student will be able to
LO1- understand the concept of constant relative motion of different bodies in different frames of references
LO2- use Lorentz transformations to apply the concepts of length contraction and time dilation
LO3- Describe relativistic effects seen in conservation of momentum and perform calculations involving mass energy equivalence
Frames of reference, Galilean relativity, non-inertial frames, Lorentz transformation-basic special relativity-velocity addition-Relativistic momentum

Unit – V: Lagrangian formalism (10 Hr)

Learning objectives

After completing this chapter, student will be able to

LO1- Apply variational calculus to demonstrate principle of least action
LO2- define generalised coordinates, generalised velocities, generalised force
LO3- Identify the motion of a mechanical system using Lagrange formalism
LO4- qualitatively analyze, understand the mechanical systems

1. Least action principle, phase space, Langrangian Formulation-Applications

Text Book

4.
5. Reference Books

24CSC101 Problem Solving and Python Programming 3 0 0 3

Conceptual introduction: Topics in computer science, algorithms; modern computer systems: hardware architecture, data representation in computers, software and operating system; Installing Python; basic syntax, interactive shell, editing, saving, and running a script. The concept of data types; variables, assignments; immutable variables; numerical types; arithmetic operators and expressions; comments in the program; understanding error messages.

Conditions, boolean logic, logical operators; ranges; Control statements: if-else, loops (for, while); short-circuit (lazy) evaluation. Strings and text files; manipulating files and directories, os and sys modules; text files: reading/writing text and numbers from/to a file; creating and reading a formatted file (csv or tab-separated). String manipulations: subscript operator, indexing, slicing a string; strings and number system: converting strings to numbers and vice versa. Binary,
octal, hexadecimal numbers.

Lists, tuples, and dictionaries; basic list operators, replacing, inserting, removing an element; searching and sorting lists; dictionary literals, adding and removing keys, accessing and replacing values; traversing dictionaries. Design with functions: hiding redundancy, complexity; arguments and return values; formal vs actual arguments, named arguments. Recursive functions. Testing, Debugging, Exceptions, Assertions. Classes and OOP: classes, objects, attributes and methods; defining classes; design with classes, data modeling; persistent storage of objects.

**Text Book**

**24CSC181 Problem Solving and Python Programming Lab**
1. Installing Python environments
2. Using Python Interpreter to do basic operations like arithmetic computations.
3. Working with variables of different datatypes and using them in expressions.
4. Building stand alone Python scripts
5. Implementing logic requiring conditional expressions and looping
6. Working with strings using inbuilt functionalities of the datatype
7. Working with Python inbuilt datatypes like Lists, Tuples and Dictionaries
8. Working with modularity : Implementing functions and designing logic in a modular fashion
9. Implement unit testing measures assertions and exception handling
10. Use Python to model object oriented programming principles using various use cases.

**Text Book**

**24PHY183 Physics Lab**
1. Young’s modulus – Uniform bending
2. Torsional Pendulum
3. Compound Pendulum
4. Coefficient of viscosity- Poiseuille’s method
Course Objectives

The course will enable the students to

- This Course offers students an opportunity to delve into the depths and richness of the Indian culture and knowledge traditions.
- It aims to provide a synoptic view of the grandiose achievements of India across diverse fields, enabling students to develop a comprehensive understanding of their country and its eternal values.
- Aligned with the Indian Knowledge Systems (IKS) framework outlined in the National Education Policy, this course serves as an introduction to the vast reservoir of wisdom and knowledge rooted in Indian heritage.
- By the end of this course, students will develop a sense of pride in their heritage, appreciate the eternal values of India, and recognize the relevance of Indian wisdom in the modern world.
- This also explores the historical contributions of India in various fields such as mathematics, science, medicine, astronomy, and architecture.

Course Outcomes:

After successful completion of the course, Students will be able to:

<table>
<thead>
<tr>
<th>Sl.No.</th>
<th>Course Outcomes</th>
<th>Knowledge level [Bloom’s Taxonomy]</th>
</tr>
</thead>
<tbody>
<tr>
<td>CO01</td>
<td>Recall key historical events, philosophies, and perspectives presented in the chapters on Indian heritage. Statement: Demonstrate the ability to remember significant historical events, philosophical concepts, and diverse viewpoints discussed in the chapters on Indian heritage.</td>
<td>Remembering</td>
</tr>
<tr>
<td>CO02</td>
<td>Explain the interconnectedness of Indian heritage, philosophy, and culture (as presented across various chapters). Statement: Understand the intricate relationships between chapters, recognizing how Indian heritage, philosophies, and cultural elements form a cohesive tapestry</td>
<td>Understanding</td>
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<tr>
<td>CO</td>
<td>Description</td>
<td>Action</td>
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<tr>
<td>CO03</td>
<td>Apply principles from chapters on becoming a strategic thinker, personality development through yoga, and compassion to real-life scenarios. Statement: Utilize insights gained from chapters on strategic thinking, yoga, and compassion to address contemporary challenges and personal growth.</td>
<td>Applying</td>
</tr>
<tr>
<td>CO04</td>
<td>Analyze the impacts of colonialism, historical timelines, and foreign perspectives on India's identity, (as discussed in relevant chapters). Statement: Deconstruct the influences of colonialism, historical evolution, and foreign views on India, assessing their implications for the nation's heritage</td>
<td>Analyzing</td>
</tr>
<tr>
<td>CO05</td>
<td>Evaluate the significance of Indian Mahatmas and Advaita Vedanta in shaping Indian traditions and values (drawing from relevant chapters). Statement: Assess the lasting impact of Indian Mahatmas and Advaita Vedanta on India's cultural and spiritual landscape, considering their contributions and relevance</td>
<td>Evaluating</td>
</tr>
<tr>
<td>CO06</td>
<td>Develop projects that integrate themes of life, happiness, nature, celebration, and selflessness, (drawing inspiration from multiple chapters). Statement: Create innovative projects that synthesize themes from various chapters, reflecting the holistic and multifaceted nature of Indian heritage.</td>
<td>Creating</td>
</tr>
</tbody>
</table>

**CO-PO Mapping: [affinity#: 3 – high; 2- moderate; 1- slightly]**

<table>
<thead>
<tr>
<th>COs</th>
<th>Program Outcomes [POs]</th>
<th>Program Specific Outcomes [PSOs]*</th>
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<tr>
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</table>

**Syllabus:**
- Chapter 1 - Educational Heritage of Ancient India
- Chapter 2 - Life and Happiness
- Chapter 3 - Impact of Colonialism and Decolonization
- Chapter 4 - A timeline of Early Indian Subcontinent
- Chapter 5 - Indian approach towards life
- Chapter 6 - Circle of Life
Chapter 7 - Pinnacle of Selflessness and ultimate freedom
Chapter 8 - Ocean of love; Indian Mahatmas.
Chapter 9 - Become A Strategic Thinker (Games / Indic activity)
Chapter 10 - Man's association with Nature
Chapter 11 - Celebrating life 24/7
Chapter 12 - Metaphors and Tropes
Chapter 13 - India: In the Views of foreign Scholars and Travellers.
Chapter 14 - Personality Development Through Yoga.
Chapter 15 - Hallmark of Indian Traditions: Advaita Vedanta, Theory of oneness
Chapter 16 - Conversations on Compassion with Amma
Semester -2

24ENG111        English II        1 0 2 2

Objectives:

To train students to convey and document information in a formal environment; to facilitate them to acquire the skill of self-projection in professional circles; to inculcate critical and analytical thinking.

<table>
<thead>
<tr>
<th>Cos</th>
<th>Course Outcomes</th>
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</thead>
<tbody>
<tr>
<td>CO 1</td>
<td>Illustrate comprehension of the fundamentals of writing</td>
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<tr>
<td>CO 2</td>
<td>Analyse audio text focussing on English phonetics, pronunciation and meaning comprehension</td>
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<tr>
<td>CO 3</td>
<td>Apply theoretical knowledge to write professional documents</td>
</tr>
<tr>
<td>CO 4</td>
<td>Infer from current news to formulate ideas and opinions</td>
</tr>
<tr>
<td>CO5</td>
<td>Prepare appropriate content for mini project and make effective presentation</td>
</tr>
</tbody>
</table>

Unit I

Vocabulary Building: One-word substitutes; Antonyms and Synonyms; Words often Confused Error Analysis (Subject-Verb Agreement; Tense Sequence; Usage of Articles and Prepositions; Determiners; Redundancy); Modifiers (misplaced, dangling, etc.)

Unit II

Circulars; Memos; Formal Letter writing; e-Mail Etiquette; Instruction, Suggestion & Recommendation; Essay writing: Analytical and Argumentative

Unit III

Sounds of English: Stress, Intonation - Listening Comprehension (3 pieces – Women in Technology Panel discussion, India Questions Abdul Kalam, UPSC Topper Mock interview Akshat Jain) - Current News Awareness

Unit IV

Reports: Incident Report, Event Report
Situational Dialogue; Group Discussion (Opinion)

Unit V

Mini Project and Presentation
References:

1. Felixa Eskey. *Tech Talk*, University of Michigan. 2005
11. Sample Question Papers from Competitive Examinations
12. Women in Technology Panel discussion
13. India Questions Abdul Kalam
    https://youtu.be/erg3CmVm6M4?si=WjP_SV1vy6FrSghG
14. UPSC Topper Mock interview, Akshat Jain
    https://youtu.be/lsJBGvyiAHI?si=L-u6kTadzJmgHHLI

21HIN111        HINDI II        2002

Unit -1
a) Visheshan- ParibhashaAurBhed.special usage of adverbs, changing voice and conjunctions in sentences.
b) kriya- ParibhashaAurBhed, rupantharkidrushti se-kaal
c) padhparichay.
d) Vigyapan Lekhan (Advertisement writing), Saar Lekhan (Precise writing).

Unit -2
Communicative Hindi – MoukhikAbhivyakthi –understanding proper pronunciation, Haptics …etc in Interviews, short speeches.

Unit -3
Film review,Audio –Visual-Media in Hindi – Movies appreciation and evaluation.News reading and presentations in Radio and Tv channels in Hindi, samvaadhlekhan,

Unit -4
a) Harishankarparasaiyi- SadacharkaThavis  
b) Jayashankarpasadh – Mamata  
c) Mannubandari- Akeli  
d) Habibtanvir- Karthus  

**Unit -5**  
a) Kavya Tarang  
b) Himadri thung shrung se (poet- Jayasankar prasad)  
c) Dhabba (poet- kedarnath sing)  
d) Proxy (poet- Venugopal),  
e) Machis(poet –Suneeta Jain),  
f) Vakth. (poet – Arun kamal)  
g) Fasal (poet- Sarveshwar Dayal Saxena)  

---  

**21KAN111 KANNADA II 2002**  

**Objectives:**  
a) To enable the students to acquire basic skills in functional language.  
b) To develop independent reading skills and reading for appreciating literary works.  
c) To develop functional and creative skills in language.  
d) To enable the students to plan, draft, edit & present a piece of writing.  

**UNIT – 1**  
a) Bettada Melondu Maneya Maadi – Akka Mahadevi  
b) Thallanisadiru Kandya – Kanakadasa  
c) Avva – P. Lankesh  
d) Neevallave – K. S. Narasimha Swamy  

**UNIT – 2**  
Gunamukha – Drama by P. Lankesh  

**UNIT – 3**  
Karvalo – Novel by Poornachandra Thejaswi  

**UNIT – 4**  
**Letter Writing –**  
Personal (congratulation, invitation, condolence etc.)  
a) Official (To Principal, Officials of various departments, etc.,)  
b) Report writing  
c) Essay writing  
d) Precise writing  

**Prescribed text:**
a) Gunamukha by P. Lankesh (Lankesh Prakashana)
b) Karvalo by Poornachandra Thejaswi (Mehta publishing house)

Reference
a) Saamanyanige Sahithya Charitre (chapter 1 to 10) – Bangalore University Publication
b) Hosa Kannada Saahithya Charithre – L.S Sheshagiri Rao
c) Kacheri Kaipidi – Kannada Adhyayana Samsthe (Mysuru University)
d) Kannada Sahithya Charithre – R. Sri Mugali
1. H.S.Krishna Swami Iyangar – *Adalitha Kannada* – Chetana Publication, Mysuru

21MAL111 Malayalam II 2002

Unit 1

Unit 2

Unit 3
Memoirs from Modern Poets: Theeppathi, Balachandran Chullikkadu-literary contributions of his time.

Unit 4
Parto of an autobiography/travelogue: Kannerum Kinavum, Chapter: Valarnnu Varunnoratmavu, V.T.Bhattathirippadu-Socio-cultural literature-historical importance.

Unit 5

21SAN111 SANSKRIT II 2002

Module I
Seven cases, Avyayas, sentence making with Avyayas, Saptha kakaras. (5hrs)
Module II
Kthavathu’ Prathyayam, Upasargas, Kthvatha, Thumnanta, Lyabantha Prathyayam. Three Lakaras – brief introduction, Lot lakara (5hrs)

Module III
New words and sentences for the communication, Slokas, moral stories (panchathanthra) Subhashithas, riddles (Selected from the Pravesha Book) (5hrs)

Module IV
Introduction to classical literature, classification of Kavyas, classification of Dramas - Important five Maha kavyas (5hrs)

Module V
Translation of paragraphs from Sanskrit to English and wise –verse (5hrs)

Module VI
Bhagavad - Geeta fourteenth chapter (all 27 Shlokas) (5hrs)

Essential Reading:
1. Praveshaha; Publisher: Samskrita bharati, Aksharam, 8th cross, 2nd phase, girinagar, Bangalore -560 085
2. Sanskrit Reader I, II and III, R.S. Vadhyar and Sons, Kalpathi, Palakkad
3. PrakriyaBhashyam written and published by Fr. John Kunnappally
4. Sanskrit Primer by Edward Delavan Perry, published by Ginn and Company Boston
5. Sabdamanjari, R.S. Vadyar and Sons, Kalpathi, Palakkad
6. Namalinganusasanam by Amarasimha published by Travancore Sanskrit series
7. SubhashitaRatnaBhandakara by Kashinath Sharma, published by Nirmayasagarpress

24MAT115 VECTOR CALCULUS 3 1 0 4

Calculus of vector-valued functions: Vector-valued functions of a real variable- Algebraic operations. Components- Limits, derivatives and integrals-Applications to curves. Tangency- Applications to curvilinear motion- Velocity, speed and acceleration-The unit tangent, the principal normal -The definition of arc length.
Vol.1, Chapter 14- Sec. 14.1 to 14.10.

Differential calculus of scalar and vector fields: Functions of $\mathbb{R}^n$ to $\mathbb{R}^m$. Scalar and vector fields-Open balls and open sets-Limits and continuity-The derivative of a scalar field with respect to a vector-Directional derivatives and partial derivatives-Partial derivatives of higher order-Directional derivatives and continuity-The total derivative-The gradient of a scalar field-A chain rule for derivatives of scalar fields-Applications to geometry. Level sets. Tangent planes.
Vol.2, Chapter-8-Sec. 8.1 to 8.17.
Line Integrals: Introduction-Paths and line integrals-Other notations for line integrals-Basic properties of line integral-Open connected sets. Independence of paths-The second fundamental theorem of calculus for line integrals-The first fundamental theorem of calculus for line integrals-Necessary and sufficient conditions for a vector field to be gradient-Necessary conditions for a vector field to be gradient-Special methods for constructing potential functions.

Vol.2, Chapter-10-Sec 10.1 to 10.5, 10.10 and 10.11, 10.14 to10.18.

Multiple Integrals: Introduction-Green’s theorem in the plane-Some applications of Green’s theorem-A necessary and sufficient condition for a two-dimensional vector field to be a gradient-Change of variables in double integral-Special cases of transformation formula.

Vol.2, Chapter-11-Sec. 11.19 to 11.22, 11.26 to 11.28.

Surface Integrals: Parametric representation of a surface-The fundamental vector product- The fundamental vector product as a normal to the surface-Surface integrals-Other notations for surface integrals-The theorem of Stokes-The curl and divergence of a vector field- Further properties of the curl and divergence-The divergence theorem (Gauss’ theorem)

Vol.2, Chapter-12-Sec. 12.1 to 12.4, 12.7,12.9 to12.15, 12.19 and 12.21.

**TEXT BOOKS:**


**REFERENCE BOOKS:**

a) Howard Anton “Calculus” John Wiley and Sons

**24MAT116 Linear Algebra 3 0 2 4**

**Vector Spaces:** Vector spaces - Sub spaces - Linear independence - Basis – Dimension.

**Inner Product Spaces:** Inner products - Orthogonality - Orthogonal basis - Gram Schmidt Process - Change of basis - Orthogonal complements - Projection on subspace - Least Square Principle.

**Linear Transformations:** Positive definite matrices - Matrix norm and condition number - QR- Decomposition - Linear transformation - Relation between matrices and linear transformations - Kernel and range of a linear transformation - Change of basis - Nilpotent transformations - Trace and Transpose, Determinants, Symmetric and Skew Symmetric
Matrices, Adjoint and Hermitian Adjoint of a Matrix, Hermitian, Unitary and Normal Transformations, Self Adjoint and Normal Transformations, Real Quadratic Forms.

**Eigen values and Eigen vectors:** Problems in Eigen Values and Eigen Vectors, Diagonalization, Orthogonal Diagonalization, Quadratic Forms, Diagonalizing Quadratic Forms, Conic Sections. Similarity of linear transformations - Diagonalisation and its applications - Jordan form and rational canonical form.

**TEXT BOOK**

**REFERENCES:**
e) Mike Cohen, Practical Linear Algebra for Data Science, Oreilly Publisher, 2022.

**24CSC111 Advanced Computer Programming 3 0 0 3**


Applied Plotting, Charting & Data Representation in Python: Fundamentals of data reading, streams etc and using Pandas, Basic Charting using Matplotlib, Advanced plots, interactive plots and animated plots, Plotting with Pandas, Seaborn.

Python packages for accessing the Web Data: Regex, urlib, BeautifulSoup, Json, Retrieving and parsing webpages (Json, XML), REST API, Facebook and Twitter API. Connecting DB with Python: Reading and Writing, possible simple SQL queries.

**Text Book:**

**24CSC112 Computer Architecture 3 0 2 4**


Fixed point Addition, Subtraction, Multiplication and Division. Floating Point arithmetic, High performance arithmetic, Subword parallelism


Text Books:


24CSC182 ADVANCED COMPUTER PROGRAMMING LAB 0 0 2 1

Programs to demonstrate functions call by reference and returning values by reference. Programs using pointer arithmetic operations and handling pointers. Programs to demonstrate dynamic memory allocation and de-allocation. Programs to show structure and union operations. Programs using files, command line arguments and macros. Programs using user defined libraries and graphics library.

22ADM111 GLIMPSES OF GLORIOUS INDIA L-T-P-C: 2-0-1-2

Course Objectives

The course will enable the students to
- The course aims at introducing Bhārath in nutshell to the student, which includes the sources of Indian thoughts, eminent personalities who shaped various disciplines, India’s significant contribution to the man kind, the current stature of Indian in the geopolitics and Indian approach to science and ecology
- This course is designed to provide a multifaceted understanding of India's cultural heritage, encompassing historical insights, philosophical perspectives, and contemporary relevance. By delving into diverse chapters, this course aims to foster deep insights into the intricate web of India's past, present, and its role on the global stage.
- Aligned with the Indian Knowledge Systems (IKS) framework outlined in the National Education Policy, this course serves as an introduction to the vast reservoir of wisdom and knowledge rooted in Indian heritage.

**Course Outcomes:**
After successful completion of the course, Students will be able to:

<table>
<thead>
<tr>
<th>S.No.</th>
<th>Course Outcomes</th>
<th>Knowledge level [Bloom’s Taxonomy]</th>
</tr>
</thead>
<tbody>
<tr>
<td>CO01</td>
<td>Recall key historical events, personalities, and philosophical concepts presented in the chapters on Indian heritage. Statement: Demonstrate the ability to remember significant historical events, noteworthy individuals, and fundamental philosophical ideas discussed in the chapters on glorious India.</td>
<td>Remembering</td>
</tr>
<tr>
<td>CO02</td>
<td>Explain the diverse roles of women, the teachings of Acharya Chanakya, and the concepts of God and Iswara as foundational elements of Indian culture. Statement: Understand the significance of women's roles, Chanakya's teachings, and spiritual concepts, appreciating their contributions to Indian society.</td>
<td>Understanding</td>
</tr>
<tr>
<td>CO03</td>
<td>Apply lessons from the Bhagavad Gita to real-life scenarios, demonstrating the relevance of its teachings. Statement: Utilize insights from the Bhagavad Gita to navigate challenges, transforming from a soldier to a seeker on a spiritual journey.</td>
<td>Applying</td>
</tr>
<tr>
<td>CO04</td>
<td>Analyze the synthesis of yoga, spirituality, and life principles in Indian culture, as explored in the chapters on Bhagavad Gita and Lessons of Yoga. Statement: Deconstruct the integration of yoga and spiritual wisdom in Indian culture, examining how these principles enhance holistic well-being.</td>
<td>Analyzing</td>
</tr>
<tr>
<td>CO05</td>
<td>Evaluate the impact of Indian soft power, the preservation of nature through faith, and ancient Indian cultures on global perceptions.</td>
<td>Evaluating</td>
</tr>
</tbody>
</table>
Statement: Assess the influence of India's cultural soft power, environmental values, and ancient traditions on its international image and ecological practices.

Develop projects that illustrate Indian contributions to the world, practical applications of Vedanta, and the Indian approach to science.

Statement: Create innovative presentations or projects that showcase India's global influence, practical insights from Vedanta, and unique scientific perspectives inspired by Indian thought.

CO-PO Mapping: [affinity#: 3 – high; 2- moderate; 1- slightly]

<table>
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<tr>
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<tr>
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<td>PO1 PO2 PO3 PO4 PO5 PO6 PO7 PO8 PO9 PO10 PO11 PO12</td>
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<td>CO06</td>
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Syllabus

Chapter 1 – Face the Brutes
Chapter 2 – Role of Women in India
Chapter 3 – Acharya Chanakya
Chapter 4 – God and Iswara
Chapter 5 – Bhagavad Gita: From Soldier to Samsarin to Sadhaka
Chapter 6 – Lessons of Yoga from Bhagavad Gita
Chapter 7 – Indian Soft powers
Chapter 8 – Preserving Nature through Faith
Chapter 9 - Ancient Indian Cultures (Class Activity)
Chapter 10 - Practical Vedanta
Chapter 11 - To the World from India (For Continuous Assessment)
Chapter 12 - Indian Approach to Science
Chapter 13 - India: In the Views of foreign Scholars and Travellers.
Chapter 14 - Personality Development Through Yoga.
Chapter 15 - Hallmark of Indian Traditions: Advaita Vedanta, Theory of oneness
Chapter 16 - Conversations on Compassion with Amma
1. Course Overview

Master Over the Mind (MAOM) is an Amrita initiative to implement schemes and organise university-wide programs to enhance health and wellbeing of all faculty, staff, and students (UN SDG -3). This program as part of our efforts for sustainable stress reduction gives an introduction to immediate and long-term benefits and equips every attendee to manage stressful emotions and anxiety facilitating inner peace and harmony.

With a meditation technique offered by Amrita Chancellor and world-renowned humanitarian and spiritual leader, Sri Mata Amritanandamayi Devi (Amma), this course has been planned to be offered to all students of all campuses of AMRITA, starting off with all first years, wherein one hour per week is completely dedicated for guided practical meditation session and one hour on the theory aspects of MAOM. The theory section comprises lecture hours within a structured syllabus and will include invited guest lecture series from eminent personalities from diverse fields of excellence. This course will enhance the understanding of experiential learning based on university’s mission: “Education for Life along with Education for Living”, and is aimed to allow learners to realize and rediscover the infinite potential of one’s true Being and the fulfilment of life’s goals.

2. Course Syllabus

Unit 1 (4 hours)

Unit 2 (4 hours)

Improving work and study performance. Meditation in daily life. Cultivating compassion and good mental health with an attitude of openness and acceptance. Research and Science of Meditation: Significance of practising meditation and perspectives from diverse fields like science, medicine, technology, philosophy, culture, arts, management, sports, economics, healthcare, environment etc. The role of meditation for stress and anxiety reduction in one’s life with insights based on recent cutting-edge technology. The effect of practicing meditation for the wholesome wellbeing of an individual.

Unit 3 (4 hours)

Communications: principles of conscious communication. Relationships and empathy: meditative approach in managing and maintaining better relationships in life during the interactions in the world, role of MAOM in developing compassion, empathy and responsibility, instilling interest, and orientation to humanitarian projects as a key to harness intelligence and compassion in youth. Methodologies to evaluate effective awareness and relaxation gained from meditation. Evaluating the global transformation through meditation by instilling human values which leads to service learning and compassion driven research.

TEXT BOOKS:

REFERENCES:
3. Swami Amritaswarupananda Puri “Awaken Children Vol 1, 5 and 7 - Dialogues with Amma on Meditation”, August 2019
4. Swami Amritaswarupananda Puri “From Amma’s Heart - Amma’s answer to questions raised during world tours” March 2018

3. Evaluation and Grading
### Course Outcomes (CO)

**CO1:** Relate to the causes of stress in one’s life.
**CO2:** Experiment with a range of relaxation techniques
**CO3:** Model a meditative approach to work, study, and life.
**CO4:** Develop appropriate practice of MA-OM technique that is effective in one’s life
**CO5:** Inculcate a higher level of awareness and focus.
**CO6:** Evaluate the impact of a meditation technique

*Programme Outcomes (PO)* (As given by NBA and ABET)

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<tr>
<th>PO1</th>
<th>PO2</th>
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Semester 3

24CSC201  Data Structures  3003

Abstraction - Abstract data types; Data Representation; Elementary data types; Basic concepts of data Structures; Mathematical preliminaries - big-Oh notation; efficiency of algorithms; notion of time and space complexity; performance measures for data structures.
ADT array - Computations on arrays - sorting and searching algorithms.

ADT Stack, Queue, list - array, linked list, cursor based implementations of linear structures. ADT Tree - tree representation, properties traversal of trees; ADT- Binary Trees – properties and algorithms, ADT Priority Queue - Heaps; heap-based implementations; applications of heaps - sorting; Search Tree - Binary search tree; balanced binary search trees - AVL tree; Applications of Search Trees - TRIE; 2-3-4 tree; concept of B-Tree. ADT Dictionary - array based and tree based implementations; hashing - definition and application.

Graphs: ADT- Data structure for graphs - Graph traversal- Transitive Closure- Directed Acyclic graphs - Weighted graphs – Shortest Paths - Minimum spanning tree – Greedy Methods for MST.

TEXTBOOKS:

REFERENCES:

24MAT204  Algebra – I  3104

Homomorphisms, Kernal of a homomorphism, Automorphisms, Cauchy’s Theorem and Sylow’s Theorem for Abelian Groups, Cayley’s Theorem.
Permutation Groups, Conjugate Elements, Normalizer of an Element, Index of Normalizer, Center of a Group, Cauchy’s Theorem on Prime Order, the Number of Conjugate Classes \( p(n) \) for a Permutation Group, Counting Principles, Cauchy Theorem.

**TEXTBOOKs:**


**24MAT205 Computational Optimization 3 0 2 4**


Convex sets: Affine and convex sets. Some important examples. Operations that preserve convexity.


**TEXT BOOKS:**


**REFERENCES:**


Continuous Functions: – Continuous Functions - Combinations of Continuous Functions –Continuous Functions on Intervals – Uniform Continuity – Continuity and Gauges – Monotone and Inverse Functions.

Text Books:


5. S. Kumaresan and Ajit Kumar, A Basic Course in Real Analysis, CRC Press.

24CSC202 OPERATING SYSTEMS 3 0 2 4

Introduction to Operating Systems: Overview - Types of systems - Computer system operations - Hardware Protection - Operating systems services - System calls
- System structure - Virtual machines. Process Management: Process concepts-
Process scheduling - Operations on Process - Cooperating process - Interprocess
communication - Multithreading models - Threading issues - Thread types - CPU
scheduling–scheduling algorithms.

Process Synchronization: Critical section problem - synchronization hardware –
Semaphores - Classical problems of synchronization - Critical regions – Monitors-
Deadlocks - Deadlock characterization - Methods of handling deadlocks - Deadlock
prevention – Avoidance - Detection and recovery.

Storage Management: Memory management – Swapping - Contiguous memory
allocation. Paging – Segmentation - Segmentation with Paging - Virtual memory -
Demand paging - Process creation – page replacement - Thrashing. File Systems:
Directory structure - Directory implementation - Disk scheduling. Case study:
Threading concepts in Operating systems, Kernel structures.

TEXT BOOK:

and Sons, 2012.

REFERENCES:

c) Stevens W R and Rago S A, “Advanced Programming in the Unix Environment”,

24CSC281 C Programming and Lab 1 0 2 2

Basic Linux commands, programs using input/output statements, operators, control structures
andloops. Programs using functions and recursions. Programs using numeric one-dimensional
array, two-dimensional array. Programs using strings, string handling functions and string
arrays.

Programs using passing arrays and strings to functions.

24CSC282 Data Structures Lab 0 0 2 1

Implementing Sample ADT, Templates - Stacks and Queues: Array implementation,
Applications - Vector, Lists, using these STLs for other implementations -Linked list: Singly
and Doubly Linked Lists Implementation, Linked Stacks, D-Queue, Circular Queue - Implementing STL: Sequences, Iterators - Trees: Binary search tree, Priority Queue, Heaps - Graphs: Graph Representations, Traversals (BFS, DFS) - Hashing: Hash Table creation, creating hash functions, dynamically resizing hash tables.

| Life Skills I | 23LSP201 | L-T-P-C: 1-0-2-2 |

**Pre-requisite:** An open mind and the urge for self-development, basic English language skills, knowledge of high school level mathematics.

**Course Objective:** To assist students in inculcating soft skills, developing a strong personality, empowering them to face life’s challenges, improving their communication skills and problem-solving skills.

**Course Outcomes**
**CO1: Soft Skills** - To develop greater morale and positive attitude to face, analyze, and manage emotions in real life situations, like placement process.
**CO2: Soft Skills** - To empower students to create better impact on a target audience through content creation, effective delivery, appropriate body language and overcoming nervousness, in situations like presentations, Group Discussions and interviews.
**CO3: Aptitude** – To analyze, understand and solve questions in arithmetic and algebra by employing the most suitable methods.
**CO4: Aptitude** - To investigate and apply suitable techniques to solve questions on logical reasoning.
**CO5: Verbal** – To infer the meaning of words & use them in the right context. To have a better understanding of the nuances of English grammar and become capable of applying them effectively.
**CO6: Verbal** - To identify the relationship between words using reasoning skills. To develop the capacity to communicate ideas effectively.
**Skills:** Communication, self-confidence, emotional intelligence, presentation skills and problem-solving Skills.

**CO-PO Mapping**

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<th>PO</th>
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**Syllabus**

**Soft Skills**
**Soft Skills and its importance:** Pleasure and pains of transition from an academic environment to work-environment. New-age challenges and distractions. Learning to benefit from constructive criticisms and feedback. Need for change in mindset and up-skilling to keep oneself competent in the professional world.

**Managing Self:** Knowing oneself, Self-perception, Importance of positive attitude, Building and displaying confidence, Avoiding being overconfident, Managing emotions, stress, fear. Developing Resilience and handling failures. Self-motivation, Self-learning, and continuous knowledge up-gradation / Life-long learning. Personal productivity - Goal setting and its importance in career planning, Self-discipline, Importance of values, ethics and integrity, Universal Human Values.

**Communication:** Process, Language Fluency, Non-verbal, Active listening. Assertiveness vs. aggressiveness. Barriers in communication. Digital communication

**Aptitude**


Ratio, Proportion & Variation: Basics, Alligations, Mixtures, and Partnership.

Averages: Basics, and Weighted Average.

Equations: Basics, Linear, Quadratic, Equations of Higher Degree and Problems on ages.

Logical Reasoning I: Blood Relations, Direction Test, Syllogisms, Series, Odd man out, Coding \\& Decoding, Cryptarithmetic Problems and Input - Output Reasoning.

**Verbal Skills**
**Vocabulary:** Familiarize students with the etymology of words, help them realize the relevance of word analysis and enable them to answer synonym and antonym questions. Create an awareness about the frequently misused words, commonly confused words and wrong form of words in English.

**Grammar (Basics):** To learn the usage of grammar and facilitate students to identify errors and correct them.

**Reasoning:** Stress the importance of understanding the relationship between words through analogy questions. Emphasize the importance of avoiding the gap (assumption) in the argument/ statements/ communication.

**Speaking Skills:** Make students conscious of the relevance of effective communication in today’s world through individual speaking activities.

**Writing Skills:** Introduce formal written communication and keep the students informed about the etiquette of email writing.
References:
2. The hard truth about Soft Skills, by Amazon Publication.
3. Verbal Skills Activity Book, CIR, AVVP
4. Nova’s GRE Prep Course, Jeff Kolby, Scott Thornburg & Kathleen Pierce
5. The BBC and British Council online resources
6. Owl Purdue University online teaching resources
7. www.thegrammarbook.com online teaching resources
8. www.englishpage.com online teaching resources and other useful websites
11. How to Prepare for Quantitative Aptitude for the CAT, Arun Sharma.
12. How to Prepare for Data Interpretation for the CAT, Arun Sharma.

Evaluation Pattern

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*CA - Can be presentations, speaking activities and tests.

Courses offered under the framework of
Amrita Values Programmes I and II

22AVP201 Message from Amma’s Life for the Modern World

Amma’s messages can be put to action in our life through pragmatism and attuning of our thought process in a positive and creative manner. Every single word Amma speaks and the guidance received in on matters which we consider as trivial are rich in content and touches the very inner being of our personality. Life gets enriched by Amma’s guidance and She teaches us the art of exemplary life skills where we become witness to all the happenings around us still keeping the balance of the mind.

22ADM211 Leadership from the Ramayana

Introduction to Ramayana, the first Epic in the world – Influence of Ramayana on Indian values and culture – Storyline of Ramayana – Study of leading characters in Ramayana – Influence of Ramayana outside India – Relevance of Ramayana for modern times.

22ADM201 Strategic Lessons from the Mahabharata

Introduction to Mahabharata, the largest Epic in the world – Influence of Mahabharata on Indian values and culture – Storyline of Mahabharata – Study of leading characters in Mahabharata – Kurukshetra War and its significance - Relevance of Mahabharata for modern times.

22AVP204 Lessons from the Upanishads
Introduction to the Upanishads: Sruti versus Smrti - Overview of the four Vedas and the ten Principal Upanishads - The central problems of the Upanishads – The Upanishads and Indian Culture – Relevance of Upanishads for modern times – A few Upanishad Personalities: Nachiketas, SatyakamaJabala, Aruni, Shvetaketu.

22AVP205 Message of the Bhagavad Gita

22AVP206 Life and Message of Swami Vivekananda
Brief Sketch of Swami Vivekananda’s Life – Meeting with Guru – Disciplining of Narendra - Travel across India - Inspiring Life incidents – Address at the Parliament of Religions – Travel in United States and Europe – Return and reception India – Message from Swamiji’s life.

22AVP207 Life and Teachings of Spiritual Masters India
Sri Rama, Sri Krishna, Sri Buddha, AdiShankaracharya, Sri Ramakrishna Paramahamsa, Swami Vivekananda, Sri RamanaMaharshi, Mata Amritanandamayi Devi.

22AVP208 Insights into Indian Arts and Literature
The aim of this course is to present the rich literature and culture of Ancient India and help students appreciate their deep influence on Indian Life - Vedic culture, primary source of Indian Culture – Brief introduction and appreciation of a few of the art forms of India - Arts, Music, Dance, Theatre.

22AVP209 Yoga and Meditation
The objective of the course is to provide practical training in YOGA ASANAS with a sound theoretical base and theory classes on selected verses of Patanjali’s Yoga Sutra and Ashtanga Yoga. The coverage also includes the effect of yoga on integrated personality development.

22AVP210 Kerala Mural Art and Painting
Mural painting is an offshoot of the devotional tradition of Kerala. A mural is any piece of artwork painted or applied directly on a wall, ceiling or other large permanent surface. In the contemporary scenario Mural painting is not restricted to the permanent structures and are being done even on canvas. Kerala mural paintings are the frescos depicting mythology and legends, which are drawn on the walls of temples and churches in South India, principally in Kerala. Ancient temples, churches and places in Kerala, South India, display an abounding tradition of mural paintings mostly dating back between the 9th to 12th centuries when this form of art enjoyed Royal patronage. Learning Mural painting through the theory and practice workshop is the objective of this course.

22AVP213 Traditional Fine Arts of India
India is home to one of the most diverse Art forms world over. The underlying philosophy of Indian life is ‘Unity in Diversity’ and it has led to the most diverse expressions of culture in India. Most art forms of India are an expression of devotion by the devotee towards the Lord and its influence in Indian life is very pervasive. This course will introduce students to the deeper philosophical basis of Indian Art forms and attempt to provide a practical demonstration of the continuing relevance of the Art.

22AVP214 Principles of Worship in India
Indian mode of worship is unique among the world civilizations. Nowhere in the world has the philosophical idea of reverence and worshipfulness for everything in this universe found universal acceptance as it in India. Indian religious life even today is a practical demonstration of the potential for
realization of this profound truth. To see the all-pervading consciousness in everything, including animate and inanimate, and constituting society to realise this truth can be seen as the epitome of civilizational excellence. This course will discuss the principles and rationale behind different modes of worship prevalent in India.

22AVP215  Temple Mural Arts in Kerala
The traditional percussion ensembles in the Temples of Kerala have enthralled millions over the years. The splendor of our temples makes art enthusiast spellbound, warmth and grandeur of color combination sumptuousness of the outline, crowding of space by divine or heroic figures often with in vigorous movement are the characteristics of murals.

The mural painting specially area visual counterpart of myth, legend, gods, devi, and demons of the theatrical world, Identical myths are popular the birth of Rama, the story of Bhima and Hanuman, Shiva, as Kirata, and the Jealousy of Uma and ganga the mural painting in Kerala appear to be closely related to, and influenced by this theatrical activity the art historians on temple planes, wood carving and painting the architectural plane of the Kerala temples are built largely on the pan-Indians almost universal model of the Vasthupurusha.

22AVP218 Insights into Indian Classical Music
The course introduces the students into the various terminologies used in Indian musicology and their explanations, like Nadam, Sruti, Svaram – svara nomenclature, Stayi, Graha, Nyasa, Amsa, Thala, Saptatalas and their angas, Shadangas, Vadi, Samavadi, Anuvadi. The course takes the students through Carnatic as well as Hindustani classical styles.

22AVP219 Insights into Traditional Indian Painting
The course introduces traditional Indian paintings in the light of ancient Indian wisdom in the fields of aesthetics, the Shadanga (Sixs limbs of Indian paintings) and the contextual stories from ancient texts from where the paintings originated. The course introduces the painting styles such as Madhubani, Kerala Mural, Pahari, Cheriyal, Rajput, Tanjore etc.

22AVP220 Insights into Indian Classical Dance
The course takes the students through the ancient Indian text on aesthetics the Natyasastra and its commentary the AbhinavaBharati. The course introduces various styles of Indian classical dance such as Bharatanatyam, Mohiniyattam, Kuchipudi, Odissi, Katak etc. The course takes the students through both contextual theory as well as practice time.

22AVP221 Indian Martial Arts and Self Defense
The course introduces the students to the ancient Indian system of self-defense and the combat through various martial art forms and focuses more on traditional Kerala’s traditional KalariPayattu. The course introduces the various exercise technique to make the body supple and flexible before going into the steps and techniques of the martial art. The advanced level of this course introduces the technique of weaponry.

23ENV300  ENVIRONMENTAL SCIENCE  P/F

Course Objectives
a) To study the nature and facts about environment
b) To appreciate the importance of environment by assessing its impact on the human world
c) To study the integrated themes and biodiversity, pollution control and waste management

Course Outcomes

**CO1:** Ability to understand aspects of nature and environment
**CO2:** Ability to analyse impact of environment on human world
**CO3:** Ability to comprehend pollution control and waste management

Syllabus

**Unit 1**

**Unit 2**

**Unit 3**

**Text Book(s)**

**Reference(s)**

Semester 4

Random variables, Probability Distributions and Probability mass functions, Cumulative Distribution functions, mathematical expectation, variance, moments and moment generating function.

Standard discrete distributions - Binomial, Poisson, Uniform, Geometric distributions, Negative binomial and Hypergeometric Distributions - Standard continuous distributions - Uniform, Exponential, Gamma, Beta and Normal distributions. Chebyshev’s theorem.

Two dimensional random variables-Joint, marginal and conditional probability distributions for discrete and continuous cases, independence, expectation of two dimensional random variables - conditional mean, conditional variance, covariance and correlation.

Functions of one and two random variables. Sampling and sampling Distributions- t, F and Chi-square distributions – central limit theorem.

Text books:


Homomorphisms, kernel, Isomorphism, Ideals, Quotient Rings, Maximal Ideals, the Field of Quotients of an Integral Domain.

Euclidean Rings, Principal Ideal, Unit Element, Greatest Common Divisor, Prime Elements, Unique Factorization Theorem, The ring of Gaussian integers, Fermat’s Theorem.

Polynomial Rings over Commutative Rings. Unique Factorization Domain. Euclidean Domains, Principal Ideal Domains, Unique Factorization Domains, and their proper inclusions.

**TEXTBOOK:**

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**24MAT216 Analysis II**

**Basic Concepts:** Definition and Examples of Metric Spaces, Distance between Sets and Diameter of a Set, Open Sets and Interior Points, Closed Sets and Closure of Subspaces.

**Complete Metric Spaces and Separable Spaces:** Convergent Sequences, Cauchy Sequences, Complete Metric Spaces, Completion. Separable Spaces, Countability, Dense Sets, Nowhere Dense Sets.

Definitions and Basic Concepts, Sequentially Compact Spaces, Totally Bounded Spaces.

**Continuous Functions:** Definition and Characterizations, Continuous Functions and Compact Spaces, Uniform Continuous Functions, Homeomorphism and Equivalent Metrics, Uniform Convergence of Sequences of Functions.

**Connected Spaces:** Separated Sets, Connected Sets, Continuous Functions and Connected Sets, Components.

**Text books:**


d) Tom M. Apostol Mathematical Analysis Narosa publishing house, New Delhi, 2nd Ed. 1989.

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**24CSC211 Design and Analysis of Algorithms**

Introduction: Running time analysis -- recall of asymptotic notation, big-oh, theta, big-omega, and introduce little-oh and little-omega. Worst case and average case.
Basic design paradigms with illustrative examples -- incremental design (e.g., incremental sorting, interpolating polynomials), decremental design (e.g., GCD with discussion on input size, factorial), and pruning (e.g., order statistics). Divide and Conquer: Integer multiplication revisited with an efficient algorithm that motivates and leads into recurrences. Solving recurrences using recurrence trees, repeated substitution, statement of master theorem. Brief recall of merge sort and its recurrence. Median in worst case linear time.

Greedy Algorithms: Greedy choice, optimal substructure property, minimum spanning trees -- Prims and Kruskals, Dijkstra shortest path using arrays and heaps, fractional knapsack, and Huffman coding (use of priority queue). Dynamic Programming: Integral knapsack (contrasted with the fractional variant), longest increasing subsequence.

Graph Algorithms – Graph Traversal BFS and DFS.


Textbooks


References


24CSC212 Database Management Systems 3 0 2 4


Relational database design – features of good relational designs – atomic domains and normal forms - 1NF, 2NF, 3NF, 4NF and BCNF – decomposition using functional dependencies - functional dependency theory – algorithm for decomposition -decomposition using multi-values dependencies – PJNF and DKNF. Over view of Transaction Management and Concurrency control

Text Book:

Reference Books

24CSC283 Algorithm Lab 0 0 2 1


AMRITA VALUE PROGRAMME II 1 0 0 1

Pre-requisite: Willingness to learn, communication skills, basic English language skills, knowledge of high school level mathematics.

Course Objective: To help students understand the corporate culture and assist them in improving their group discussion skills, communication skills, listening skills and problem-solving skills.

Course Outcomes
CO1: Soft Skills - To improve the inter-personal skills, professional etiquette and leadership skills, vital for arriving at win-win situations in Group Discussions and other team activities.
CO2: Soft Skills - To develop the ability to create better impact in a Group Discussions through examination, participation, perspective-sharing, ideation, listening, brainstorming and consensus.
CO3: Aptitude - To interpret, critically analyze and solve questions in arithmetic and algebra by employing the most suitable methods.
**CO4: Aptitude** - To analyze, understand and apply suitable methods to solve questions on logical reasoning.

**CO5: Verbal** - To be able to use vocabulary in the right context and to be competent in spotting grammatical errors and correcting them.

**CO6: Verbal** - To be able to logically connect words, phrases, sentences and thereby communicate their perspectives/ideas convincingly.

**Skills:** Communication, etiquette and grooming, inter-personal skills, listening skills, convincing skills, problem-solving skill.

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Syllabus

**Soft Skills**


**Group Discussions:** Advantages of group discussions, Types of group discussion and Roles played in a group discussion. Personality traits evaluated in a group discussion. Initiation techniques and maintaining the flow of the discussion, how to perform well in a group discussion. Summarization/conclusion.

**Aptitude**

Logarithms, Inequalities and Modulus: Basics

Sequence and Series: Basics, AP, GP, HP, and Special Series.


Time, Speed and Distance: Basics, Average Speed, Relative Speed, Boats & Streams, Races and Circular tracks.

Logical Reasoning II: Arrangements, Sequencing, Scheduling, Venn Diagram, Network Diagrams, Binary Logic, and Logical Connectives, Clocks, Calendars, Cubes, Non-Verbal reasoning and Symbol based reasoning.
**Verbal Skills**
Vocabulary: Help students understand the usage of words in different contexts.

Grammar (Medium Level): Train students to comprehend the nuances of Grammar and empower them to spot errors in sentences and correct them.

Reading Comprehension (Basics): Introduce students to smart reading techniques and help them understand different tones in comprehension passages.

Reasoning: Enable students to connect words, phrases and sentences logically.

Oral Communication Skills: Aid students in using the gift of the gab to interpret images, do a video synthesis, try a song interpretation or elaborate on a literary quote.

References:
4. Verbal Skills Activity Book, CIR, AVVP
5. Nova’s GRE Prep Course, Jeff Kolby, Scott Thornburg & Kathleen Pierce
6. The BBC and British Council online resources
7. Owl Purdue University online teaching resources
8. www.thegrammarbook.com online teaching resources
9. www.englishpage.com online teaching resources and other useful websites
11. Quantitative Aptitude for All Competitive Examinations, Abhijit Guha.
13. How to Prepare for Data Interpretation for the CAT, Arun Sharma.
15. Quantitative Aptitude for Competitive Examinations, R S Aggarwal.

**Evaluation Pattern**

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SEMMESTER 5

24MAT302  COMPLEX ANALYSIS  3 1 0 4

Review: Algebra of complex numbers, operations of absolute value and conjugate, standard inequalities for absolute value.

Limits, Continuity, derivatives and analytic functions, Cauchy-Riemann equations, Harmonic functions and harmonic conjugates, Power series, Exponential and Logarithmic functions.


Taylors series, Laurent series; Isolated singularities: removable singularities, poles and essential singularities; Cauchy's residue theorem, Residues at Infinity, evaluation of definite integrals using Cauchy's residue theorem.


Linear Transformations-The Transformation $w = 1/z$ - Mappings by $1/z$ -Linear Fractional Transformations. (Chapter 8, Sec: 90-94).

TEXT BOOKS

24MAT303  Statistical Inference Theory  3-0-2-4


Interval Estimation: Introduction - confidence Interval for mean of a Normal Distribution with Variance known and unknown - Confidence Interval for the two means of a Normal Distribution with Variance known and unknown, Confidence
interval for one and two Population Proportions, Confidence interval for the variance and ratio of variances.

Inference theory - introduction to hypothesis testing - large sample tests for single mean and two means - large sample tests for single proportion and two proportions.

Small sample tests for single mean and two means – paired t-test - test for single variance – test for equality of two variances.

Chi-square goodness of fit for Binomial, Poisson and Normal distributions, Independence of attributes, test for homogeneity, Non-parametric tests - sign test, signed rank test and Mann-Whitney U test.

Text books:

24MAT304 DIFFERENTIAL EQUATIONS 4 0 0 4

Review of differential equations (order, degree, linear, nonlinear, implicit and explicit form of solution, general solutions, particular solution, singular solution). Exactness, nonexact equations reduce to exact form.
Equations solvable for \( \frac{dy}{dx}, y, x \), equations in Clairaut’s form, equations reducible to Clairaut’s form.
Conversion of nth order differential equation to n first order differential equations, homogeneous linear system with constant coefficients, fundamental matrices, complex eigen values, repeated eigenvalues. simultaneous linear differential equations with constant coefficients, simultaneous linear differential equations with variable coefficients.
Review of partial differential equations (order, degree, linear, nonlinear).
Formation of equations by eliminating arbitrary constants and arbitrary functions. General, particular and complete integrals. Lagrange’s linear equation, Charpit’s method. Methods to solve the first order partial differential equations of the forms 
\[ f(p,q) = 0, \quad f(z,p,q) = 0, \quad f_1(x,p) = f_2(y,q) \] and Clairut’s form \( z = px + qy + f(p,q) \) where 
\[ p = \frac{\partial z}{\partial x} \quad \text{and} \quad q = \frac{\partial z}{\partial y}. \]


**TEXT BOOKS:**
4. Dennis Zill, A First Course in Differential Equations, Cengage Learning, 9th edition

**24CSC301 Evolutionary Computing 3 0 0 3**

Text Books:

24CSC302 THEORY OF COMPUTATION 3 0 2 4

Automata and Languages: Chomsky hierarchy of languages, Introduction Finite Automata - Regular Expressions - Nondeterministic Finite Automata - equivalence of NFAs and DFAs – Minimization of DFA.

Regular Expressions - Non-Regular Languages - Pumping Lemma for regular languages.

Parse tree derivations (top-down and bottom-up) Context free languages –Chomsky normal form, GNF - Push Down Automata - Pumping lemma for context free language. CYK Algorithm, Deterministic CFLs. Ambiguous grammar, removing ambiguity, Computability Theory: Turing Machines - Non-deterministic Turing Machines –CSG, the Church Turing


TEXTBOOK:

REFERENCES:

**Pre-requisite:** Team Spirit, self-confidence and required knowledge, basic English language skills, knowledge of high school level mathematics.

**Course Objective:** To help students understand the nuances of leadership, know the importance of working in teams, face challenging situations, crack interviews, improve communication skills and problem-solving skills.

**Course Outcomes**

**CO1: Soft Skills** - To acquire the ability to work in teams, present themselves confidently and showcase their knowledge, skills, abilities, interests, practical exposure, strengths and achievements to potential recruiters through a resume, video resume, and personal interview.

**CO2: Soft Skills** - To have better ability to prepare for facing interviews, analyse interview questions, articulate correct responses and respond appropriately to convince the interviewer of one’s right candidature through displaying etiquette, positive attitude and courteous communication.

**CO3: Aptitude** - To manage time while arriving at appropriate strategies to solve questions in geometry, statistics, probability and combinatorics.

**CO4: Aptitude** - To analyze, understand and apply suitable methods to solve questions on data analysis and data sufficiency.

**CO5: Verbal** - To use diction that is less verbose and more refined and to use prior knowledge of grammar to correct/improve sentences.

**CO6: Verbal** - To understand arguments, analyze arguments and use inductive/deductive reasoning to arrive at conclusions. To be able to generate ideas, structure them logically and express them in a style that is comprehensible to the audience/recipient.

**Skills:** Communication, teamwork, leadership, facing interviews and problem-solving.

**CO-PO Mapping**

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</table>

**Syllabus**

**Soft Skills**

**Team Work:** Value of teamwork in organizations, Definition of a team. Why team? Effective team building. Parameters for a good team, roles, empowerment and need for transparent communication, Factors affecting team effectiveness, Personal characteristics of members and its influence on team. Project Management Skills, Collaboration skills.
Leadership: Initiating and managing change, Internal problem solving, Evaluation and co-ordination, Growth and productivity, Importance of Professional Networking.

Facing an interview: Importance of verbal & aptitude competencies, strong foundation in core competencies, industry orientation / knowledge about the organization, resume writing (including cover letter, digital profile and video resume), being professional. Importance of good communication skills, etiquette to be maintained during an interview, appropriate grooming and mannerism.

Aptitude
Geometry: 2D, 3D, Coordinate Geometry, and Heights & Distance.


Statistics: Mean, Median, Mode, Range, Variance, Quartile Deviation and Standard Deviation.

Data Interpretation: Tables, Bar Diagrams, Line Graphs, Pie Charts, Caselets, Mixed Varieties, and other forms of data representation.

Data Sufficiency: Introduction, 5 Options Data Sufficiency and 4 Options Data Sufficiency.

Campus recruitment papers: Discussion of previous year question papers of all major recruiters of Amrita Vishwa Vidyapeetham.

Miscellaneous: Interview Puzzles, Calculation Techniques and Time Management Strategies.

Verbal Skills
Vocabulary: Create an awareness of using refined language through idioms and phrasal verbs.

Grammar (Advanced Level): Enable students to improve sentences through a clear understanding of the rules of grammar.

Reasoning Skills: Facilitate the student to tap his reasoning skills through Syllogisms, and critical reasoning arguments.

Reading Comprehension (Advanced): Enlighten students on the different strategies involved in tackling reading comprehension questions.

Public Speaking Skills: Empower students to overcome glossophobia and speak effectively and confidently before an audience.

Writing Skills: Practice closet tests that assess basic knowledge and skills in usage and mechanics of writing such as punctuation, basic grammar and usage, sentence structure and rhetorical skills such as writing strategy, organization, and style. Practice formal written communication through writing emails especially composing job application emails.
References:
4. Verbal Skills Activity Book, CIR, AVVP
5. Nova’s GRE Prep Course, Jeff Kolby, Scott Thornburg & Kathleen Pierce
6. The BBC and British Council online resources
7. Owl Purdue University online teaching resources
8. www.thegrammarbook.com online teaching resources
9. www.englishpage.com online teaching resources and other useful websites
11. Quantitative Aptitude for All Competitive Examinations, Abhijit Guha.
13. How to Prepare for Data Interpretation for the CAT, Arun Sharma.
15. Quantitative Aptitude for Competitive Examinations, R S Aggarwal.

**Evaluation Pattern**

<table>
<thead>
<tr>
<th>Assessment</th>
<th>Internal</th>
<th>External</th>
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<tr>
<td>Continuous Assessment (CA)* – Soft Skills</td>
<td>30</td>
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<tr>
<td>Continuous Assessment (CA)* – Aptitude</td>
<td>10</td>
<td>25</td>
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<tr>
<td>Continuous Assessment (CA)* – Verbal</td>
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<tr>
<td>Total</td>
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</table>

*CA - Can be presentations, speaking activities and tests.

24CSC381 Open Lab-I 0 0 2 1

The students can choose any of the following:

- JAVA Programming
- C++
- Web Design
- Algorithms.io
- Hadoop
- Cascading
- TensorFlow
- SAS (Statistical Software Suite)
- Julia
Semester -6

24CSC311 Computer Networks 3 0 2 4

Course Outcomes:

1. Gain the knowledge of the basic computer network technology.
2. Gain the knowledge of the functions of each layer in the OSI and TCP/IP reference model.
3. Obtain the skills of subnetting and routing mechanisms.
4. Familiarity with the essential protocols of computer networks, and how they can be applied in network design and implementation.


Data link layer: Design issues, framing, Error detection and correction.
Elementary data link protocols: simplex protocol, A simplex stop and wait protocol for an error-free channel, A simplex stop and wait protocol for noisy channel.
Sliding Window protocols: A one-bit sliding window protocol, A protocol using Go-Back-N, A protocol using Selective Repeat, Example data link protocols.
Medium Access sub layer: The channel allocation problem, Multiple access protocols: ALOHA, Carrier sense multiple access protocols, collision free protocols. Wireless LANs, Data link layer switching.


Transport Layer: Transport Services, Elements of Transport protocols, Connection management, TCP and UDP protocols.
Application Layer – Domain name system, SNMP, Electronic Mail; the World WEB, HTTP, Streaming audio and video.

TEXT BOOK:
b) REFERENCE BOOKS:
24CSC312 Machine Learning 3 1 0 4


Multi-class/Structured Outputs, Ranking


Introduction to Bayesian Learning and Inference.

Text books/ Reference books.


Association Rule Mining: - Efficient and Scalable Frequent Item set Mining Methods – Mining Various Kinds of Association Rules – Association Mining to Correlation Analysis – Constraint-Based Association Mining.


Text Books:

24MAT312  Numerical Computations  3 0 2 4

Roots of Transcendental and Polynomial Equations: Bisection method, Iteration methods based on first degree equation, Rate of convergence, system of nonlinear equations.

Solution of System of Linear Algebraic Equations, Gauss-Elimination, LU Decomposition and Gauss-Seidel, Conjugate gradient method.


Interpolation and Approximation: Lagrange, Newton’s Divided Difference, Newton’s Forward and Backward interpolations and cubic splines,

Differentiation and Integration: Numerical differentiation, Maxima and Minima, Numerical integration, Newton-Cotes formulas, Romberg integration, Gaussian integration,


Solutions of Partial Differential equations: Elliptic, Parabolic and Hyperbolic equations implicit and explicit methods.

TEXT BOOKS:

REFERENCE BOOKS:
24MAT313  Transform Techniques  3 0 0 3


Text Book:

2. L. Debnath, Integral transforms and their Applications, CRC Press, New York-
3. London- Tokyo, 1995

24CSC314  Internet of Things  1 0 2 2

Introduction to IoT - IoT definition - Characteristics - Things in IoT - IoT Complete Architectural Stack - IoT enabling Technologies - IoT Challenges - IoT Levels - A Case Study to realise the stack.

Sensors and Hardware for IoT - Accelerometer, Proximity Sensor, IR sensor, Gas Sensor, Temperature Sensor, Chemical Sensor, Motion Detection Sensor. Hardware Kits - Arduino, Raspberry Pi, Node MCU. A Case study with any one of the boards and data acquisition from sensors (Lab Component).

Cloud and Data analytics - Types of Cloud - IoT with cloud challenges - Selection of cloud for IoT applications - Fog computing for IoT - Edge computing for IoT - Cloud security aspects for IoT applications - RFM for Data Analytics - Case study with AWS / AZURE / Adafruit / IBM Bluemix (Lab Component).

Case studies with architectural analysis:
IoT applications - Smart City - Smart Water - Smart Agriculture - Smart Energy - Smart Healthcare - Smart Transportation - Smart Retail - Smart waste management. (Lab Component - As a project)

Text and Reference Books
2. Infosys Training E Materials.
5. NPTEL Reference: https://onlinecourses.nptel.ac.in/noc17_cs22/preview

24CSC382 Data Mining Lab 0021

1) Working with objects using SQL for the following
   i. Data definition language: create, alter, grant, revoke, drop, truncate.
   ii. Data manipulation language: select, insert, update, delete.
   iii. Transaction control statements: commit, rollback, savepoint.

2) Constraints – Queries: Simple selection, projection and selection with conditions.
3) Functions: aggregate functions, group by, order by, date and conversion functions.
4) Set operators, joins, sub query: simple, nested, correlated, existence test, membership test, DDL and sub
5) queries and DML and sub queries.
6) Working with other schema objects: view, sequence, index, synonym, cluster, lock, BLOB, CLOB, nested table, type.
7) PL/SQL programs, cursors, functions, procedures, packages, triggers, exception handling.
8) Front end tool: form creation, validation, trigger and report generation.
9) Mini Project.
Implementation of the FIND-Algorithm for finding the most specific hypothesis based on a given set of training data samples.

EM algorithm

Implementation of the Locally weighted Regression algorithm

Implementation of the Candidate-Elimination algorithm.

Implementation of the K means algorithm

Demonstration of the working of the decision tree based ID3 algorithm. Use an appropriate data set for building the decision tree and apply this knowledge to classify a new sample.

Building an Artificial Neural Network by implementing the Back propagation algorithm and test the same using appropriate data sets Back propagation Algorithm.

Implementation of the naïve Bayesian classifier for a sample training data set.

Implementation of the k-Nearest Neighbour algorithm to classify the data set.

Implementation of the non-parametric Locally Weighted Regression algorithm in order to fit data points.

The students can choose any of the following, which is not studied in 24CSC381 Open Lab-I:

- JAVA Programming
- C++
- Web Design
- Algorithms.io
- Hadoop
- Cascading
- TensorFlow
- SAS (Statistical Software Suite)
- Julia

Evaluation: 60 marks for CA (weekly lab evaluation) + 40 marks for end semester


Case Studies: Transport networks, Biological networks, etc.,

TEXTBOOKS


REFERENCES BOOKS


5. Graph Algorithms in Neo4j
Software process and lifecycle: Software Product, Software Processes, Study of different process models, Project Management Concepts, Planning and Scheduling, Team organization and people management.

Software requirement engineering: Software requirements, extraction and specification, Feasibility Studies, Requirements Modeling, object oriented analysis.


Risk Management: Metrics and Measurement, Estimation for software projects, software configuration management, Maintenance and Reengineering.

Software Testing: Unit testing, integration testing, black box and white box testing, regression testing, performance testing, object oriented testing. Verification and validation of Software: Software Inspections and Audit, Automated Analysis, Critical systems validation.


Self-Study:

Text Books: 1. Ian Sommerville, Software Engineering, Addison – Wesley
2. Rajib Mall, Fundamentals of Software Engineering, Prentice Hall of India
3. Ivar Jacobson, Object Oriented Software Engineering A use case Approach, Pearson

24CSC502 Number Theory and Information Security 3 1 0 4

Algorithms for integer arithmetic:

Divisibility, GCD, modular arithmetic, modular exponentiation, Montgomery arithmetic, congruence, Chinese remainder theorem, orders and primitive roots, quadratic residues, integer and modular square roots, prime number theorem, continued fractions and rational approximations.

Prime and extension fields, representation of extension fields, polynomial basis, primitive elements, normal basis, optimal normal basis, irreducible polynomials, Root-finding and factorization algorithm, Lenstra-Lenstra-Lovasz algorithm.

Elliptic curves: The elliptic curve group, elliptic curves over finite fields, Schoof's point counting algorithm.

Primality testing algorithms: Fermat Basic Tests, Miller–Rabin Test, AKS Test.
**Integer factoring algorithms:** Trial division, Pollard rho method, p-1 method, CFRAC method, quadratic sieve method, elliptic curve method.


**Quantum Computational Number Theory:** Grover's algorithm, Shor's algorithm

Applications in Algebraic coding theory and cryptography.

**TEXT BOOKS:**


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**24MAT502 Basic Topology 3 1 0 4**


**Text Books:**

24CSC503  Deep Learning  3 0 2 4

**Basics:** Biological Neuron, Idea of computational units, McCulloch–Pitts unit and Thresholding logic, Linear Perceptron, Perceptron Learning Algorithm, Linear separability. Convergence theorem for Perceptron Learning Algorithm.

**Feedforward Networks:** Multilayer Perceptron, Gradient Descent, Backpropagation, Empirical Risk Minimization, regularization, autoencoders.

**Deep Neural Networks:** Difficulty of training deep neural networks, Greedy layerwise training.

**Convolutional Neural Networks:** LeNet, AlexNet.

**Recurrent Neural Networks:** Back propagation through time, Long Short Term Memory, Gated Recurrent Units, Bidirectional LSTMs, Bidirectional RNNs

**Generative models:** Restrictive Boltzmann Machines (RBMs), Introduction to MCMC and Gibbs Sampling, gradient computations in RBMs, Deep Boltzmann Machines.

**Recent trends:** Variational Autoencoders, Generative Adversarial Networks, Multi-task Deep Learning, Multi-view Deep Learning.

**Transformers:** Transfer learning, data augmentation and hyperparameter search.

**Applications:** Vision, NLP, Speech (just an overview of different applications in 2-3 lectures)
Case Studies with Keras, MXNet, Deeplearning4j, Tensorflow, CNTK, or Theano.

**Text books:**
2. Ian Goodfellow, Yoshua Bengio and Aaron Courville, Deep Learning, MIT press 2016
Pattern Recognition and Machine Learning, Christopher Bishop, 2007

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**Semester 8**

24CSC511  Artificial Intelligence  3 0 2 4

Search Methods: Uninformed Search, Informed Search, Path Search vs. Local Search. Game Playing Through Search: Minimax and Alpha-Beta

Constraint Satisfaction. Inductive Learning. Decision Trees. Artificial Neural Networks
Propositional & First Order Logic.
Architecture for Intelligent Agents — Agent communication — Negotiation and Bargaining —
Argumentation among Agents — Trust and Reputation in Multi-agent systems.
AI applications — Language Models — Information Retrieval- Information Extraction —
Natural Language Processing — Machine Translation — Speech Recognition — Robot —
Hardware — Perception — Planning — Moving.

Text Books:
4. Introduction to Artificial Intelligence – Eugene Charniak, Drew McDermott (Pearson Education Asia)

24CSC512 Parallel and Distributed Systems 3 0 2 4


System models : physical models, architecture models, operating system support. Distributed file systems – introduction- time and global states – synchronization of physical clocks – coordination and agreements: Mutual exclusion, election, consensus.

Text Books
24CSC513 Data Security 3 0 0 3

Access control mechanisms in general computing systems; Authentication and authorization mechanisms- Passwords (Single vs Multifactor), Captcha, Single Sign-on- Oauth and Openid connect, Authentication Protocols (Kerberos, X.509).

Malwares and its protection mechanisms- Viruses, Worms, Trojans, Ransomware, Polymorphic malware, Antivirus, Firewall and Intrusion detection systems.

Networking Basics, Web, Email, and IP Security- SSL, TLS, WEP, SET, Blockchain, PGP, IPSEC.


Text book:

References:

24CSC514 Reinforcement Learning 3 0 2 4
Introduction: Reinforcement Learning, Elements of Reinforcement Learning, Limitations and Scope, An Extended Example- Tic-Tac-Toe.


Text Book:

References:
1. Phil Winder, Reinforcement Learning, O’Reilly Media Publisher, 2020.

Semester 9

24CSC698 Project –I 8 credits

The students shall take a project in their ninth semester for eight credits. This project will be as an internship in either industries or academic institutions. A faculty member and a mentor from industries / academic institution will be assigned for each student for this Project-I. Students expected to submit a report on their works.

A review committee will review and evaluate all the projects.

Evaluation: Mid team review – 40 marks and End team review – 60 marks
The students shall take this project in their tenth semester for 12 credits. This can be the continuation of the Project-I. This project will be as an internship in either industries or academic institutions. A faculty member and a mentor from industries / academic institution will be assigned for each student for this Project-II. Students expected to submit a detailed project report.

A review committee will review and evaluate all the projects.

Evaluation: Mid team review – 40 marks and End team review – 60 marks.
Elective Courses

24MAT531 Advanced Algebra 3 0 0 3

Cyclotomic Polynomial and Extensions of Fields.
Introduction to the Representation Theory. Linear Actions and Modules over group rings.

REFERENCES:

24MAT532 Advanced Topology

3 0 0 3


TEXT BOOKS:
Normed linear spaces, Banach spaces, Classical examples: $C[0,1], l_p, C, C_0, C_{00}, L^p[0,1]$, Continuity of Linear Operator and bounded linear operator, Quotient spaces
Finite dimensional normed spaces, Riesz lemma, (non) compactness of unit ball, Hahn Banach theorem and Its consequences.
Uniform Boundedness principle, Closed Graph Theorem, Bounded Inverse Theorem, Open Mapping Theorem, Banach Steinhauss Theorem
Bounded Linear Functionals, Dual space of classical spaces, Reflexivity of the Banach Space, Hilbert spaces, Projection theorem, Orthonormal basis, Bessel inequality, Parseval’s equality
Seperable Hilbert spaces and Countable orthonormal basis, example of non seperable spaces, Uncountable orthonormal basis and definition of convergence of Fourier series – Riesz-Fisher’s theorem, Riesz representation theorem

REFERENCE BOOKS:

1. Linear Analysis by Bela Bollobas, Cambridge University Press, 1999
3. Introduction to Topology and Modern Analysis by G. F. Simmons, McGraw Hill Education, 2004

Compact operators on Hilbert Spaces. (a) Fredholm Theory (b) Index, C*- algebras - noncommutative states and representations, Gelfand-Neumark representation theorem, Von- Neumann algebras; projections, double commutant theorem, L∞ functional calculus, Toeplitzoperators.

REFERENCE BOOKS:


Integration of Functions of a Real Variable: Integration of Non-Negative Functions - The General Integral - Integration of Series - Riemann and Lebesgue Integrals.

Abstract Measure Spaces: Measures and Outer Measures - Extension of a Measure - Uniqueness of the Extension - Completion of a Measure - Measure Spaces - Integration with Respect to a Measure.

Inequalities and the Spaces: The Spaces - Convex Functions - Jensen’s Inequality - The Inequalities of Holder and Minkowski - Completeness of $L^p(\mu)$.


**24MAT536 Theory of Ordinary Differential Equations**

Linear differential equations: Introduction, initial value problems, the wronskian and linear independence, reduction of order of a homogeneous equation, non-homogeneous equation. **Existence - Uniqueness of Solutions to First Order Equations:** Equations with variable separated, Exact equations, the method of successive approximations, Lipschitz condition, Convergence of successive approximations, Non–local existence of solutions, Approximations to, and uniqueness, of solutions. Systems of first order equations, Existence and uniqueness theorem, fundamental matrix, nonhomogenous linear systems, linear systems with constant coefficients. Complex n-dimensional space, Systems as vector equations, Existence and
uniqueness of solutions to systems, Existence and Uniqueness of linear systems, Equations of order $n$.


**TEXT BOOKS:**

**22MAT537 PARTIAL DIFFERENTIAL EQUATIONS 3 0 0 3**

Geometrical interpretation of a first-order pde, method of characteristics and general solutions, Monge cone, Lagrange’s equations, canonical forms of first-order linear equations, method of separation of variables. Second-order equations in two independent variables, canonical forms, equations with constant coefficients, general solutions. The Cauchy problem, the Cauchy-Kowalewskaya theorem, homogeneous wave equations, the D’Alembert solution of wave equation, initial boundary-value problems, equations with nonhomogeneous boundary conditions, vibration of finite string with fixed ends, (review) nonhomogeneous wave equations. Basic concepts, types of boundary-value problems, maximum and minimum principles, uniqueness and continuity theorems. Dirichlet problem for a circle, Dirichlet problem for a circular annulus, Neumann problem for a circle, Dirichlet problem for a rectangle, Dirichlet problem involving the Poisson equation, the Neumann problem for a rectangle. Derivation of the heat equation and solutions of the standard initial and boundary value problems, uniqueness and the maximum principle, time-independent boundary conditions, time-dependent boundary conditions.

**TEXT BOOKS:**

**References:**


24MAT538 COMMUTATIVE ALGEBRA 3003

1. Rings and ideals, modules and operations on them (tensor product, Hom, direct sum and product). Rings and modules of Fractions, primary decomposition. Integral dependence and Valuations, Chain Conditions.
2. Noetherian Rings and Artin Rings.
3. Discrete valuation Rings and Dedekind Domains, Dimension theory.

TEXT BOOKS / References

24MAT539 FIXED POINT THEORY 3003

Application of fixed point theory to Game theory and Mathematical Economics.

TEXT BOOKS // REFERENCE BOOKS:


Review of Conservation equations for mass, momentum and energy; coordinate systems: Eulerian and Lagrangian approach, Conservative and non-conservative forms of the equations, rotating co-ordinates.

Classification of system of PDEs: parabolic elliptic and hyperbolic; Boundary and initial conditions; Overview of numerical methods; Review of Finite Difference Method, Introduction to integral method, method of weighted residuals, finite elements finite volume method & least square method.


TEXT BOOKS / REFERENCE BOOKS:

Finite Element Method: Variational formulation - Rayleigh-Ritz minimization - weighted residuals - Galerkin method applied to boundary value problems. Global and local finite element models in one dimension - derivation of finite element equation. Finite element interpolation - polynomial elements in one dimension, two dimensional elements, natural coordinates, triangular elements, rectangular elements, Lagrangian and Hermite elements for rectangular elements - global interpolation functions. Local and global forms of finite element equations -
boundary conditions - methods of solution for a steady state problem - Newton-Raphson continuation. One dimensional heat and wave equations.

**TEXT AND REFERENCE BOOKS**


**24MAT542 Advanced Graph Theory 3 0 0 3**

**Review of Graphs:** Graphs and Sub graphs, isomorphism, matrices associated with graphs, degrees, walks, connected graphs, shortest path algorithm.


**Matching:** Matchings, maximal matchings. Coverings and minimal coverings. Berge's theorem, Hall's theorem, Tutte’s perfect matching theorem, Job assignment problem.

Coverings, Independent Sets and Cliques; Basic Relations. Graph dominations and coverings.

**Colorings:** Vertex colorings, greedy algorithm and its consequences, Brooks’ theorem. Chromatic polynomials. Edge-colorings, Vizing theorem on edge-colorings.


**TEXT BOOKS**


**REFERENCES BOOKS**

2. Balakrishnan and Ranganathan, Graph Theory, springer.


Information Theory: Entropy, Huffman coding, Shannon-Fano coding, entropy of Markov process, channel and mutual information, channel capacity; Error correcting codes: Maximum likelihood decoding, nearest neighbour decoding, linear codes, generator matrix and parity-check matrix, Hamming bound, Gilbert-Varshamov bound, binary Hamming codes, Plotkin bound, nonlinear codes, Reed-Muller codes, Cyclic codes, BCH codes, Reed-Solomon codes, Algebraic codes.
Reference Books:


24MAT545 Statistical Pattern Recognition

Introduction and Bayesian Decision Theory– Pattern recognition systems – the design cycle – learning and adaptation – Bayesian decision theory – continuous features – Minimum error rate classification – discriminant functions and decision surfaces – the normal density based discriminant functions.


TEXT BOOKS / References:


### 24MAT546 WAVELETS


Construction of Wavelets on $\mathbb{Z}_N$, The First Stage Construction of Wavelets on $\mathbb{Z}_N$, The Iteration Step.

Examples and Applications, $l^2(\mathbb{Z})$,

Complete Orthonormal Sets in Hilbert Spaces, $L^2([-\pi, \pi])$ and Fourier Series,

The Fourier Transform and Convolution on $l^2(\mathbb{Z})$, First-Stage Wavelets on $\mathbb{Z}$

The Iteration Step for Wavelets on $\mathbb{Z}$, Implementation and Examples.

$L^2(R)$ and Approximate Identities, The Fourier Transform on $\mathbb{R}$, Multiresolution Analysis and Wavelets, Construction of Multiresolution Analyses, Wavelets with Compact Support and Their Computation.

**References:**


### 24MAT547 Statistical Quality Control

Introduction to Total Quality Management – Japanese System of Total Quality Management

- Quality Circles

- 7 Quality Control tools

- 7 New Quality Control tools

Basic concept of quality control, process control and product control - Process and measurement system capability analysis - Area properties of Normal distribution. Statistical process control, theory of control charts, Shewhart control charts for variables-$\bar{x}$, R, s charts, attribute control charts - p, np, c, u charts, modified control charts.

Acceptance sampling for attributes, single sampling, double sampling, multiple sampling and sequential sampling plans, rectifying inspection plans, measuring performance of the sampling plans- OC, AOQ, ASN, ATI curves.

Taguchi methods: Meaning of Quality, Taguchi’s loss function, Introduction to orthogonal arrays – test strategies, steps in designing, conducting and analyzing an experiment, parameter and tolerance design: control and noise factors, signal to noise ratios, experimental design in Taguchi Methods, orthogonal arrays and parameter Design.

**TEXT AND REFERENCE BOOKS**


**24MAT548 Time Series Analysis**

Text Books:


References:


24MAT549 COMPUTATIONAL GEOMETRY 3 0 0 3

Convex hulls: construction in 2d and 3d, lower bounds; Triangulations: polygon triangulations, representations, point-set triangulations, planar graphs; Voronoi diagrams: construction and applications, variants; Delaunay triangulations: divide-and-conquer, flip and incremental algorithms, duality of Voronoi diagrams, min-max angle properties; Geometric searching: point location, fractional cascading, linear programming with prune and search, finger trees, concatenable queues, segment trees, interval trees; Visibility: algorithms for weak and strong visibility, visibility with reflections, art-gallery problems; Arrangements of lines: arrangements of hyperplanes, zone theorems, many-faces complexity and algorithms; Combinatorial geometry: Ham-sandwich cuts, Helly's theorems, k-sets, polytopes and hierarchies, polytopes and linear programming in d-dimensions, complexity of the union of convex sets, simply connected sets and visible regions; Sweep techniques: plane sweep for segment intersections, Fortune's sweep for Voronoi diagrams, topological sweep for line arrangements; Randomization in computational geometry: algorithms, techniques for counting; Robust geometric computing; Applications of computational geometry.

TEXT BOOKS /References


24MAT550 QUEUING THEORY AND INVENTORY CONTROL 3 0 0 3

Inventory concept – Components of Inventory model.
Deterministic Continuous Review model - Deterministic Periodic Review model.
The classical EOQ – Non zero lead time – EOQ with and without shortages.
Deterministic Multiechelon Inventory models for supply chain management.
A stochastic continuous review model – A stochastic single period model for perishable products.

TEXT BOOKS

24MAT551 Nonlinear Dynamics and Chaos 3 0 0 3


Text / Reference Books:
**Nonlinear Dynamics and Chaos: With Applications to Physics, Biology, Chemistry, and Engineering by Steven H. Strogatz (CRC Press; 2nd Edition), 2015.**

**Chaos: An Introduction to Dynamical systems by K. T. Alligood, T. D. Sauer, J. A. Yorke (Springer Verlag), 1996**

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**Soft Computing**

**2023**

Artificial Intelligence (AI): A Brief review – Pitfalls of Traditional AI–Why computational intelligence (CI)

- Concepts of CI – Importance of tolerance of imprecision and uncertainty– Constituent techniques of CI– overview of Artificial Neural Networks, Fuzzy Logic, Evolutionary Computation.

Fuzzy Logic:Introduction – the case of imprecision, the utility and limitation of fuzzy systems. Classical sets and Fuzzy sets: operations, properties and mapping.

Classical relations and fuzzy relations: cardinality, operations, properties and composition – tolerance and equivalence relations. Properties of membership function, fuzzification and defuzzification. Logic and fuzzysystems. Fuzzy control systems – Aircraft landing control problems.


**Text Books:**


**Reference Books:**

24CSC532 Cryptography 2023

**Stream ciphers:** Pseudo-random generators, Attacks on the one time pad, Linear generators, Cryptanalysis of linear congruential generators, The subset sum generator.

**Block ciphers:** Pseudorandom functions and permutations (PRFs and PRPs), PRP under chosen plaintext attack and chosen ciphertext attack, Case study: DES, AES, *modes of operation*.

**Message integrity:** Cryptographic hash functions, message authentication code, CBC MAC and its security, Cryptographic hash functions based MACs, Authenticated Encryption-Authenticated encryption ciphers from generic composition.

**Public key encryption:** RSA, Rabin, Knapsack cryptosystems, Diffie-Hellman key exchange protocol, ElGamal encryption, Elliptic curve cryptography.

**Digital signatures:** RSA, ElGamal and Rabin’s signature schemes, blind signatures.

**Entity authentication:** Passwords, challenge-response algorithms, zero-knowledge protocols.

**Network security:** Certification, public-key infra-structure (PKI), secure socket layer (SSL), Kerberos.

**TEXT BOOKS/REFERENCES:**


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24CSC533 BUSINESS ANALYTICS 2023

**INTRODUCTION TO BUSINESS ANALYTICS:**

Business Analytics - Terminologies, Process, Importance, Relationship with
Organisational Decision Making, Analytics in Decision Making, BA for Competitive Advantage.

MANAGING RESOURCES FOR BUSINESS ANALYTICS:
Managing BA Personnel, Data and Technology. Organisational Structures aligning BA.
Managing Information policy, data quality and change in BA.

DESCRIPTIVE ANALYTICS:
Introduction to Descriptive analytics – Visualising, and Exploring Data - Descriptive Statistics - Sampling and Estimation - Probability Distribution for Descriptive Analytics – Analysis of Descriptive analytics.

PREDICTIVE ANALYTICS:
Introduction to Predictive analytics - Logic and Data Driven Models - Predictive Analysis Modeling and procedure - Data Mining for Predictive analytics. Analysis of Predictive analytics.

PRESCRITIVE ANALYTICS:
Introduction to Prescriptive analytics - Prescriptive Modeling - Non Linear Optimisation - Demonstrating Business Performance Improvement.

Case Studies:
Text:

24CSC534 DEEP LEARNING FOR IMAGE PROCESSING 2023


Case Studies:

TEXT BOOKS / References:


24CSC535 Predictive Analytics 2023


TEXT BOOKS / References:
24CSC536    Mining of Massive Datasets    2023


Extensions to MapReduce. Finding Similar Items - Applications of Near-Neighbor Search - Shingling of Documents - Similarity-Preserving Summaries of Sets - Locality-Sensitive Hashing for Documents - Distance Measures


Text Books:

24CSC537    Data Compression    2023

static and dynamic, application in text compression, Shannon Fano Elias Coding, Arithmetic coding, Dictionary based coding-static, adaptive, UNIX compress.

Scalar and Vector Quantization: Scalar Quantization – Introduction, Uniform and Adaptive quantization. Vector Quantization- Introduction, Advantages, LBG, Tree vector quantization, Trellis coded quantization

Audio Compression: Distortion criteria- Auditory perception, PCM, DPCM, ADPCM, Predictive coding- basic algorithm, Basic sub-band coding, MPEG Audio Coding


TEXT BOOKS:

24CSC538 Introduction to Embedded Systems 2023

Architecture of Microprocessors: General definitions of computers, micro-processors, micro controllers and digital signal processors.
Overview of Microcontrollers- Introduction to 8051 microcontroller, General Architecture of a MCU and more specific to 8051 family MCUs, Pin diagram of 8051 MCU and various control signals, Various addressing modes of 8051, 8051 Instruction Set and Programming - Data Movement, Arithmetic & Logical, Control instructions with example programs, 8051 Interfacing with peripherals - Simple IO devices and sensor devices interfacing with 8051 MCU, Timer / counter modules and interrupts in 8051, RS232 based serial Communication using 8051
ARM Architecture: RISC Machine, Architectural Inheritance, Programmers model. ARM Organization and Implementation. 3 Stage pipeline, 5 Stage pipeline, ARM Instruction execution, ARM Implementation, Co-processor interface, ARM Assembly language Programming, Data processing instructions, Data Transfer Instructions, Control flow instructions, Architectural support for high level programming, Thumb Instruction

**TEXT BOOKS**


**References:**

2) Kenneth Ayala - The 8051 Microcontroller & Embedded Systems Using Assembly and C 1st Edition

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**24CSC539 INFORMATION RETRIEVAL 2023**


Web search basics – Web crawling and indexes – Link analysis.

**TEXT BOOK:**


**REFERENCES:**

Online Social Networks (OSNs):

Introduction - Types of social networks (e.g., Twitter, Facebook), Measurement and Collection of Social Network Data. Techniques to study different aspects of OSNs -- Follower-followee dynamics, link farming, spam detection, hashtag popularity and prediction, linguistic styles of tweets. Case Study: An Analysis of Demographic and Behaviour Trends using Social Media: Facebook, Twitter and Instagram

Fundamentals of Social Data Analytics:

Introduction - Working with Social Media Data, Topic Models, Modelling social interactions on the Web – Agent Based Simulations, Random Walks and variants. Case Study: Social Network Influence on Mode Choice and Carpooling during Special Events: The Case of Purdue Game Day

Applied Social Data Analytics:


Text and Reference books:


Serving Layer- Performance Metrics, Requirements and Design, ElephantDB. Speed Layer- Realtime Views, Cassandra basics, Query and Stream Processing , Apache Storm

TEXT BOOK:

REFERENCES:
https://thrift.apache.org/


24CSC542 Full Stack Development 2023

The main objective of full stack engineer is to keep every part of the system running smoothly. A Full Stack Developer can performs tasks ranging from resizing an image or text in a webpage to patching the kernel.

1: All-in-One JavaScript Development Suite

- Fundamentals of JavaScript
- JavaScript for Beginning Web Developers
- JavaScript for Absolute Beginners
- Fundamentals of jQuery
- Fundamentals of Ajax Development
- Create a node.js Real Time Chat Application
- Advanced JavaScript

2: All-In-One HTML/HTML5 And CSS/CSS3 Suite
• All-In-One HTML/HTML5 And CSS/CSS3 Suite

• Applying Designs to WireFrames with HTML5 and CSS3
• Build Your Own HTML5 Video Player
• Building Responsive Websites with HTML5 and CSS3
• HTML5 and CSS3 Site Design
• HTML5 Mobile Game Development by Example - Educational Game
• HTML5 Mobile Game Development by Example - Veggies vs Zombies
• Make HTML5 Games with No Coding Required
• Understanding HTML5 Input Types
• Website Wireframing with HTML5 and CSS3

3 : Node.Js Training

• Introduction and Foundation
• Node Projects
• Working with shrink-wrap to lock the node modules versions
• Working with asynchronous programming
• Building a HTTP Server with Node.JS using HTTP APIs
• File System
• Buffers, Streams, and Events
• Multi-Processing in NodeJS
• ExpressJS
• Express JS with MongoDB and Sqlite
• io, The Front-end, and A Chat App
• Introduction to Task Managers with unit testing

4 : Angular Training

• What is a SPA? What is Angular?
• Preparing for TypeScript
• Angular-4 new features
• Building with A4 Components
• Bootstrap Scaffolding
• Angular 4 Binding and Events
• Dependency Injection and services
• Directives
• Pipes
• Forms
• HTTP, Promises, and Observables
• Testing
Cloud Computing Overview: Origins of Cloud computing – Cloud components - Essential characteristics – On-demand self-service, Broad network access, Location independent


Cloud Simulators: CloudSim and GreenCloud: Introduction to Simulator, understanding CloudSim simulator, CloudSim Architecture(User code, CloudSim, GridSim, SimJava) Understanding Working platform for CloudSim, Introduction to GreenCloud. Module-V: Introduction to VMWare Simulator Basics of VMWare, advantages of VMware virtualization, using Vmware workstation, creating virtual machines-understanding virtual machines, create a new virtual machine on local host, cloning virtual machines, virtualize a physical machine, starting and stopping a virtual machine.

TEXT BOOKS


References:

INTRODUCTION TO DATA WRANGLING: What Is Data Wrangling?- Importance of Data Wrangling -How is Data Wrangling performed?- Tasks of Data Wrangling-Data Wrangling Tools-
WORKING WITH EXCEL FILES AND PDFS: Installing Python Packages-Parsing Excel Files-Parsing Excel Files -Getting Started with Parsing-PDFs and Problem Solving in Python-Programmatic Approaches to PDF Parsing-Converting PDF to Text-Parsing PDFs Using pdf

DATA CLEANUP: Why Clean Data?- Data Clean up Basics-Identifying Values for Data Clean up-Formatting Data-Finding Outliers and Bad Data-Finding Duplicates-Fuzzy Matching-RegEx Matching-Normalizing and Standardizing the Data-Saving the Data-Determining suitable Data Clean up-Scripting the Clean up-Testing with New Data.


TEXT BOOKS:


Introduction to Python-Python Basics-Data Meant to Be Read by Machines-CSV Data-JSON Data-XML Data.

24CSC545 Parallel and Distributed Systems 2023


System models: physical models, architecture models, operating system support. Distributed file systems – introduction - time and global states – synchronization of physical clocks – coordination and agreements: Mutual exclusion, election, consensus.

**Text Books**


**References**


**24CSC546**

**HIGH PERFORMANCE COMPUTING**


Integrating task parallelism with data parallelism: Introduction and motivation, A model for integrating task parallelism into data parallel programming platforms, Integration of the model into ARC, Design and implementation applications, performance analysis, guidelines for composing user programs, related work. Anonymous remote computing and communication model: Introduction, Location in dependent inter task communication with DP, DP model of iterative grid computations, Design and implementation of distributed pipes.
24CSC547  Advance Deep Learning  2 0 2 3

Transfer learning in CNN and RNN such as using image classifiers, text classification, sentimental analysis.


Graph Convolution Networks.

Text / Reference Books:

1. Francios Chollet, Deep Learning with Python by.

24CSC548  ADVANCED BIG DATA ANALYTICS  2-0-2-3

How MapReduce Works - Anatomy of a MapReduce Job Run, Failures, Shuffle and Sort, Task Execution MapReduce Types and Formats - MapReduce Types, Input Formats, output formats, MapReduce Features- Counters, Sorting, Joins, Side Data Distribution

Simple analytics using MapReduce, Calculating frequency distributions and sorting using MapReduce, Calculating histograms using MapReduce, Calculating scatter plots using MapReduce. Hierarchical clustering, Clustering algorithm to large dataset, classification using Navie bayes classifier, other applications.

TEXT BOOKS /References:
2. Srinath Perera and Thilina Gunarathne , Hadoop MapReduce Cookbook : Recipes for analyzing

Prediction, Tools for Structure prediction; Protein structural visualization; Structure validation tools; Ramachandran Plot. QSAR : Quantitative Structure and Activity Relationship - Historical Development of QSAR, Tools and Techniques of QSAR, Molecular Structure Descriptors.

Multivariate Statistical methods in QSAR -Principal Component Analysis (PCA) and Hierarchical Cluster Analysis(HCR). Regression analysis tools - Pincipal Component Regression (PCR), Partial Least Squares (PLS) - Case studies.


Docking Studies- Target Selection, Active site analysis, Ligand preparation and conformational analysis, Rigid and flexible docking. Molecular visualization tools: RasMol and Swiss-Pdb Viewer Molecular docking tools: AutoDock and ArgusLab.

References/ TEXT BOOKS


Basic probability theory; randomized complexity classes; game-theoretic techniques; Markov, Chebyshev, and moment inequalities; limited independence; coupon collection and occupancy problems; tail inequalities and the Chernoff bound; conditional expectation; the probabilistic method; Markov chains and random walks; algebraic techniques; probability amplification and derandomization.

Lovasz Local Lemma and applications, the method of conditional probabilities. Randomized Data Structures: Hashing. Fingerprinting, Schwarzt-Zippel, Pattern Matching. Applications: Sorting and searching; data structures; combinatorial optimization and graph algorithms; geometric algorithms and linear programming; approximation and counting problems; parallel and distributed algorithms; online algorithms.

Text Books:


**24CSC551 Data Analytics in Computational Biology 2023**

Introduction to Bioinformatics - applications of Bioinformatics - challenges and opportunities - introduction to NCBI data model- Various file formats for biological sequences.

Bioinformatics resources – Importance of databases - Biological databases- Primary & Secondary databases (Genbank, EMBL, DDBJ, Swiss Prot, PDB, NDB, BLOCKS, Pfam, ProSITE, etc.).

such as Probabilistic models of evolution and maximum likelihood algorithm, Bootstrapping methods, use of tools such as PHYLIP, MEGA, PAUP.

References/ Textbooks


24CSC552 Image Processing and Computer Vision 2023


Deep learning for visual data. Data-driven image classification, linear classification, activation functions, various cost functions, gradient-based optimization with backpropagation.

Convolutional neural networks (CNN) and methods for training them, transfer learning and data augmentation. Different architectures and applications in image analysis (classification, detection,

Case Studies:

**TEXT BOOK:**

**REFERENCES:**

**24CSC553 Multimedia Systems 2023**

**Digital Signal Processing:** Waveforms, Amplitude, Frequency and Phase Signal to Noise ratio and Decibel Scales, Signal Flow Graphs, Digital Signal Filtering, Finite Impulse Response.

**Fourier Transform:** Frequency components of Audio and Video Data, Frequency Domain, Fourier's theorem: 1D and 2D transforms, Magnitude and Phase Spectra, Time-Frequency Representation.

**Digital Filters:** Low Pass Filters: Ideal, Butterworth, Filtering Noisy Images, High Pass and Band-Pass Filters, Fourier Transform and Convolution.

**Multimedia Data:** Discrete and Continuous Media, Analog and Digital Signals: Analog/Digital Converter, Text and Static Data, Audio: digitising Sound, Graphics, Images and Video.

**Digital Audio:** MIDI and MPEG-4, Nyquist Sample Rate and Bit Size, MIDI: definition, components, hardware aspects, Messages, Channels, Structured Audio, MIDI Semantics and Control, Common Digital Audio Formats.

**Graphics, Images and Videos:** Graphic/Image File Formats: 24-bit and 8-bit colors, BitMaps, Gray Scale and Dithering, Graphic Formats: GIF, JPEG, TIFF, PNG, EPS. RGB and CMY Color Models, Chrominance, Luma, Luminance and Gamma Correction, Color Vision: Photoreceptors, Cone Sensitivity and Color Property.

**Compression Algorithms:** Coding and Decoding Algorithms.

**Text Books:**