AUTONOMOUS

SYLLABUS

III & IV Semesters

2023

B. E in CSE (Artificial Intelligence and Machine Learning)

MITE

Invent Solutions

MANGALORE INSTITUTE OF TECHNOLOGY & ENGINEERING

MANGALORE INSTITUTE OF TECHNOLOGY & ENGINEERING
(A Unit of Rajalaxmi Education Trust®, Mangalore)
Autonomous Institute affiliated to VTU, Belagavi, Approved by AICTE, New Delhi
Accredited by NAAC with A+ Grade & ISO 9001:2015 Certified Institution

SCHEME & SYLLABUS

III/IV SEMESTER B.E.

CSE(ARTIFICIAL INTELLIGENCE AND MACHINE LEARNING)

2023 Scheme

(W.E.F 2023 Admission Students)

MANGALORE INSTITUTE OF TECHNOLOGY & ENGINEERING

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Institute Vision

*"To attain perfection in providing **Globally Competitive Quality Education** to all our Students and also benefit the global community by using our strength in **Research and Development**"*

Institute Mission

*"To establish world class educational institutions in their respective domains, which shall be C**enters of Excellence** in their stated and implied sense. To achieve this objective we dedicate ourselves to meet the challenges of becoming **Visionary and Realistic**, **Sensitive and Demanding**, **Innovative and Practical,** Theoretical **and Pragmatic;** ALL at the same time"*

Department Vision

"To create well groomed, technically competent and skilled AIML professionals who can become part of industry and undertake quality research at global level to meet societal needs."

Department Mission

- *Provide state of art infrastructure, tools and facilities to make students competent and achieve excellence in education and research.*
- *Provide a strong theoretical and practical knowledge across the AIML discipline with an emphasis on AI based research and software development.*
- *Inculcate strong ethical values, professional behaviour and leadership abilities through various curricular, co-curricular training and development activities.*

Program Educational Objectives (PEOs)

- *Graduates will follow logical, practical and research-oriented approach for solving the real world problems by providing AI based solutions.*
- *Graduates will work independently as well as in multidisciplinary teams at workplace.*
- *Graduates will setup start-up and become successful entrepreneurs.*

Program Specific Outcomes (PSOs)

The graduates of AIML department will be able to

- *Train machine learning models to address real life challenging problems using acquired AI knowledge.*
- *Develop applications using ML techniques related to the field of medical, agriculture, defence, education and various scientific explorations.*

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LIST OF COURSES

III/IV Semester			
Sl. No.	**Course Code**	**Course Title**	**Semester**
BASIC SCIENCE COURSES			
1	**23BSCI201**	Engineering Mathematics-III	III
2	**23BSCC202**	Engineering Mathematics-IV	IV
PROFESSIONAL CORE COURSES			
3	**23CIPC203**	Data Structures and Applications	III
4	**23CIPC204**	Digital Systems Design	III
5	**23CIPC205**	Computer Organization	III
6	**23CIPC206**	Software Engineering	III
7	**23CIPC207**	Design and Analysis of Algorithms	IV
8	**23CIPC208**	Introduction to Machine Learning	IV
9	**23CIPC209**	Operating Systems	IV
10	**23CIPC210**	Object Oriented Concepts with Java Programming	IV
HUMANITIES & SOCIAL SCIENCE COURSES			
11	**23HMCC215**	Universal Human Values	III
12	**23HMCC216**	Research Methodology & Intellectual Property Rights	IV
SKILL ENHANCEMENT COURSES			
13	**23CISE251**	Data Visualization	III
14	**23CISE252**	Python Programming	III
15	**23CISE253**	Open Source Tools and Technologies	III
16	**23CISE254**	Agile Project Management Using Scrum	IV
17	**23CISE255**	Mobile Application Development using Flutter	IV
18	**23CISE256**	Front End Technologies	IV
AUDIT COURSES			
19	**23AUCC221**	Yoga-I	III
20	**23AUCC222**	Physical Education-I	III
21	**23AUCC223**	NSS-I	III
22	**23AUCC224**	Arts-I	III
23	**23AUCC225**	Yoga-II	IV
24	**23AUCC226**	Physical Education-II	IV
25	**23AUCC227**	NSS-II	IV
26	**23AUCC228**	Arts-II	IV
27	**23AUCC229**	Environmental Studies	IV

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III Semester (2023 Scheme): CSE(Artificial Intelligence and Machine Learning)

Sl. No	Course Code	Course Title	Category	Teaching Dept.	Teaching Hours /Week			Exam Marks			Duration of Exam (SEE) in Hrs	Credits
					L	T	P	CIE	SEE	Total		
1	23BSCI201	Engineering Mathematics-III	Basic Science Course	Mathematics	3	0	0	50	50	100	3	3
2	23CIPC203	Data Structures and Applications	Professional Core Course	CSE Allied Branches	3	0	2	50	50	100	3	4
3	23CIPC204	Digital Systems Design	Professional Core Course	CSE Allied Branches	3	0	2	50	50	100	3	4
4	23CIPC205	Computer Organization	Professional Core Course	CSE Allied Branches	4	0	0	50	50	100	3	4
5	23CIPC206	Software Engineering	Professional Core Course	CSE Allied Branches	3	2	0	50	50	100	3	4
6	23CISE25X	Skill Enhancement Course*	SE Course	CSE Allied Branches	1	0	2	50	50	100	3	2
7	23HMCC215	Universal Human Values	Humanities & Social Sciences	Any Dept.	2	0	0	50	50	100	2.5	2
8	23AUCC22X	Yoga/Physical Education/NSS/Arts**	Audit Course	Yoga Teacher/ PED/NSS Coordinator/ Cultural Coordinator	0	0	1	100	-	100	-	-
											Total	**23**

***Skill Enhancement Course(s):**

Sl. No.	Course Code	Course Title	Certification Platform
1	23CISE251	Data Visualization	MOOC's/Industry
2	23CISE252	Python Programming	MOOC's/Industry
3	23CISE253	Open Source Tools and Technologies	MOOC's/Industry

****Yoga/Sports/NSS/Arts:**

Sl. No.	Course Code	Course Title
1	23AUCC221	Yoga-I
2	23AUCC222	Physical Education-I
3	23AUCC223	NSS-I
4	23AUCC224	Arts-I

Note:** To be offered from 3rd to 6th Semester

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IV Semester (2023 Scheme): CSE(Artificial Intelligence and Machine Learning)

Sl. No	Course Code	Course Title	Category	Teaching Dept.	Teaching Hours /Week			Exam Marks			Duration of Exam (SEE) in Hrs	Credits
					L	T	P	CIE	SEE	Total		
1	23BSCC202	Engineering Mathematics-IV	Basic Science Course	Mathematics	3	0	0	50	50	100	3	3
2	23CIPC207	Design and Analysis of Algorithms	Professional Core Course	CSE Allied Branches	3	0	2	50	50	100	3	4
3	23CIPC208	Introduction to Machine Learning	Professional Core Course	CSE Allied Branches	3	0	2	50	50	100	3	4
4	23CIPC209	Operating Systems	Professional Core Course	CSE Allied Branches	4	0	0	50	50	100	3	4
5	23CIPC210	Object Oriented Concepts with Java Programming	Professional Core Course	CSE Allied Branches	3	0	2	50	50	100	3	4
6	23CISE25X	Skill Enhancement Course*	SE Course	CSE Allied Branches	1	0	2	50	50	100	3	2
7	23HMCC216	Research Methodology & Intellectual Property Rights	Humanities & Social Sciences	CSE Allied Branches	2	0	0	50	50	100	3	2
8	23AUCC229	Environmental Studies	Audit Course	Civil Engg.	1	0	0	100	-	100	-	-
9	23AUCC22X	Yoga/Physical Education/NSS/Arts**	Audit Course	Yoga Teacher/ PED/NSS Coordinator/ Cultural Coordinator	0	0	1	100	-	100	-	-
											Total	**23**

***Skill Enhancement Course(s):**

Sl. No.	Course Code	Course Title	Certification Platform
1	23CISE254	Agile Project Management Using Scrum	MOOC's/Industry
2	23CISE255	Mobile Application Development using Flutter	MOOC's/Industry
3	23CISE256	Front End Technologies	MOOC's/Industry

****Yoga/Sports/NSS/Arts:**

Sl. No.	Course Code	Course Title
1	23AUCC225	Yoga-II
2	23AUCC226	Physical Education-II
3	23AUCC227	NSS-II
4	23AUCC228	Arts-II

ENGINEERING MATHEMATICS - III			
Semester	**III**	CIE Marks	**50**
Course Code	**23BSCI201**	SEE Marks	**50**
Teaching Hrs/Week (L: T:P)	**3:0:0**	Exam Hrs	**03**
Total Hrs	**42**	Credits	**03**

Course Learning Objectives: This course is designed to

1. Impart knowledge of basic connectives and laws of logic for analyzing logical statements and arguments using rules of Inference and Quantifiers.
2. Establish a strong foundation in Relations and Functions essential to solve engineering problems.
3. Develop systematic understanding of the Pigeon Hole Principle, Recurrence Relations and their applications in solving engineering problems.
4. Provide a comprehensive understanding of numerical methods for solving problems arising in science and engineering

Module 1: Relations and Functions	**No. of Hrs: 08**

Cartesian Products and Relations, Equivalence Relations, Partition, Partial order relation, Posets, Hasse Diagrams, Computer Recognition – Zero-One Matrices and Directed Graphs, Functions, One-to-One, Onto Functions, Function Composition and Inverse Functions.

Module 2: Set theory and Recurrence Relations	**No. of Hrs: 08**

Review of Set theory, Counting Principles (Counting, Sum and Product rule), Principle of Inclusion and Exclusion, Pigeon Hole Principle. Recurrence Relations: First Order Linear Recurrence Relation, the Second Order Linear Homogeneous Recurrence Relation with Constant Coefficients.

Module 3: Fundamentals of Logic	**No. of Hrs: 10**

Fundamentals of Logic: Basic connectives and Truth Tables, Logical equivalence, The Laws of Logic, Logical Implications, Rules of Inference and Quantifiers.

Module 4: Numerical Methods -1	**No. of Hrs: 08**

Finite differences, Newton's Forward & Backward difference, Newton's Divided Difference, Lagrange's and Inverse Lagrange's Interpolation methods.

Module 5: Numerical Methods -2	**No. of Hrs: 08**

Solution of Polynomial and Transcendental Equations: Regula-Falsi and Newton-Raphson methods. **Numerical Differentiation:** Forward and Backward difference methods **Numerical integration:** Simpson's (1/3)rd rule, (3/8)th rule and Romberg's method.

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

1. Illustrate the fundamental concepts of Relations and Functions, Recurrence Relations, Mathematical Logic, and Numerical Methods.
2. Apply suitable techniques to solve engineering and scientific problems related to Relations & Functions, Recurrence Relations and Mathematical Logic.
3. Make use of appropriate Numerical Methods to solve engineering and scientific problems.
4. Solve real-life problems related to Relations & Functions, Recurrence Relations, Mathematical Logic, and Numerical Methods.
5. Employ software tool to efficiently solve engineering and scientific problems allied with Relations & Functions, Recurrence relations, Mathematical Logic, and Numerical Methods.

Textbooks:

1. Kenneth H. Rosen, "Discrete Mathematics and its Applications", 7th Edition, McGraw Hill, 2012.
2. E. Kreyszig, "Advanced Engineering Mathematics", 10th Edition, John Wiley & Sons, 2018.

Reference Books:

1. Ralph P. Grimaldi, "Discrete and Combinatorial Mathematics", 5th Edition, Pearson Education, 2004.
2. Thomas Koshy, "Discrete Mathematics with Applications", 1st Edition, Elsevier Science, 2012.
3. B. Kolman, R.C. Busby, S.C. Ross, "Discrete Mathematical Structures", 6th Edition, Pearson Education India, 2015.
4. S. R. K. Iyengar & R. K. Jain, "Numerical Methods", 1st Edition, New age International (P) limited Publishers, 2020.

Web links:

1. NPTEL Course : https://archive.nptel.ac.in/courses/127/106/127106019/
2. NPTEL Course :https://archive.nptel.ac.in/courses/111/106/111106086/
3. Youtube Videos :https://www.youtube.com/watch?v=xd7V0OKkEEg
4. NPTEL Course :https://nptel.ac.in/courses/106106183
5. Youtube Videos :https://youtube.com/playlist?list=PLEAYkSg4uSQ2Wfc_l4QEZUSRdx2ZcFziO&si=8xNZ776P4ICkQQDS

Data Structures and Applications			
Semester	**III**	CIE Marks	**50**
Course Code	**23CIPC203**	SEE Marks	**50**
Teaching Hrs/Week (L:T: P)	**3:0:2**	Exam Hrs	**03**
Total Hrs	**64**	Credits	**04**

Course Learning Objectives: This course is designed to

1. Explain the fundamentals of data structures and their applications for implementing solutions to problems
2. Illustrate representation of data structures: Stack, Queues, Linked Lists, Trees and Graphs
3. Describe the Design and Development of Solutions to problems using Arrays, Stack, Queues, Linked Lists and Graphs
4. Illustrate the Hashing techniques in data storage

Module 1: Introduction to Data structures and Arrays	**No. of Hrs: 8+4**

Introduction: Data and Information, Data types – primitive and non-primitive, Data Structure, Types of Data Structures, Linear & non-linear Data Structures Classification of Data Structures, Abstract Data Types, **Arrays:**One Dimensional Arrays and operations, Multidimensional Arrays: Memory Representation of Two-Dimensional Arrays and operations, Multi-Dimensional Arrays, Sparse Arrays, Sparse Matrix, Advantages and Limitations of Arrays. Applications of arrays

Laboratory Components:

1. Programming Exercises on Dynamic Memory allocation
2. Programming Exercises on Array Operations
3. Programming Exercises on Application of array

Module 2: Linked List	**No. of Hrs: 8+4**

Linked List: Linked List, Singly Linked List-Memory Allocation and De-allocation, Creation , Traversal, Searching, Insertion in Linked List, Deletion from Linked List, Copying a List into other List, Merging Two Linked Lists, Splitting a List into Two Lists, Reversing of Singly Linked List, Circular Linked List, Applications of Circular Linked List, Doubly Linked List, Traversing a Doubly Linked List, Searching in a Doubly linked List, Insertion of nodeinto Doubly Linked List, Deleting a node from Doubly Linked List, Header Linked List, Applications of the Linked list, Representation of Polynomials, Storage of Sparse Arrays and Matrix

Laboratory Components:

1. Programming Exercises using singly linked list
2. Programming Exercises on traversing doubly linked list
3. Programming Exercises on applications of Circular linked list

Module 3: Stacks and Queues	**No. of Hrs: 8+6**

Stacks: Basic Stack Operations, Representation of a Stack using Static Array, Dynamic array and linked list, Multiple stack implementation using single array, Stack Applications: Reversing list, Factorial Calculation, Infix to postfix Transformation, Evaluating Arithmetic Expressions and Recursion, **Queues:** Basic Queue Operations, Representation of a Queue using array and linked list, Implementation of Queue Operations, Applications of Queues-Round Robin Algorithm, Circular Queues, DeQueue Priority Queues

Laboratory Components:

1. Programming Exercises on multiple stack implementation using single array
2. Programming Exercises on stack applications
3. Programming Exercises on queues
4. Programming Exercise on applications of queues

Module 4: Trees	**No. of Hrs: 8+6**

Trees: Definition of tree, Properties of tree, Binary Tree, Representation of Binary trees using arrays and linked lists, Operations on a Binary Tree, Binary Tree Traversals, Reconstruction of Binary tree from its Traversals ,Binary search tree, B-tree , B+ tree, AVL tree, Threaded binary tree

Laboratory Components:

1. Programming Exercises on Representation of binary trees using arrays and linked list
2. Programming Exercises on Binary Search tree
3. Programming Exercises on B-tree
4. Programming Exercises on Binary tree Traversal

Module 5: Graphs and Hashing	**No. of Hrs: 8+4**

Graph: Introduction, Graph, Graph Terminology, Memory Representation of Graph, Adjacency Matrix Representation of Graph, Adjacency List or Linked Representation of Graph, Operations Performed on Graph, Graph Traversal, Applications of the Graph, Reachability, Shortest Path Problems, Spanning Trees,**Hashing:** Hash function, Address calculation techniques, Common hashing functions Collision resolution, Linear probing, Quadratic, Double hashing, Bucket hashing, Deletion and rehashing

Laboratory Components:

1. Programming Exercises on graphs
2. Programming Exercises on Hashing

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

1. Describe data structures such as arrays, stacks, queues, linked lists, trees, graphs
2. Implement data structures such as arrays, stacks, queues, linked lists, trees, graphs
3. Apply the data structures such as arrays, stacks, queues, linked lists, trees, and graphs to solve given problems.
4. Apply Hashing in data storage and retrieval

Textbooks:

1. Ellis Horowitz, Sartaj Sahni and Susan Anderson-Freed, Fundamentals of Data Structures in C , 2nd Edition, Universities Press, 2014.
2. Seymour Lipschutz, Data Structures Schaum's Outlines, Revised 1stEdition, McGraw Hill, 2014.

Reference Books:

1. Jean-Paul Tremblay & Paul G. Sorenson, An Introduction to Data Structures with Applications, 2nd Edition, McGraw Hill, 2013.
2. Gilberg & Forouzan, Data Structures: A Pseudo-code approach with C, 2nd Edition, Cengage Learning, 2014.

Web links:

1. NPTEL course on Data structures: https://archive.nptel.ac.in/courses/106/106/106106130/
2. NPTEL course on Data structures: https://nptel.ac.in/courses/106102064

Digital Systems Design			
Semester	**III**	CIE Marks	**50**
Course Code	**23CIPC204**	SEE Marks	**50**
Teaching Hrs/Week (L:T: P)	**3:0:2**	Exam Hrs	**03**
Total Hrs	**64**	Credits	**04**

Course Learning Objectives: This course is designed to

1. Illustrate the various Boolean expressions applicable
2. Familiarize the working of combinational and sequential logic circuits using k-map techniques
3. Provide the knowledge of FPGA and HDL programming techniques for digital system design
4. Impart the knowledge of RAM along with error detection and correction techniques
5. Illustrate the basic knowledge on ADC and DAC techniques for analog to digital conversion and vice versa

Module 1: Introduction to Digital Systems	**No. of Hrs: 8+6**

Digital systems, binary codes, Boolean functions, canonical and standard forms, Gate level minimization: map method, two variable, three variable, four-variable map, Product-of-sums simplification, don't-care conditions, NAND and NOR implementation, Exclusive-OR functions, Introduction to Verilog-HDL

Laboratory Components:

1. Introduction to verilog HDL and verify the simulation results using test-bench.
2. Design Verilog HDL to implement simple circuits using structural, Data flow and Behavioral models.
3. Given a 4-variable logic expression, simplify it using K-Map Technique and implement the simplified expression using HDL

Module 2: Combinational Circuits	**No. of Hrs: 8+6**

Introduction, analysis procedure, design procedure, magnitude comparator, decoders, encoders, multiplexers, HDL models of combinational circuits

Laboratory Components:

1. Design an HDL program for the following combinational circuits:
   a) Magnitude comparator
   b) Multiplexers
   c) Demultiplexers
2. Design an HDL program for the following combinational circuits:
   a) Decoders
   b) Encoders

Module 3: Sequential circuits	**No. of Hrs: 9+6**

Introduction, storage elements-flip-flops, Analysis of clocked sequential circuits, registers, register with parallel load, shift registers, Ripple counter, synchronous counters, ring counter, and johnson's counter

Laboratory Components:

1. HDL program to implement the up counter and the down counter
2. HDL program to design the 4-bit BCD up counter and down counter
3. HDL program to implement synchronous counter (Ring counter and Johnston's counter)

Module 4: Programmable Logic	**No. of Hrs: 8**

Memory and Programmable Logic: Random-Access Memory, Memory Decoding, Error Detection and Correction, Read Only Memory, Programmable Logic Array, Programmable Array Logic, Digital Integrated Circuits : Special Characteristics, Complementary MOS

Module 5: ADC and DAC	**No. of Hrs: 9+4**

Digital Versus Analog, Digital-to-Analog Conversion, D/A-Converter Circuitry, DAC Specifications, Integrated-Circuit DAC, DAC Applications, Analog-to-Digital Conversion, Digital-Ramp ADC, Successive-Approximation ADC

Laboratory Components:

1. Simulate ADC techniques in multisim software
2. Simulate the DAC techniques in multisim software

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

1. Applying the mapping techniques to realize and simplify various Boolean expressions
2. Designing different types of combinational and sequential circuits along with Verilog-HDL programs
3. Design RAM along with error detection and correction techniques
4. Apply ADC and DAC techniques for analog to digital conversion and vice versa

Textbooks:

1. Ciletti, Michael D. and M. Morris Mano,"Digital design", Prentice-Hall, 2007
2. Ronald J. Tocci, Neal S. Widmer, Gregory L. Moss, Digital Systems Principles and Applications, 10th Edition, Pearson Education International,2007
3. Brown, Stephen D.and Zvonko G. Vranesic, "Fundamentals of digital logic with Verilog design" Vol. 1.,New York: McGraw-Hill, 2003

Reference Books:

1. Donald D. Givone, Digital Principles and Design, Tata McGraw Hill, India
2. Roth, Fundamentals of Logic Design, 5th Edition, Thomson, India, 2004
3. C. V. S. Rao, Switching and Logic Design, 3rd Edition, Pearson Education, India. 2009.

Web links:

1. YouTube Videos :https://www.youtube.com/playlist?list=PLyqSpQzTE6M_dZdF7Bd-UncI5_L_1VkXF
2. YouTube Videos: https://www.youtube.com/playlist?list=PLBlnK6fEyqRjMH3mWf6kwqiTbT798eAOm

Computer Organization			
Semester	**III**	CIE Marks	**50**
Course Code	**23CIPC205**	SEE Marks	**50**
Teaching Hrs/Week (L:T: P)	**4:0:0**	Exam Hrs	**03**
Total Hrs	**52**	Credits	**04**

Course Learning Objectives: This course is designed to

1. Impart the knowledge of basic structure and operation of a digital computer system
2. Familiarize Input /Output and memory organization
3. Provide comprehensive understanding of arithmetic operations and its implementation
4. Illustrate the basic processing unit of a computer
5. Describe the concept of instruction level parallelism

Module 1: Basic Structure of Computers	**No. of Hrs: 11**

Introduction, Functional Units, Basic Operational Concepts, Performance. Instruction Set Architecture: Memory Locations and Addresses, Memory Operations, Instructions and Instruction Sequencing, Addressing Modes, Assembly Language, Encoding of Machine Instructions

Module 2: I/O operations and Memory System	**No. of Hrs: 11**

Accessing IO Devices, Interrupts, Direct Memory Access, Buses, **Memory System:** Basic Concepts, Semiconductor RAM Memories, Memory Hierarchy, Cache Memories, and Performance Considerations

Module 3: Arithmetic Operations	**No. of Hrs: 11**

Addition and subtraction of signed numbers, Design of Fast Adders, Multiplication of positive Numbers, Signed operand Multiplication, Fast multiplication, Integer Division, Floating-Point Numbers and Operations

Module 4: Processing Unit	**No. of Hrs: 10**

Fundamental Concepts, Execution of a Complete Instruction, Multiple bus organization, Hardwired control, Microprogrammed control

Module 5: Pipeline	**No. of Hrs: 09**

Basic Concepts, Data Hazards, Instruction hazards, Super Scalar operations, Performance Considerations

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

1. Describe the basic structure of computers and the assembly language
2. Apply concepts of I/O device interaction, interrupt mechanisms, direct memory access, and memory system designs to optimize computer system performance
3. Apply various techniques for arithmetic operations and control signal generation
4. Apply the instruction level parallelism to improve the performance

Textbooks:

1. Carl Hamacher, Zvonko Vranesic, Safwat Zakyn , Naraig Manjikia, computer organization and embedded systems , 6th Edition, Pearson Education, 2013

Reference Books:

1. Andrew s. Tanenbaum , structured computer organization, 6th Edition, McGraw-Hill Companies, Inc ,2012.
2. David A. Patterson and John L. Hennessy, "Computer Organization and Design: The Hardware/Software interface", Elsevier, Third Edition, 2005
3. William Stallings, "Computer Organization and Architecture – Designing for Performance", Pearson Education, Ninth Edition, 2012
4. John P. Hayes, "Computer Architecture and Organization", Tata McGraw Hill, Third illustrated Edition, 2007

Web links:

1. NPTEL Course Materials : https://archive.nptel.ac.in/courses/106/105/106105163/

Software Engineering			
Semester	**III**	CIE Marks	**50**
Course Code	**23CIPC206**	SEE Marks	**50**
Teaching Hrs/Week (L:T: P)	**3:2:0**	Exam Hrs	**03**
Total Hrs	**64**	Credits	**04**

Course Learning Objectives: This course is designed to

1. Develop a foundational understanding of software engineering principles, process models, and the Unified Process
2. Establish a strong foundation in agile development concepts, including agility, cost of change, agile processes, extreme programming, and modeling principles
3. Learn requirements engineering, including groundwork, elicitation, use cases, modeling strategies, and validation techniques
4. Master software design principles, including the design process, architectural styles, component design, and user interface design
5. Understand quality concepts, review techniques, software quality assurance, and software testing strategies

Module 1: The Software Process	**No. of Hrs: 9+4**

Software And Software Engineering: The Nature of Software, Unique Nature of WebApps, Software Engineering, The Software Process, Software Engineering Practice, Software Myths. **Process Model**: A Generic Process Model, Process Assessment and Improvement, Prescriptive Process Models, Specialized Process Models, The Unified Process

Module 2: Agile Development	**No. of Hrs: 8+4**

Agile Development: What is Agility, Agility and the cost of Change, What is an Agile Process, Extreme Programming, Other Agile Process Models, A Tool Set for the Agile Process. Modeling : Core Principles, Principles that Guide each Framework Activity

Module 3: Requirements Modeling	**No. of Hrs: 9+4**

Understanding Requirements : Requirements Engineering, Establishing the Groundwork, Eliciting Requirements, Developing Use Cases, Building the Requirements Use Model, Negotiating Requirements, Validating Requirements, Requirements Modeling: Requirement Analysis, Scenario-Based Modeling, UML Models that Supplement the Use Case, Data modeling Concepts, Class Based Modeling, Requirements Modeling Strategies, Flow Oriented Modeling, Creating a Behavioral Model

Module 4: Design Concepts	**No. of Hrs: 9+4**

Design Concepts - Design with the concept of Software Engineering, The Design Process, Design Concept, The Design Model, Architectural Design - Software Architecture, Architecture Genres, Architecture Styles, Architecture Design, Architectural Mapping using Data Flow, Component Level Design - What is a Component, Designing Class Based components, Conducting Component Level Design, User Interface Design - The Golden Rules, User Interface Analysis and Design, Interface analysis, Interface Design Steps, Design Evaluation

Module 5: Quality Management	**No. of Hrs: 9+4**

Quality Concepts- What is Quality, Software Quality, The Software Quality Dilemma, Achieving Software Quality,
Review Techniques - Cost Impact of Software Defects, Defect Amplification And Removal, Review Metrics and their Use, Reviews Formality Spectrum, Informal Reviews, Formal Technical Reviews,
Software Quality Assurance - Elements of Software Quality Assurance, SQA Tasks Goals and Metrics, Formal Approaches to SQA, Statistical Software Quality Assurance, Software Reliability,
Software Testing Strategies - Strategic Approach to Software Testing, Strategic Issues, Test Strategies, Validation Testing, System Testing, The Art of Debugging

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

1. Understand software fundamentals, web app uniqueness, software process models, and software engineering practices, including myths
2. Apply agile principles, Extreme Programming, other agile models, and core principles for software modeling framework activities
3. Apply requirements engineering, use case development, UML modeling, and strategies for validating and analyzing requirements
4. Apply software design concepts, architectural styles, component design, and user interface principles and evaluation techniques in software design
5. Apply software quality concepts, review techniques, quality assurance elements, and strategic software testing strategies

Textbooks:

1. Roger S. Pressman, Bruce R. Maxim, "Software Engineering - A Practitioner Approach", McGraw Hill, 8th edition
2. Sommerville, Ian. Software engineering. 9th ed. International ed. Tokyo: Pearson, 2011
3. Booch, Grady, James Rumbaugh, and Ivar Jacobson. "Unified modeling language user guide", 2nd edition, Addison-Wesley Object Technology Series ,2005.

Reference Books:

1. Pressman, Roger S. Software Engineering, Ninth Edition, Pearson, 2011
2. Gamma, Erich, et al. Design patterns: elements of reusable object-oriented software. Pearson Deutschland GmbH, 1995

Web links:

1. Programming Methodology (Stanford)- https://www.youtube.com/watch?v=KkMDCCdjyW8&list=PL3BD1325B3C4F50BE

Data Visualization			
Semester	**III**	CIE Marks	**50**
Course Code	**23CISE251**	SEE Marks	**50**
Teaching Hrs/Week (L:T: P)	**1:0:2**	Exam Hrs	**03**
Total Hrs	**37**	Credits	**02**

Course Learning Objectives: This course is designed to

1. Provide insight into data visualization tools
2. Demonstrate different types of charts, graphs, and visualization techniques and when to use them appropriately
3. Provide knowledge on exploratory data analysis to gain insights and identify patterns in data
4. Illustrate the features and capabilities of each tool and select the most appropriate tool for different visualization tasks
5. Impart skills on interactive visualizations that engages users and enable exploration of data from different perspectives

Data visualization with Matplotlib library	**No. of Hrs: 11**

Introduction: Introduction to Data visualization, Data visualization considerations, factors, Python Data visualization tool: Understanding Matplotlib library, Basic plotting with Matplotlib: line plots, scatter plots, Customizing plots: labels, titles, colors, and styles

Histograms and box plots: Creating bar plots and pie charts, Creating histograms and box plots,Subplots and layouts

Scatter plots and pair plots: Introduction to Seaborn library, creating scatter plots and pair plots, Creating heatmaps

Time series visualizations: Introduction to Plotly library ,Creating time series visualizations, Customizing time series plots

Maps and geographic visualizations: Creating 3D plots, Creating maps and geographic visualizations

Laboratory Components:	**No. of Hrs: 26**

1. Create a bar plot showing the distribution of a categorical variable in the dataset using Matplotlib
2. Create a line plot to visualize the trend of a numerical variable over time using Matplotlib
3. Create a histogram showing the distribution of a numerical variable in the dataset using Matplotlib
4. Create a pie chart to visualize the proportion of categorical variables in the dataset using Matplotlib
5. Create a box plot to identify outliers in a numerical variable using Seaborn
6. Create a heatmap to visualize the correlation between numerical variables in the dataset using Seaborn
7. Create a pair plot to visualize the pair-wise relationship between numerical variables in the dataset
8. Create a scatter plot to visualize the relationship between two numerical variables using Plotly
9. Create a stacked area chart to visualize the part-to-whole relationship of numerical variables over time
10. Create a Time Series Visualization and Maps using Plotly Libraries
11. Create a Python program to draw 3D Plots using Plotly Libraries

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

1. Apply data visualization tools such as Matplotlib, Seaborn, and Pandas to create various types of data visualizations
2. Apply data visualization techniques to analyze and interpret data sets effectively, gaining insights and making data-driven decisions
3. Effectively communicate analytical findings and insights through visually appealing and informative data visualizations

Text Book:

1. Dr.Abhinav, "Data Visualization using Python Programming- A Technical Guide For Beginners, Researchers and Data Analyst", 1st Edition, Shashwat Publication, 2023

Reference Book:

1. Tim Grobmann and Mario Dobler, "Data Visualization Workshop", 1st Edition, Packt Publishing, 2020
2. Andy Krik ,"Data Visualisation: A Handbook for Data Driven Design", 1st Edition, SAGE Publications Ltd, 2019
3. Kristen Sosulski, "Data Visualization Made Simple",1st Edition, Routledge Publications, 2018

Web links:

1. YouTube Videos : https://youtu.be/eFByJkA3ti4
2. YouTube Videos :https://youtu.be/KYLVu9mbv_U?list=PLZ2ps__7DhBZ12NClTmMLsnU0mF9ZUSG_

Python programming			
Semester	**III**	CIE Marks	**50**
Course Code	**23CISE252**	SEE Marks	**50**
Teaching Hrs/Week (L:T: P)	**1:0:2**	Exam Hrs	**03**
Total Hrs	**37**	Credits	**02**

Course Learning Objectives: This course is designed to

1. Familiarize the syntax and semantics of Python Programming Language
2. Impart the knowledge to use of Functions , strings and Illustrate the process of structuring the data using Lists & Dictionaries
3. Illustrate built-in functions to navigate the file system
4. Illustrate the operations on Excel spreadsheet using Python

Module 1: Data types and Operators	**No. of Hrs: 2 + 4**

Data types: The Integer, Floating point and string data types, String concatenation and replication, storing values in variables, Dissecting your program, Comparison Operators, Boolean Operators, Flow control statements, Ending a program early with sys.exit()

Module 2: Functions	**No. of Hrs: 3 + 6**

Functions: def statements with Parameters, Return values and return statements, The none value, Keyword arguments and print(), **Lists**: The List Data Type, Working with Lists, Methods

Module 3: Dictionaries and Structuring Data	**No. of Hrs: 3 + 6**

The Dictionary Data type, Manipulating Strings: Working with strings, Useful String Methods

Module 4: File Handling	**No. of Hrs: 3 + 4**

Reading and Writing Files: Files and File Paths, The os.path Module, The File Reading/Writing Process. **Organizing Files:** The shutil Module, Walking a Directory Tree

Module 5: Working with Excel Spreadsheets	**No. of Hrs: 2 + 4**

Installing the openpyxl Module, Reading Excel documents, Writing Excel Documents, Setting the Font Style of Cells, Font Objects, Formulas, Adjusting Rows and Columns

Laboratory Component:

1. Programming exercises to demonstrate the use of different flow control statements
2. Programming exercises to demonstrate the use of functions
3. Programming exercises to demonstrate the use of Lists and Dictionaries
4. Programming exercises on strings and demonstrate the use of various string methods
5. Programming exercises on Excel Spreadsheets using Python

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

1. Implement Python programs to solve problems using flow control and decision -making constructs
2. Design functions in python programs to solve problems using lists, dictionaries and strings
3. Develop python programs for file manipulation
4. Create python programs for handling Excel Spreadsheets

Textbooks:

1. AI Sweigart, "Automate the Boring Stuff with Python", William Pollock, 2015

Reference Books:

1. Charles R. Severance, "Python for Everybody: Exploring Data Using Python 3", 1st Edition, Shroff Publishers, 2017.
2. Allen B. Downey, "Think Python: How to Think Like a Computer Scientist", 2nd Edition. Green Tea Press, 2015,
3. Reema Thareja, "Python Programming using problem solving approach", Oxford University press, 2017.

Web links:

1. Learn Python By Example - https://www.learnbyexample.org/python/
2. Python Tutor code visualizer: Visualize code in Python, JavaScript, C, C++, and Java - https://pythontutor.com/render.html#mode=edit
3. YouTube Videos - https://www.youtube.com/watch?v=1F_OgqRuSdI&list=PL0-84-yl1fUnRuXGFe_F7qSH1LEnn9LkW

Open Source Tools and Technologies			
Semester	**3**	CIE Marks	**50**
Course Code	**23CISE253**	SEE Marks	**50**
Teaching Hours/Week (L: T: P)	**1:0:2**	Exam Hrs	**3**
Total Hours	**37**	Credits	**2**

Course Learning Objectives: This course is designed to

1. Introduce popular open source tools and technologies related to the field of Computer Science and Engineering
2. Describe the working of version control systems such as git, and related platforms such as GitHub /GitLab/ BitBucket
3. Illustrate the process of reporting issues, fixing them and providing the fixes as patches or submitting pull requests/merge requests
4. Prepare the students and apply to open source programs such as Google Summer of Code, Google Season of Documentation, Bitcoin Summer of Code and similar programs
5. Demonstrate the ability to create, manage, and collaborate on open source projects

Open Source Tools & Technologies	**No. of Hrs: 11**

Open source Integrated Development Environments (IDEs): Anaconda, Jupyter Notebook/ Jupyter Lab, PyCharm, VS Code, Code blocks

Open source tools for Computer Vision: OpenCV, scikit-image, Pillow, Matplotlib & Seaborn, Annotation Tools: LabelImg, VGG Image Annotator (VIA)

Open source tools for Networking, Cyber Security and Ethical hacking: Virtualization tools box, Kali Linux, Wireshark

Openly available version control systems: Git, mercurial, SVN, Popular platforms for version control systems: GitHub, GitLab, BitBucket

Laboratory Components	**No. of Hrs: 26**

Lab Component

- Installation and environment setup in Anaconda
- Launching Jupyter Notebook and installing add on libraries
- Installation of PyCharm
- Installation of Code blocks and use of debug facility
- Load and display an image using OpenCV and Pillow
- Perform image resizing and cropping
- Convert an image to grayscale and save the result
- Apply Gaussian blur and edge detection (Sobel, Canny)
- Enhance image contrast using histogram equalization
- Apply rotation and scaling to an image
- Implementation of color space conversion of an image
- Detect and visualize edges using Canny edge detection
- Implement template matching within an image
- Capture video from a webcam and apply real-time edge detection
- Installation of Virtual Box and creating virtual machine
- Installation Kali Linux
- Password cracking in Kali Linux

Case Studies:

- Implement real-time face detection (Haar cascades)
- Demonstrate Man in Middle attack using Wireshark in Kali Linux
- Use of Git for version control and GitHub for creating repository

Course Outcomes At the end of the course, the student will be able to

1. Install and set up open source IDEs such as Anaconda, Jupyter Notebook, Pycharm, VS Code, Code Blocks.
2. Apply basic image processing operations using open-source tools to process and analyze images and video
3. Apply open source tools to identify exploitable vulnerabilities in computer system and computer networks.
4. Apply open source version control systems for collaborative project development

Reference Books:

1. Jan Erik Solem, Programming Computer Vision with Python: Tools and algorithms for analyzing images 1st Edition, O'Reilly Media,2012
2. Ayush Vaishya, Mastering OpenCV with Python: Use NumPy, Scikit, TensorFlow, and Matplotlib to learn Advanced algorithms for Machine Learning through a set of Practical Projects, Orange Education Pvt Ltd,2023
3. Aurélien Géron, Hands-on Machine Learning with Scikit-Learn, Keras, and TensorFlow Concepts, Tools, and Techniques to Build Intelligent Systems, 2nd Edition, O'Reilly Media,2019

Web links:

1. Open source guide: https://opensource.guide/
2. GitHub document : https://docs.github.com/en
3. GitHub Contributing Guide : https://docs.gitlab.com/ee/development/contributing/
4. Pro Git Book: https://git-scm.com/book/en/v2

Universal Human Values			
Semester	**III**	CIE Marks	**50**
Course Code	**23HMCC215**	SEE Marks	**50**
Teaching Hours/Week (L:T: P)	**2:0:0**	Exam Hrs	**2.5**
Total Hours	**26**	Credits	**2**

Course Learning Objectives: This course is designed to
1.Impart the concepts of value education, life skills and personality
2.Create awareness about human relationship with family and society
3.Impart the knowledge on different orders in nature
4.Deliver the concept of professional ethics and value-based profession

Module 1: Introduction to Value Education	**No. of Hrs: 6**

Definition& meaning of Values, Types of values, Life skills-Overview, scope, Types, Importance of life skills, SWOT Analysis, Happiness and prosperity– Basic needs of human aspirations, Current scenario, Methods to fulfill the basic human aspirations

Module 2: Harmony in Self& Body	**No. of Hrs: 5**

Human being as co-existence of the Self and the Body, Needs, Harmony, Body as an Instrument of the Self, Strategies to enhance self-regulation and health, Empathy-Definition, Essential characteristics of empathy, Benefits of empathy, Sympathy Vs empathy

Module 3: Harmony in the Family and Society	**No. of Hrs: 5**

Family, Types of family, Family dynamics, Family life education, Harmony in the family – Basic unit of human interaction, 'Trust' – the foundational value in relationship, 'Respect' – as the right evaluation, Justice in human-to human relationship, Harmony in the society, Vision for the universal human order

Module 4: Harmony in Nature	**No. of Hrs: 5**

Introduction, Interconnectedness, Self-regulation and mutual fulfillment among the four orders of nature, Realizing existence as co-existence at all levels, Relationship of mutual fulfillment, Holistic perception of harmony in existence

Module 5: Implications of the Holistic understanding – A look at professional ethics	**No. of Hrs: 5**

Engineering ethics-Overview, Scope and Approach, Natural acceptance of human values, Definitiveness of ethical human conduct, Basis for humanistic education, Competence in professional ethics holistic technologies, Management models-case studies, Strategies for transition towards value-based life and profession

Course Outcomes: At the end of the course, the student will be able to
1.Understand the personality development through life skills & exhibiting the same
2.Realise the need of harmony in individual, family and society
3.Explain the need of harmony in nature towards co-existence
4.Understand the importance of ethics in professional life towards holistic approach

Textbooks:

1. R.R. Gaur, R. Asthana, G.P. Bagaria, "A Foundation Course in Human Values and Professional Ethics", 2nd Revised Edition, Excel Books, New Delhi, 2019
2. R.S. Naagarazan, "A Textbook on Professional Ethics and Human Values", 1st Edition, New Age International Publishers, 2006

Reference Books:

1. A. Nagaraj, "Jeevan Vidya: EK Parichaya", 1st Edition, Jeevan Vidya Prakashan, Amarkantak, 1999
2. A.N. Tripathi, "Human Values", 1st Edition, New Age International Publishers, New Delhi, 2004

Web links:

1. Module 1: https://www.youtube.com/watch?v=2ve49BWAJRE
2. Module 2: https://youtu.be/0ERSMkRPQBM
3. Module 3: https://youtu.be/3RAU4hreptI
4. Module 4: https://youtu.be/LwpU7N6A8fg
5. Module 5:https://youtu.be/EVWcuFXeSgk

Yoga-I			
Semester	**III**	CIE Marks	**100**
Course Code	**23AUCC221**	SEE Marks	**-**
Teaching Hrs/Week (L:T: P)	**0:0:1**	Exam Hrs	**-**
Total Hrs	**13**	Credits	**-**

Course Learning Objectives: This course is designed to

1. Empower students to achieve and maintain good health
2. Promote the practice of mental hygiene
3. Facilitate students in attaining emotional stability
4. Impart moral values and higher level of consciousness

Contents	**No. of Hrs: 13**

- Yoga, its origin, history and development, Yoga, its meaning, definitions
- Different schools of yoga, Aim and Objectives of yoga, importance of prayer
- Yogic practices for common man to promote positive health
- Rules to be followed during yogic practices by practitioner
- Difference between yogic and non yogic practices
- Suryanamaskar prayer and its meaning, Need, importance and benefits of Suryanamaskar13 count, 1rounds
- Asana, Need, importance of Asana, Different types of asana, Asana its meaning by name, technique, precautionary measures and benefits of each asana
- Different types of Asanas
  a) Sitting
    1. Padmasana
    2. Vajrasana
  b) Standing
    1. Vrikshana
    2. Trikonasana
  c) Prone line
    1. Bhujangasana
    2. Shalabhasana
  d) Supine line
    1. Utthitadvipadasana
    2. Ardhahalasana
- Meaning, importance and benefits of Kapalabhati, 10 strokes/min 3 rounds
- Meaning by name, technique, precautionary measures and benefits of Pranayama AnulomaViloma

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

1. Describe the meaning, aim and objectives of Yoga
2. Perform Suryanamaskar and able to analyze its benefits
3. Exhibit the different Asanas by name, its importance, methods and benefits
4. Perform Kapalabhati
5. Perform the different types of Pranayama by its name, precautions, procedure and uses

Textbooks:

1. Ajitkumar ,"YogaPravesha in Kannada" 1st Edition, Raashtroththaana Saahithya, 2017,ISBN-13: 978-8175310124
2. BKS Iyengar, "Light on Yoga", 1st Edition, Thorsons, 2017, ISBN-13: 978-0008267919
3. Dr. M L Gharote& Dr. S K Ganguly,"Teaching Methods for Yogic practices", 1st Edition, Kaivalyadhama, 2001, ISBN-13 : 978-8189485252

Reference Book:

YaminiMuthanna, "Yoga for Children step by step", 1st Edition, Om Books International, 2022, ISBN-13: 978-9394547018

Web links:

1. My Life My Yoga: https://youtu.be/KB-TYlgd1wE
2. Adiyoga: https://youtu.be/aa-TG0Wg1Ls

Physical Education-I			
Semester	**III**	CIE Marks	**100**
Course Code	**23AUCC222**	SEE Marks	**-**
Teaching Hrs/Week (L:T: P)	**0:0:1**	Exam Hrs	**-**
Total Hrs	**13**	Credits	**-**

Course Learning Objectives: This course is designed to

1. Impart the fundamental concepts and skills of Physical Education, Health, Nutrition and Fitness
2. Familiarization of health-related Exercises, Sports for overall growth and development
3. Build a strong foundation for the professionals in Physical Education and Sports

Contents	**No. of Hrs: 13**

- Definitions & components of Physical Fitness and Life Style
- Meaning and Definitions of Physical Fitness and Life Style
- Physical activity for engineers: stress management & injury prevention
- Components of fitness: cardiovascular endurance, muscular strength & endurance, flexibility, body composition (Lectures & Assessments)
- FITT principle (Frequency, Intensity, Time, Type) of exercise planning (Lectures)
- Fitness assessments: BMI, flexibility tests (Practical Sessions)
- Warm-up and cool-down techniques to prevent injuries (Practical Sessions)

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

1. Explain the benefits of physical activity for academic performance, stress management, and injury prevention in engineers
2. Design a personalized fitness program utilizing the FITT principle for targeted improvement
3. Demonstrate proper warm-up and cool-down techniques to enhance performance and prevent injuries

Textbooks:

1. Muller, J. P., "Health, Exercise and Fitness", 1st Edition, Sports Publication, 2018
2. Uppal, A.K., "Physical Fitness", Friends Publication New Delhi, 1992
3. Russell R.P., "Health & Fitness through Physical Education: Human Kinematics",Human Kinetics Publishers, 1994

Reference Books:

1. Anaika , "Play Field Manual", Friends Publication New Delhi, 2005
2. Pinto John & Roshan Kumar Shetty, "Introduction to Physical Education"

Web links:

1. How to exercise with a fitness plan: https://www.youtube.com/watch?v=08ryXxjaF1o
2. Health Related Physical Fitness: https://www.youtube.com/watch?v=rc3ZDoheMQs

National Service Scheme -I			
Semester	**III**	CIE Marks	**100**
Course Code	**23AUCC223**	SEE Marks	**-**
Teaching Hrs/Week (L:T: P)	**0:0:1**	Exam Hrs	**-**
Total Hrs	**13**	Credits	**-**

Course Learning Objectives: This course is designed to

1. Develop discipline, character, brotherhood, the spirit of adventure and ideals of selfless service amongst young citizens
2. Develop youth leadership in the students
3. Induce social consciousness among students through various societal activities
4. Impart knowledge in finding practical solutions to individual and community problems

NSS -Contents	**No. of Hrs: 13**

Introduction:

1. Importance and role of youth leadership, Life competencies
2. Skill development and empowerment
3. Innovation and personal growth

Activities:

4. Organic farming
5. Waste management

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

1. Understand the importance of nation building and individual contribution to the betterment of the society
2. Discover grassroots challenges of community and solve them by technological intervention
3. Create societal impact by upholding the value of one for all and all for one
4. Maintain discipline and team spirit

Textbooks:

1. Ministry of Youth Affairs & Sports, Government of India, "National Service Scheme Manual", 2022
2. Rajiv Gandhi National Institute of Youth Development, Ministry of Youth Affairs & Sports, Government of India,"Introduction Training Module for National Service Scheme Program officers", 2017
3. Gurmeet Hans, "Case material as Training Aid for field workers", TISS, 1996

Reference Books:

1. Dr. G R Bannerjee, "Social service opportunities in Hospitals", TISS, 2012
2. Ram Ahuja, "Social Problems in India", Rawat publications,3rd Edition, 2014

Web links:

1. History of NSS: https://thebetterindia.com/140/national-service-scheme-nss/
2. NSS – an introduction: https://www.youtube.com/@nationalserviceschemeoffic4034/videos

Arts-I			
Semester	**III**	CIE Marks	**100**
Course Code	**23AUCC224**	SEE Marks	**-**
Teaching Hrs/Week (L:T: P)	**0:0:1**	Exam Hrs.	**-**
Total Hrs	**13**	Credits	**-**

Course Learning Objectives: This course is designed to

1. To impart an understanding of the creative process from initial concept to final execution
2. Create and demonstrate proficiency in a chosen arts discipline through practical application
3. Analyze and appreciate diverse art forms and styles
4. To participate in art competitions at regional, state, national, and international levels, as well as in cultural events

Contents	**No. of Hrs: 13**

Note: Student shall select any one form of arts and continue the same till 6th semester

Performing Arts (Dance)	Welcome and Brainstorming, Introduction to Performing Arts: Dance, Folk, Cinema, Basic study of Folk Dance Forms, Exploration of Coastal Karnataka Folk Forms,Introduction to Bharatanatyam/Kathak: Theory and Practical,Introduction to Western Dance: Theory and Practical - Basics of Hip Hop, Introduction to Yakshagana: Theory and Practical, Group Presentation, Evaluation
Music	Welcome and Brainstorming, Introduction to Music and its Classifications, Voice and Pitch test, Voice Culture exercises, Exercises for Pitch, Volume, Energy, and Clarity, Basic Singing Practice with Scales, Understanding Compositions and Pitch Mapping, Practice on a Specific Song, Group Presentation, Evaluation
Arts & Crafts	Welcome and Brainstorming, Introduction to Art & Craft, Lines and Shapes, Object Drawing, Colors and Gradations, Color Fusion, Sketching Basics, Paper crafts, Group Presentation, Evaluation
Theatre	Welcome and Brainstorming, Introduction to acting and theatre, Talent Hunt, Physical and Voice Exercise, Body Language in acting, eye contact and tone, Theatre Compositions, Evaluation

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

1. Capable of creating choreography and delivering live performances for an audience
2. Employ a range of acting techniques and use them to create a performance
3. Evolve into creative, effective, independent, and reflective individuals capable of making informed decisions in both process and performance
4. Acquire knowledge and comprehension of the roles and processes used in current theatre arts practice

Textbooks:

1. Bruce Benward and Marilyn Sake, “Music in Theory and Practice”, McGraw-Hill Education, 2014
2. Otto G. Ocvirk, Robert E. Stinson, Philip R. Wigg, Robert Bone, and David L. Cayton, “Art Fundamentals: Theory and Practice”, McGraw-Hill Education, 2012
3. Anne Bogart and Tina Landau, “The Viewpoints Book: A Practical Guide to Viewpoints and Composition”, Theatre Communications Group, 2004

Reference Books:

1. Jacqueline M. Smith, "Dance Composition: A practical guide to creative success in dance making"
2. Ralph Mayer, "The Artist's handbook of method and materials"
3. Dr. Arun Bangre, "Glimpses of Indian music and dance"

Web links:

1. Audio visual catalogu:https://ccrtindia.gov.in/audio-visual-catalogue/
2. Essential Acting Lesson for Beginners: https://www.youtube.com/watch?v=GGl9Wri70aQ

ENGINEERING MATHEMATICS - IV			
Semester	**IV**	CIE Marks	**50**
Course Code	**23BSCC202**	SEE Marks	**50**
Teaching Hrs/Week (L:T: P)	**3:0:0**	Exam Hrs	**3**
Total Hrs	**42**	Credits	**3**

Course Learning Objectives: This course is designed to

1. Impart the basic knowledge on collection and presentation of data, measure of central tendency and dispersion, correlation, regression, and curve fitting for analyzing data
2. Provide a comprehensive understanding of sampling distributions, estimation methods, hypothesis testing, experimental designs, and analysis of variance along with exploring their engineering applications
3. Develop a systematic understanding of Markov chain and its application in solving Engineering and Scientific problems
4. Build a strong foundation in multivariate analysis techniques for analyzing data
5. Develop skills for analyzing data using R program

Module 1: Statistics	**No. of Hrs: 08**

Statistics: Collection & Presentation of data - Graphical & Tabular representation, Measures of Central Tendency, Dispersion, Skewness and Kurtosis

Correlation & Regression-Scatter plot, Multiple & Partial Correlation and Regression Coefficients, Curve fitting – Linear & Non-Linear

Module 2: Sampling, Estimation & Inference	**No. of Hrs: 09**

Sampling, Estimation & Inference: Population and Sample, Complete Enumeration v/s Sample Surveys – Merits, Demerits, and Applications. Sampling Distributions (t, Chi-Squared & F distributions)

Estimation-Maximum likelihood, Moment Estimators, Bayes' Estimators

Hypothesis testing - t test, z-test, Chi-Squared test for independence of attributes & Goodness of fit, Non-Parametric tests. Interval estimation

Module 3: Design of Experiments and Analysis of Variance	**No. of Hrs: 08**

Design of Experiments – Principles of experimentation in design, Basic Principle of Analysis of Variance (ANOVA), One-way ANOVA, Two-way ANOVA, Types of designs - Completely Randomized Design (CRD), Randomized Block Design (RBD), Latin Square Design (LSD). Missing plot technique, and Analysis of Covariance (ANOCOVA)

Module 4: Stochastic Process	**No. of Hrs: 07**

Stochastic Process: Types,Markov Chains, Chapman–Kolmogorov equations for n-step transition probabilities, Classification of States, Limiting Probabilities

Module 5: Multivariate Analysis	**No. of Hrs: 10**
Multivariate Analysis: Multivariate normal distribution, estimation & inference on vector parameters, Multivariate linear regression, Principal Components Analysis (PCA), Factor Analysis, Discriminant Analysis, Classification & Cluster Analysis	

Course Outcomes:

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

1. Apply Statistical methods to real world data to get deeper insights useful for informed decision making
2. Estimate the parameters of a distribution and perform various tests as inferential measures
3. Plan/Conduct/Choose experiments and analyze results by applying principles of Design of Experiments
4. Model systems that evolve over time in a probabilistic manner
5. Use R program for analyzing and visualizing data

Textbooks:

1. S. C. Gupta, & V. K. Kapoor, "Fundamental of Mathematical Statistics", 12th Edition, Sultan Chand & sons, 2020
2. Ronald E. Walpole, Raymond H Myers, Sharon L Myers & Keying Ye, "Probability & Statistics for Engineers & Scientists", 9th Edition, Pearson Education, 2017
3. Richard Arnold Johnson & Dean W. Wichern, "Applied Multivariate Statistical Analysis", Pearson International, 2023

Reference Books:

1. S. C. Gupta, & V. K. Kapoor, "Fundamental of Applied Statistics", 4th Edition, Sultan Chand & sons, 2018
2. George Casella & Roger L. Berger, "Statistical Inference", 1st Edition, Cengage Learning India Pvt. Ltd., 2007
3. William J. Stewart, "Probability, Markov Chains, Queues, and Simulation", Princeton University Press, 2009
4. Sudha G. Purohit, Sharad D. Gore & Shailaja R. Deshmukh, "Statistics Using R", 2nd Edition, Narosa Publishing House, 2019
5. Shayle R. Searle & Andre I. Khuri, "Matrix Algebra: useful for Statistics", 2nd Edition, Wiley Series in Probability and Statistics, 2017

Web links:

1. Descriptive statistics, https://archive.nptel.ac.in/courses/111/104/111104120/
2. Probability and statistical inference, https://archive.nptel.ac.in/courses/111/104/111104146/
3. Sampling theory and linear regression Analysis, https://archive.nptel.ac.in/courses/111/104/111104147/
4. Stochastic process, https://archive.nptel.ac.in/courses/111/102/111102111/
5. Multivariate Analysis, https://archive.nptel.ac.in/courses/111/104/111104024/

Design and analysis of algorithms			
Semester	**IV**	CIE Marks	**50**
Course Code	**23CIPC207**	SEE Marks	**50**
Teaching Hrs/Week (L:T: P)	**3:0:2**	Exam Hrs	**03**
Total Hrs	**64**	Credits	**04**

Course Learning Objectives: This course is designed to

1. Provide an in-depth understanding of fundamental algorithms and analysis of recursive and nor-recursive algorithms
2. Impart knowledge of various algorithm design techniques including brute force, divide-and-conquer, decrease-and-conquer, greedy algorithms, transform-and-conquer, dynamic programming, backtracking, branch-and-bound techniques, and string algorithms
3. Provide an in-depth understanding of computational complexity, complexity classes and NP-completeness

Module 1 :Introduction to Algorithm Analysis	**No. of Hrs: 10**

Introduction to Algorithms: Need for Algorithm Efficiency, Fundamental Stages of Problem Solving, Basics of Algorithm Analysis: Basics of Algorithm Complexity, Introduction to Time complexity, Analysis of Iterative Algorithms, Rate of Growth, Asymptotic Analysis, Space Complexity Analysis

Module 2:Basic Algorithm Design Techniques	**No. of Hrs: 9+4**

Mathematical Analysis of Recursive Algorithms: Introduction to Recurrence Equations, Formulation of Recurrence Equations, Techniques for Solving Recurrence Equations, Divide-and-conquer Recurrences, Master Theorem, Brute Force Approaches: Sequential Search, Recursive Form of Linear Search Algorithm, Sorting Problem, Bubble Sort, Selection Sort, Divide-and-conquer Approach: Introduction, Merge Sort, Quick Sort, Finding Maximum and Minimum Elements

Laboratory Components:

1. Implement Selection sort and analyze its time complexity
2. Sort a given set of elements using the quick sort method and determine the time required to sort the elements. Repeat the experiment for different values of n (the number of elements in the list to be sorted) and plot a graph of the time taken versus n. The elements can be read from a file or can be generated using the random number generator

Module 3: Decrease-and-conquer and Greedy Approach	**No. of Hrs:9+6**

Decrease-and-conquer Approach: Introduction, Decrease by Constant Method, Insertion Sort, Decrease by Constant Factor Method, Binary Search. Greedy Algorithms: Introduction to Greedy Approach, Scheduling Problems, Scheduling with Deadline, Knapsack Problem, Optimal Storage of Tapes, Optimal Tree Problems, Huffman Coding, Optimal Graph Problems, Minimum Spanning Trees, Single-source Shortest-path

Laboratory Components:

1. Implement Insertion Sort and analyse the time complexity
2. Implement fractional knapsack problem using Greedy Strategy
3. Implement minimum spanning tree using Prim's algorithm and analyze its time complexity

Module 4:Transform-and-Conquer, Dynamic Programming and Backtracking	**No. of Hrs: 8+6**

Transform-and-conquer Approach: Introduction to Transform and Conquer, Change of Representation, Heap Sort, Dynamic Programming: Floyd–Warshall All Pairs Shortest-path Algorithm, Bellman–Ford Algorithm, Traveling Salesperson Problem, Knapsack Problem, Optimal Binary Search Trees, Dynamic Programming Approach for Constructing Optimal BSTs, Backtracking: Basics of Backtracking, N-queen Problem, Sum of Subsets, Vertex Coloring Problem

Laboratory Components:

1. Apply dynamic programming methodology to find all pairs shortest path of a directed graph using Floyd's algorithm
2. Program to solve transitive closure using Warshall algorithm
3. Find the solution to the Travelling Salesman Problem. Repeat the experiment for a graph having total number of nodes (n) = 4, 8, 12, 16, 20 and note the time required to find the solution. Plot the graph taking n on the x-axis and time on y-axis and analyse the graph to determine whether it is exponential or not

Module 5:Branch-and-Bound, String Algorithms and Computational Complexity	**No. of Hrs: 8+4**

Branch-and-bound Technique: Introduction, Traveling Salesperson Problem, Knapsack Problem. String Algorithms: naïve String Matching Algorithm, Knuth–Morris–Pratt Algorithm, Rabin-Karp String Matching Algorithm, Basics of Computational Complexity: Complexity Classes, Theory of NP-complete Problems, Satisfiability Problem and Cook's Theorem. Example Problems for Proving NP-completeness, Clique Decision Problem is NP-complete

Laboratory Components:

1. Find the solution of the 0/1 Knapsack Problem using Branch and Bound Technique
2. Implement a naïve string matching algorithm for any given string T and pattern P

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

1. State algorithm efficiency using asymptotic notations and mathematically compute the time complexity and space complexity of algorithms
2. Solve problems and determine their complexities using divide & conquer approaches and decrease & conquer approaches
3. Apply algorithmic design techniques like greedy method and transform & conquer method to solve given problems and compute their computational complexity
4. Solve problems and determine their complexities by applying dynamic programming approaches, backtracking and branch & bound methods
5. Make use of String matching algorithms to match patterns in text and describe whether or not a given algorithm belongs to NP -complete complexity classes

Textbooks:

1.S. Sridhar,"Design and Analysis of Algorithms", 1st Edition, Oxford University Press, 2014

Reference Books:

1. Anany Levitin, Introduction to the Design and Analysis of Algorithms, 3rd Edition (Indian), Pearson, 2017
2. Cormen T, Leiserson C., Rivest R. and Stein C, "Introduction to Algorithms" 3rd Edition, MIT Press, 2009
3. Horowitz E., Sahni S. and Rajasekaran S, "Fundamentals of Computer Algorithms" 2nd Edition, University Press (India)Pvt. Ltd, 2008
4. Dave P. H. and Dave H. B, "Design and Analysis of Algorithms",2nd Edition, Pearson Education India, 2013
5. Tamassia R. and Goodrich M. T, "Algorithm Design and Applications", 1st Edition, Wiley, 2014

Web links:

1. Module 1 to Module 5 Video Lecture & Slides, https://web.stanford.edu/class/archive/cs/cs161/cs161.1138/
2. MIT OpenCourseWare Introduction to Algorithms Lecture Notes, https://ocw.mit.edu/courses/6-006-introduction-to-algorithms-spring-2020/pages/lecture-notes/
3. MIT Open Course Ware Lecture Notes :https://ocw.mit.edu/courses/6-046j-designand-analysis-of-algorithms-spring-2012/pages/lecture-notes/
4. MIT Open Course Ware Video Lectures: https://www.youtube.com/playlist?list=PLUl4u3cNGP63EdVPNLG3ToM6LaEUuStEY

Introduction to Machine Learning			
Semester	**IV**	CIE Marks	**50**
Course Code	**23CIPC208**	SEE Marks	**50**
Teaching Hrs/Week (L: T: P)	**3:0:2**	Exam Hrs	**03**
Total Hrs	**64**	Credits	**04**

Course Learning Objectives: This course is designed to

1. Impart the knowledge on core concepts and underlying principles of machine learning.
2. Familiarize the various data preprocessing techniques.
3. Enable to build basic Machine Learning models using classification, regression, gradient descent algorithms and ensemble methods.

Module 1: Foundations of Machine Learning — **No. of Hrs: 8+4**

Learning Problems, Designing a Learning System, Perspectives & Issues in Machine Learning, A Concept Learning Task, Concepts Learning as Search, Find S, Version Spaces and Candidate Elimination Algorithm, Inductive Bias, Introduction to Machine Learning, Framework for Developing Machine Learning Models

Laboratory Components:

1. Implement and demonstrate the **FIND-S algorithm** for finding the most specific hypothesis based on a given set of training data samples.
2. Implement and demonstrate the **Candidate-Elimination** algorithm for a given set of training data examples stored in a .CSV file

Module 2: Dataset Pre-processing — **No. of Hrs: 8+4**

Data Preparation Tasks: Data Cleaning, Feature Selection, Data Transforms Feature Engineering, Dimensionality Reduction, Data Preparation: Problems with Naive Data Preparation, Train and Test dataset, K-Fold Cross Validation, Data Cleaning: Basics of Data Cleaning, Outlier Identification and Removal, Marking and Remove Missing Data, Statistical Imputation, Feature Selection :Overview of Feature Selection, Categorical Feature Selection, Numerical Feature Selection, Data Transforms: Scale numerical data, Encoding Categorical Data, Dimensionality Reduction:-LDA, PCA, SVD

Laboratory Components:

1. Demonstrate the following concepts of data preprocessing techniques by using a pertinent dataset.
   a. Identify and remove outliers using IQR and Local Outlier Factor methods.
   b. Identify and remove missing values.
   c. Selection of numerical and Categorical features.
   d. Data transform using one hot encoder and minmax scaler
2. Implement dimensionality reduction using PCA, LDA

Module 3: Linear Regression and Gradient Descent — **No. of Hrs: 9+4**

Linear Regression: Introduction, Steps in Building Linear Regression, Building the Linear Regression Model, Gradient Descent Algorithm, Scikit-Learn Library for Machine Learning: Splitting Dataset, Building Regression Model, Prediction, Measuring Accuracy- R Squared Value, RMSE, Bias-Variance Trade-off, K-fold Cross Validation, Advanced Regression Model: Building Regression Model for IPL Dataset**,** Applying Regularization

Laboratory Components:

1. Build and evaluate a machine learning model to predict car prices using various features from the given dataset
   a. dataset: https://www.kaggle.com/datasets/bwabomaulid/car-price-prediction
2. Compare the performance of Batch Gradient Descent, Stochastic Gradient Descent, and Mini-batch Gradient Descent for linear regression. Implement each method to optimizea linear regression model, visualize their convergence paths, and analyze their effectiveness in fitting the model

Module 4: Classification	**No. of Hrs: 9+4**

Overview of Classification Problems, Binary Logistic Regression, Credit Classification example, Model Evaluation: Receiver Operating Characteristic (ROC) and Area Under the Curve (AUC), Confusion Matrix, Finding Optimal Classification Cut-off: Youden's index, Cost-based approach, K-Nearest Neighbors, Bayes Theorem: Bayes Theorem & Concept Learning, Bayes Optimal Classifier, Naïve Bayes Classifier, Learning to Classify Text, Bayesian Belief Network, EM Algorithm

Laboratory Components:

1. Train a regularized logistic regression classifier on the Iris dataset using sklearn, and report the classification accuracy.
2. Implement a Bayesian network considering medical data to demonstrate the diagnosis of heart patients using standard Heart Disease Data Set.

Module 5: Advanced Machine Learning Algorithms	**No. of Hrs: 8+6**

Ensemble Learning and Random Forests: Voting Classifiers, Bagging and Pasting, Random Patches and Random Subspaces, Random Forests, Boosting, Stacking, Clustering: K-Means Clustering, Support Vector Machines (SVM): Linear SVM Classification, Nonlinear SVM Classification, SVM Regression, Decision Function and Predictions, Training Objective

Laboratory Components:

1. Implement and evaluate the performance of Random Forest and AdaBoost classifiers ona selected dataset
2. Apply K-Means clustering on a suitable dataset and analyze the results
3. Train an SVM classifier on the Iris dataset using sklearn and report the best classification accuracy and number of support vectors

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

1. Describe the foundational concepts of Concept Learning & Machine learning.
2. Applies the essential data preparation techniques for robust and efficient machine learning implementations.
3. Apply regression model and gradient descent algorithm to various realistic dataset & evaluate the performance evaluation of models.
4. Apply various Classification algorithm to realistic dataset & evaluate the performance evaluation of models
5. Apply ensemble approach, SVM & K-Means algorithms to realistic dataset and fine tune the model for performance increase.

Textbooks:

1. Tom M. Mitchell, "Machine Learning", Mc Graw Hill, 2003.
2. Jason Brownlee: Data Preparation for Machine Learning: Data Cleaning, Feature Selection, and Data Transforms in Python,2020,
3. Manaranjan Pradhan, U Dinesh kumar," Machine Learning using Python", Wiley, 2019
4. Aurelien Geron, "Hands-On Machine Learning with Scikit-Learn, Keras, and TensorFlow", 2nd Edition, O'Reilly Publisher, 2019

Reference Books:

1. Andreas C. Müller, Sarah Guido, "Introduction to Machine Learning with Python A Guide for Data Scientists", 1st Edition, O'Reilly Publisher, 2016

Web links:

1. NPTEL Course on Machine Learning : http://digimat.in/nptel/courses/video/106105152/L01.html
2. Youtube Course on Machine Learning : https://www.youtube.com/watch?v=LcWFedjaR4Q

OPERATING SYSTEMS			
Semester	**IV**	CIE Marks	**50**
Course Code	**23CIPC209**	SEE Marks	**50**
Teaching Hrs/Week (L:T: P)	**4:0:0**	Exam Hrs	**03**
Total Hrs	**52**	Credits	**04**

Course Learning Objectives: This course is designed to

1. Impart the knowledge of need for OS & different OS structure
2. Provide comprehensive understanding of process scheduling, multithreaded models and identify suitable scheduling technique
3. Explain process synchronization and concept of Deadlock
4. Introduce Memory and Virtual memory management, File system and storage techniques

Module 1: Introduction to operating systems and System structure	**No. of Hrs: 11**

Introduction: Introduction to operating systems, Computer System architecture, Operating System structure, Operating System operations: Process management, Memory management, Storage management, Protection and Security, Distributed system, Special-purpose systems, Computing environments

System structures: Operating System Services, User - Operating System interface, System calls, Types of system calls, System programs, Operating system design and implementation, Operating System structure, Virtual machines

Module 2: Process Management	**No. of Hrs:11**

Process concept: Process scheduling, Operations on processes, Inter process communication, Multi-threaded Programming: Overview, Multithreading models, Thread Libraries, Threading issues

Process Scheduling: Basic concepts, Scheduling Criteria: Scheduling Algorithms, Thread scheduling, Multiple-processor scheduling

Module 3: Process Coordination	**No. of Hrs: 10**

Process Synchronization: Background, The critical section problem, Peterson's solution, Synchronization hardware, Semaphores, Classical problems of synchronization,

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

Module 4: Memory Management	**No. of Hrs: 10**

Memory management strategies: Background, Swapping, Contiguous memory allocation, Paging, Structure of page table, Segmentation

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

Module 5: File systems and Storage Management	**No. of Hrs: 10**

File System: File concept, Access methods, Directory structure, File system mounting, File sharing, Protection

Implementation of File System: File system structure, File system implementation, Directory implementation, Allocation methods, Free space management

Secondary Storage Structure: Mass storage structures, Disk structure, Disk attachment, Disk scheduling, Disk management

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

1. Explain the structure and functionality of operating system
2. Apply various scheduling algorithm for a given set of process
3. Identify the root causes of deadlock and provide solution for deadlock elimination
4. Apply various techniques for memory management
5. Explain file and secondary storage management strategies

Textbooks:

1. P.K. Nag, Abraham Silberschatz, Peter Baer Galvin, Greg Gagne, "Operating System Principles" 8th Edition, Wiley-India, 2015

Reference Books:

1. Ann McHoes Ida M Fylnn, "Understanding Operating System", 6th Edition, Cengage Learning, 2013.
2. D.M Dhamdhere, "Operating Systems: A Concept Based Approach", 3rd Edition, McGraw- Hill, 2013.
3. P.C.P. Bhatt, "An Introduction to Operating Systems: Concepts and Practice", 4th Edition, PHI(EEE), 2014.
4. William Stallings, "Operating Systems: Internals and Design Principles", 6th Edition, Pearson, 2008.
5. Anthony M. Bedford and Wallace Fowler, "Engineering Mechanics: Statics and Dynamics", 5th Edition, Prentice Hall, 2007.

Web links:

1. Introduction to Operating System Video Lecture: https://www.youtube.com/watch?v=vBURTt97EkA&list=PLBlnK6fEyqRiVhbXDGLXDk_OQAeuVcp2O
2. Multithreading Video Lecture :https://www.youtube.com/watch?v=HW2Wcx-ktsc
3. Introduction to Deadlock Video Lecture :https://www.youtube.com/watch?v=MYgmmJJfdBg
4. Deadlock Detection & Recovery Video Lecture :https://www.youtube.com/watch?v=Y14b7_T3AEw&list=PLEJxKK7AcSEGPOCFtQTJhOElU44J_JAun&index=30
5. Introduction to Paging in OS Video Lecture :https://www.youtube.com/watch?v=pJ6qrCB8pDw&list=PLIY8eNdw5tW-BxRY0yK3fYTYVqytw8qhp
6. Introduction to Linux Operating System Video Lecture : https://www.youtube.com/watch?v=TTBkc5eiju4 1: https://ciechanow.ski/internal-combustion-engine/

Object Oriented Concepts with Java Programming			
Semester	**IV**	CIE Marks	**50**
Course Code	**23CIPC210**	SEE Marks	**50**
Teaching Hrs/Week (L:T: P)	**3:0:2**	Exam Hrs	**03**
Total Hrs	**64**	Credits	**04**

Course Learning Objectives: This course is designed to

1. Explain key constructs of the Java programming language.
2. Demonstrate object-oriented principles through practical applications.
3. Illustrate packages, multi-threading, and exception handling mechanisms

Module 1:History of Java, Introduction to Java Programming Language	**No. of Hrs: 10+6**

An Overview of Java: Object-Oriented Programming (OOP) –Two Paradigms: Structured and Object Oriented - Abstraction and OOP Principles: Polymorphism, Inheritance, and Encapsulation. Code Blocks, Lexical Elements - Whitespaces, Identifiers, Literals, Comments, and Separators. The Java Keywords, Data Types, Variables, and Arrays: The Primitive Types - Integers, Floating-Points, Characters and Booleans Variables, Type Conversion and Type Casting, Automatic Type Promotion in Expressions, Arrays, Introducing Type Inference with Local Variables, Operators: Arithmetic Operators, Relational Operators, Boolean Logical Operators, The Assignment Operator, and The Ternary Operator. Operator Precedence, Using Parentheses, Control Statements: Selection Statements - if, if-then-else, nested if-then-else, and switch. Iteration Statements –loop variants: while, do-while, and for. Nested Loops, Jump Statements (break, continue, and return), Local Variable Type Inference

Laboratory Components:

1. Write Java Programs that demonstrate assigning values to different primitive data types and printing the variable values on the console
2. Write Java Programs that use different types of operators and displays the results of these operations on the console
3. Write Java Programs to demonstrate various control structures
4. Write Java programs that demonstrate various operations on arrays - including array initialization, traversing the array, and manipulating array elements

Module 2:Classes and Methods	**No. of Hrs:8+2**

Introducing Classes: Class Fundamentals, Declaring Objects, Assigning Object Reference Variables, Methods, Constructors, "this" Keyword, and Garbage Collection, Methods and Classes: Overloading Methods, Argument Passing, Objects as Parameters, Returning Objects, Recursion, Access Control, understanding static and final keywords, Nested and Inner Classes

Laboratory Components:

1. Write Java programs to demonstrate the concept of classes and objects.
2. Develop Java programs to demonstrate Method and Constructor Overloading**.**

Module 3:Inheritance and Interfaces	**No. of Hrs: 8+4**

Inheritance: Inheritance Basics, using super keyword, Types of Inheritance, Multilevel Hierarchy, When and how Constructors Are Executed, Method Overriding, Polymorphism, Dynamic Method Dispatch, Abstract Classes, Using final with Inheritance, The Object Class, Interfaces: Definition, Default Interface Methods, Use of static Methods in an Interface, Private Interface Methods

Laboratory Components:

1. Demonstrate polymorphism concepts by developing suitable methods, defining appropriate member data and writing the main test program
2. Develop Java programs to create abstract class and abstract methods. Create subclasses that extend the parent class and override the respective base class methods
3. Write Java programs that demonstrates the working of Interface

Module 4:Packages and Exceptions	**No. of Hrs: 8+4**

Packages: Packages, Packages and Member Access, Importing Packages, Exceptions: Exception-Handling Fundamentals, Exception Types, Uncaught Exceptions, using try and catch, Multiple catch Clauses, Nested try Statements, throw, throws, finally, Java's Built-in Exceptions, Creating Your Own Exception Subclasses, Chained Exceptions

Laboratory Components:

1. Develop Java programs to demonstrate package concepts and import mechanism
2. Develop Java programs to raise a custom exception (user defined exception) for Division ByZero using try, catch, throw and finally

Module 5:Multi-threading, Enumerations, Type Wrappers and Auto-boxing	**No. of Hrs: 8+6**

Multithreaded Programming: The Java Thread Model, The Main Thread, Creating a Thread, Creating Multiple Threads, Using isAlive() and join(), Thread Priorities, Synchronization, Inter-thread Communication, Obtaining a Thread's State, Enumerations, Type Wrappers and Autoboxing: Enumerations - The values() and valueOf() Methods, Type Wrappers - Character, Boolean, The Numeric Type Wrappers Autoboxing/Unboxing Occurs in Expressions, Autoboxing/Unboxing of Boolean, Character Values etc.,

Laboratory Components:

1. Write programs to illustrate creation of threads using different mechanisms
2. Develop programs to implement the following
   i) Customized Enumeration type ii) Autoboxing iii) Wrappers

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

1. Illustrate proficiency in creating programs using branching and looping constructs
2. Develop a class that encompasses both data attributes and methods tailored to a specific context
3. Apply the principles of inheritance and interfaces to address practical challenges in real-world scenarios
4. Utilize the concept of packages and exception handling to tackle intricate problems
5. Develop programs by integrating concepts such as multithreading, autoboxing, and enumerations

Textbooks:

1. Herbert Schildt"Java: The Complete Reference, 12th Edition, McGraw-Hill, 2021

Reference Books:

1. E Balagurusamy, "Programming with Java", 6th Edition, by McGraw Hill Education, 2019
2. Bruce Eckel, "Thinking in Java", Fourth Edition, Prentice Hall, 2006

Web links:

1. Engineering Java Tutorial: https://www.geeksforgeeks.org/java/
2. Introduction To Programming In Java (by Evan Jones, Adam Marcus and Eugene Wu): https://ocw.mit.edu/courses/6-092-introduction-to-programming-in-java-january-iap-2010/
3. Java Tutorial: https://www.w3schools.com/java/
4. Java Tutorial: https://www.javatpoint.com/java-tutorial

Research Methodology & Intellectual Property Rights			
Semester	**III**	CIE Marks	**50**
Course Code	**23HMCC216**	SEE Marks	**50**
Teaching Hrs/Week (L:T: P)	**2:0:0**	Exam Hrs.	**2.5**
Total Hrs	**26**	Credits	**02**

Course Learning Objectives: This course is designed to

1.Impart knowledge on basics of research

2.Discuss the concepts of Intellectual Property Rights

Module 1: Introduction, Literature Review and Technical Reading	**No. of Hrs: 7**

Meaning of Research, Objectives of Research, Motivation in Research, Types of Research, Research Approaches, Significance of Research, Research Methods versus Methodology, Research and Scientific Method, Importance of Knowing How Research is Done, Research Process, Criteria of Good Research

New and Existing Knowledge, Analysis and Synthesis of Prior Art, Bibliographic Databases, Effective Search: The Way Forward, Introduction to Technical Reading, Conceptualizing Research, Critical and Creative Reading, Taking Notes While Reading, Reading Mathematics and Algorithms, Reading a Datasheet

Module 2: Research Design	**No. of Hrs: 5**

What is a Research Problem? Selecting the Problem, Necessity of Defining the Problem, Technique Involved in Defining a Problem, Meaning of Research Design, Need for Research Design, features of a Good Design, Important Concepts Relating to Research Design, Different Research Designs, Basic Principles of Experimental Designs

Module 3: Ethics in Engineering Research & Technical Writing	**No. of Hrs: 5**

Ethics in Engineering Research Practice, Types of Research Misconduct, Ethical Issues Related to Authorship, Free Writing and Mining for Ideas, Attributes and Reasons of Technical Writing, Writing Strategies, Journal Paper: Structure and Approach, Language Skills, Writing Style, and Editing, Rules of Mathematical Writing, Publish Articles to Get Cited, or Perish, IMRaD Guidelines, COPE Guidelines

Module 4: Introduction to Intellectual Property	**No. of Hrs: 4**

Role of IP in the Economic and Cultural Development of the Society, IP Governance, IP as a Global Indicator of Innovation, Origin of IP History of IP in India- Copyrights, Patents, Trademarks, Geographical Indications, Trade secrets, Semiconductor Integrated circuits and layout designs, Plant varieties, Industrial Design

Module 5: Process of Patenting	**No. of Hrs: 5**

Prior Art Search, Choice of Application to be Filed, Patent Application Forms. Jurisdiction of Filing Patent Application, Publication, Pre-grant Opposition, Examination. Grant of a Patent. Validity of Patent Protection, Post-grant Opposition, Commercialization of a Patent

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

1. Apply the basic research principles and methodologies
2. Review the Literature, Technical Reading, Attributions and Citations
3. Understand Various Intellectual Property Rights
4. Draft patent application

Textbooks:

1. C.R Kothari "Research MethodologyMethods and Techniques" 2nd Edition, Newage international, 2009
2. Dipankar Deb, Rajeeb Dey, Valentina E. Balas,"Engineering Research Methodology A Practical Insight for Researchers",1st Edition, Springer Nature, 2019
3. Prof. Rupinder Tewari Ms. MamtaBhardwa, "Intellectual Property A Primer for Academia", Publication Bureau Panjab University Chandigarh, 2021

Reference Books:

1. David V. Thiel,"Research Methods for Engineers", 1st Edition, Cambridge University Press, 2014
2. William G. Zikmund, Barry J. Babin, Jon C Carr, Mitch Griffin, "Business Research Methods", 9th Edition, Cengage India Private Limited, 2013
3. "WIPO Intellectual Property Handbook", WIPO Publication

Web links:

1. Research Methodology Course: https://onlinecourses.nptel.ac.in/noc24_ge41/preview
2. Module 4,5: https://www.ipindia.gov.in/
3. Module 4,5: https://www.wipo.int/
4. Refence Management tool: https://desktop-download.mendeley.com/download/Getting_Started_Guide.pdf
5. IMRad Guidelines: https://writingcenter.gmu.edu/writing-resources/imrad/writing-an-imrad-report
6. COPE Guidelines: https://publicationethics.org/files/u7141/1999pdf13.pdf

Agile Project Management Using Scrum			
Semester	**IV**	CIE Marks	**50**
Course Code	**23CISE254**	SEE Marks	**50**
Teaching Hrs/Week (L:T: P)	**2:0:0**	Exam Hrs	**2.5**
Total Hrs	**26**	Credits	**02**

Course Learning Objectives: This course is designed to

1. Demonstrate the fundamental principles of Agile methodologies and the Scrum framework
2. Illustrate the roles and responsibilities within a Scrum team
3. Impart knowledge on Scrum events effectively
4. Impart skills in Agile estimation and planning techniques
5. Provide advanced Scrum techniques and scaling practices

Module 1 :Fundamentals of Agile and Scrum	**No. of Hrs: 05**
Agile Principles and Mindset: History and Core Principles of Agile, Agile Manifesto and Values, Introduction to Scrum: Overview of Scrum Framework, Scrum Roles: Product Owner, Scrum Master, Development Team, Scrum Events: Sprint, Sprint Planning, Daily Scrum, Sprint Review, Sprint Retrospective, Scrum Artifacts: Product Backlog, Sprint Backlog, Increment	
Module 2 :Roles and Responsibilities in Scrum	**No. of Hrs: 05**
Product Owner: Defining Product Vision, Managing and Prioritizing Product Backlog, Scrum Master: Facilitating Scrum Processes, Coaching the Team, Removing Impediments. Development, Team: Self-Organization and Cross-Functionality, Collaboration and Communication within the Team	
Module 3 :Scrum Processes and Events	**No. of Hrs: 05**
Sprint Planning and Execution: Setting Objectives for the Sprint, Creating the Sprint Backlog, Executing and Adapting During the Sprint, Daily Scrum and Communication: Conducting Effective Daily Stand-ups, Improving Team Coordination, Sprint Review and Retrospective: Demonstrating Work Done, Reflecting on Team Performance and Process Improvements	
Module 4 :Agile Planning and Estimation	**No. of Hrs: 05**
User Stories and Backlog Refinement: Writing Effective User Stories, Continuous Backlog Refinement, Agile Estimation Techniques: Story Points and Relative Estimation, Planning Poker and Other Estimation Methods	
Module 5 :Advanced Scrum Techniques	**No. of Hrs: 06**
Scaling Scrum: Approaches to Scaling Scrum in Large Organizations, Nexus and LeSS Frameworks, Agile Metrics and Reporting: Key Performance Indicators in Scrum, Using Burn-down and Burn-up Charts, Measuring Team Performance and Productivity, Hands-on Scrum Simulation-Running a Full Sprint Cycle, Applying Scrum Principles in a Controlled Environment, Case Studies from Industry	

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

1. Explain the Agile Manifesto and principles, and describe the Scrum roles, events, and artifacts, and explain how they interrelate within the Scrum process
2. Describe the responsibilities of the Product Owner, Scrum Master, and Development Team, and discuss how these roles contribute to the success of a Scrum project
3. Apply Sprint Planning, Daily Scrums, Sprint Reviews, and Sprint Retrospectives, ensuring each event achieves its intended purpose
4. Apply story points, planning poker, and other estimation techniques to create realistic and manageable sprint plans
5. Implement scaling frameworks such as Nexus and LeSS, and utilize metrics and reporting tools to monitor and enhance team performance

Textbooks:

1. Ken Schwaber "Agile Project Management with Scrum", 1st Edition, Microsoft press, 2004

Reference Books:

1. Henrik Kniberg . "Scrum and XP from the Trenches: How We Do Scrum" Lulu Press, Inc, 2007

Web links:

1. Agile Scrum Tutorial (YouTube) :https://www.youtube.com/watch?v=TPEgII1OilU
2. NPTEL Course :https://www.youtube.com/watch?v=x90kIAFGYKE

Mobile Application Development using Flutter			
Semester	**IV**	CIE Marks	**50**
Course Code	**23CISE255**	SEE Marks	**50**
Teaching Hrs/Week (L:T: P)	**1:0:2**	Exam Hrs	**03**
Total Hrs	**37**	Credits	**02**

Course Learning Objectives: This course is designed to

1. Explain the core principles of Flutter, describe the widget tree, and understand the role of Dart in Flutter development
2. Impart knowledge to create responsive and interactive UI layouts, utilize built-in and custom widgets, and apply styling and themes to achieve desired UI/UX
3. Describe various state management approaches (such as Provider, Riverpod, or Bloc), handle asynchronous data fetching, and manage local and remote data storage
4. Illustrate Access and use device features like camera, GPS, and sensors, as well as integrate RESTful APIs, Firebase, and other external services into their Flutter applications

Module 1: Introduction to Flutter and Dart	**No. of Hrs: 11**

Introduction: Introduction to Flutter, Dart, and the Flutter ecosystem, Setting up the Flutter development environment, Basics of the Dart programming language. Dart Basics and Flutter Fundamentals: Dart Programming- Dart syntax and language features, Variables, data types, functions, and control flow

State Management and Navigation : Understanding state management in Flutter: Stateful vs Stateless widgets, Basics of state management, Introduction to advanced Flutter widgets : Lists, grids, and custom widgets, Animations and transitions

Working with APIs and Data Storage: Fetching data from APIs and local storage: Introduction to HTTP requests, Using packages for network calls, Introduction to local storage (SQLite, shared preferences)

Firebase Integration: Introduction to Firebase and its services, Firebase Authentication. Cloud Firestore and real-time database

Testing and Debugging: Testing in Flutter: Unit testing, widget testing, and integration testing.

List of Experiments	**No. of Hrs: 26**

1. Setting up the Flutter SDK and creating the first Flutter applications
    a. Installation of Flutter and Dart
    b. Introduction to Flutter's structure (widgets, material design, etc.)
    c. Building and running a simple "Hello World" applications
2. Exploring Flutter's fundamental widgets
    a. Text, Image, and Container widgets
    b. Column and Row layout widgets
3. Implementing stateful widgets and navigation
    a. Creating and managing state in a Flutter applications
    b. Navigation between screens using Navigator and Routes
4. Designing complex UIs
    a. Implementing ListView and GridView
    b. Building custom widgets and incorporating animations
5. Integrating APIs and data storage in Flutter applications
    a. Storing data locally and retrieving it
6. Integrating Firebase with Flutter
    a. Setting up Firebase in a Flutter applications
    b. Implementing user authentication
    c. Storing and retrieving data from Firestore
7. Debugging and testing Flutter applications
    a. Writing and running tests.
    b. Using Flutter's debugging tools
8. Capstone project.
    a. Students work in teams to develop a complete Flutter applications
    b. Stages: Planning, design, implementation, testing, and deployment
    c. Final presentation and demonstration of the project

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

1. Explain Set up a Flutter development environment and create basic applications using Flutter
2. Building user-friendly, visually appealing, and interactive mobile interfaces for both iOS and Android platforms
3. Develop application state using various approaches (such as Provider, Riverpod, or Bloc), handle asynchronous data operations, and integrate data from local and remote sources

Textbooks:

1. Thomas Bailey, Alessandro Biessek, "Flutter for Beginners: Cross-platform mobile development from Hello, World! to app release with Flutter 3.10+ and Dart 3.x", 3rd Edition, PACT Publisher, 2023

Reference Books:

1. Marco L. Napoli "Beginning Flutter: A Hands On Guide to App Development" 1st Edition, Wrox Publisher, 2019

Web links:

1. Flutter Course for Beginners :https://www.youtube.com/watch?v=VPvVD8t02U8

Front End Technologies			
Semester	**IV**	CIE Marks	**50**
Course Code	**23CISE256**	SEE Marks	**50**
Teaching Hrs/Week (L:T: P)	**1:0:2**	Exam Hrs	**03**
Total Hrs	**37**	Credits	**02**

Course Learning Objectives: This course is designed to

1. Familiarize with the syntax and semantics of HTML and XHTML
2. Explain the use of CSS in the design of web pages
3. Establish the importance of JavaScript in designing interactive web pages

Module 1: Introduction to HTML, CSS, JavaScript — **No. of Hrs: 12**

Introduction: World wide web and its evolution, E-mail, Telnet, FTP, E–commerce, Cloud Computing, Video conferencing, Internet service providers, IP Address, URL, Domain Name Servers, Web 2.0, Web 3.0, Web Browsers, Search Engine ,Web Server

Hypertext Markup Language: HTML - Structure, Basic Tags, Conventions - Block Elements, Inline Elements, Attributes, Anchor References, Various Elements- Lists, Images, section, article, aside, nav, menu, header and footer Elements

Cascading Style Sheets: CSS Overview - CSS Rules, CSS Syntax and Style , Class Selectors, ID Selectors, style Attribute, style Container, External CSS, CSSProperties: color properties, font properties, line-height property, text properties, borderproperties. element box, padding property, margin

JavaScript:Structure of JavaScript, Buttons, Functions, Variables, Identifiers , Assignment Statements , Objects - Document Object Model, Forms: form Element, Controls, Text Control, Accessing a Form's Control Values, reset and focus Methods , Event Handler Attributes: onchange, onmouseover, onmouseout

Advanced JavaScript: External JavaScript Files, Loops: While, do, for, Radio Buttons, Checkboxes, Fieldset and Legend Elements, Manipulating CSS with JavaScript, Using z-index to Stack Elements, text area Controls , Pull-Down Menus, List Boxes

List of Experiments — **No. of Hrs: 26**

1. Demonstrate the use of basic HTML elements such as Heading and paragraph
2. Demonstrate the use of image, anchor and frame tags
3. Demonstrate the applications of Lists, Tables
4. Demonstrate the applications of forms with various elements
5. Demonstrate the usage of inline & document CSS
6. Demonstrate the usage of external CSS
7. Demonstrate the usage Alert and Prompt
8. Design HTML form for keeping record and validate it using JavaScript
9. Manipulating CSS with JavaScript- Using z-index to Stack Elements
10. Build a JavaScript Program to demonstrate the usage of While Loop, do While Loop and External JavaScript Files in JavaScript.
11. Build a JavaScript Program to demonstrate the usage of Radio Buttons, Checkboxes, for Loop - fieldset and legend Elements in JavaScript
12. Apply Pull-Down Menus, List Boxes with Event Handler and Listener using JavaScript

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

1. Develop HTML documents by adding various semantic markup tags
2. Apply various attributes, values and types of CSS
3. Design interactive web pages using JavaScript

Textbooks:

1. Laura Lemay, Rafe Colburn and Jennifer Kyrnin, "Mastering HTML, CSS and JavaScript Web Publishing", 1st Edition, BPB Publication, , 2016

Reference Books:

1. Alex Banks and Eve Porcello, Learning React "Functional Web Development withReact and Redux, 1st Edition, O'Reilly Publishers", 2017
2. Thomas A. Powell, "HTML & CSS: The Complete Reference". Fifth Edition, Tata McGraw Hill, 2017
3. John Dean, Jones & Bartlett Learning, "WEB PROGRAMMING with HTML5, CSS and JavaScript", Jones and Bartlett Publishers, 2018

Web links:

1. W3Schools online tutorial :https://www.w3schools.com/html/
2. Freecodemap website tutorial :https://www.freecodecamp.org/news/html-css-and-javascript-explained-for-beginners/
3. NPTEL :https://onlinecourses.swayam2.ac.in/aic20_sp11/preview

Environmental Studies & Sustainability			
Semester	**IV**	CIE Marks	**100**
Course Code	**23AUCC229**	SEE Marks	**-**
Teaching Hrs/Week (L:T: P)	**1:0:0**	Exam Hrs	**-**
Total Hrs	**13**	Credits	**-**

Course Learning Objectives: This course is designed to

1. Create environmental awareness among the students
2. Provide knowledge on different types of pollution and their impacts in the environment
3. Enable the learners to understand the environmental management plan and socio-economic skills for sustainable development
4. Know about the major challenges in Environmental Issues and Evaluate possible solutions

Module 1: Ecosystems and Biodiversity	**No. of Hrs: 2**

Ecosystems: Value of Forest, Desert, Wetlands, River, Oceanic and Lake
Biodiversity: Types, Value, Hot-spots, Threats and Conservation of biodiversity, Forest Wealth and Deforestation

Module 2: Sustainable Energy Resources	**No. of Hrs: 2**

Energy Resources: Types of Energy, Conventional Sources and Non-Conventional Sources, Renewable Energy Sources: Hydrogen, Solar, OTEC, Tidal, Wind, Geothermal, Biomass and Bio Fuels

Module 3: Environmental Pollution and Sustainable Waste Management	**No. of Hrs: 3**

Environmental Pollution: Surface and Ground Water Pollution, Noise pollution, Air Pollution and Carbon Trading
Sustainable Waste Management & Public Health Aspects: Bio-medical Waste, Solid Waste, Hazardous Waste, E-waste, Industrial and Municipal Sludge

Module 4: Global Environmental Concerns	**No. of Hrs: 3**

Population Growth, Climate Change, Ground Water Depletion/Recharging, Ozone Depletion, Radon and Fluoride problem in drinking water, Disaster Management, Resettlement and Rehabilitation of People

Module 5: Environmental Pollution Mitigation Tools	**No. of Hrs: 3**

Remote Sensing& G.I.S., Environment Impact Assessment, Environmental Management Systems, ISO14001, Green Credit Program, Waste Audits, Environmental Stewardship - NGOs

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

1. Describe the principles of ecology and environmental issues of air, land and water on a global scale
2. Explain their environmental knowledge and observation skills to analysis of a problem or question related to the sustainable environment and energy
3. Illustrate the Global environmental concerns and the individual responsibility to protect environment with environmental protection laws and education for sustainable environment
4. Outline the strategies, technologies, and methods for sustainable management of environmental systems and for the remediation or restoration of degraded environment

Textbooks:

1. Benny Joseph, "Environmental Studies",2nd Edition, Tata Mcgraw-Hill, 2012
2. Erach Bharucha, "Environmental Studies",1st Edition, University Grant Commission and Bharati Vidyapeeth Institute of Environmental Education and Research, Pune, 2004

Reference Books:

1. B. S Chauhan, "Environmental Studies", 1st Edition, Laxmi Publications Pvt. Ltd.,2019
2. S M Prakash, "Environmental Studies", 3rd Edition, Pristine Publishing House, Mangalore, 2018
3. Aloka Debi,"Environmental Science and Engineering", 2ndEdition, Universities Press (India) Pvt. Ltd, 2012
4. R. J. Ranjit Daniels and Jagadish Krishnaswamy, "Environmental Studies", 1stEdition, Wiley India Private Ltd., New Delhi, 2009
5. M.Ayi Reddy, "Environmental Science and Technology", 1stEdition, BS Publications, 2007

Web links:

1. Environmental Studies Module 1: https://www.youtube.com/watch?v=siGaqKXCmg8
2. Question Bank| Environmental Studies: https://www.youtube.com/watch?v=F9uwkhoT3MQ
3. Environmental Science and Engineering Module 1-5: https://www.youtube.com/watch?v=Y5B1nWYle40

Yoga-II			
Semester	**IV**	CIE Marks	**100**
Course Code	**23AUCC225**	SEE Marks	**-**
Teaching Hrs/Week (L:T: P)	**0:0:1**	Exam Hrs	**-**
Total Hrs	**13**	Credits	**-**

Course Learning Objectives: This course is designed to

1. Empower students to achieve and maintain good health
2. Promote the practice of mental hygiene
3. Facilitate students in attaining emotional stability
4. Impart moral values and higher level of consciousness

Contents	**No. of Hrs: 13**

- Ashtanga Yoga, its need and importance

- Yama :Ahimsa, satya, asteya, brahmacarya, aparigrahaNiyama :shoucha, santosh, tapa, svaadhyaya, Eshvarapranidhan etc.,.

- Suryanamaskar13 count- 2 rounds of practice
- Asana, Need, importance of Asana, Different types of asana, Asana its meaning by name, technique, precautionary measures and benefits of each asana
- Different types of Asanas
  a) Sitting
    1. Sukhasana
    2. Paschimottanasana
  b) Standing
    1. ArdhakatiChakrasana
    2. ParshvaChakrasana
  c) Prone line
    1. Dhanurasana
    2. Sarpasana
  d) Supine line
    1. Halasana
    2. KarnaPeedasana
- Meaning, importance and benefits of Kapalabhati. 20 strokes/min 3 rounds
- Meaning, Need, importance of Pranayama, Different types, Meaning by name, technique, precautionary measures and benefits of each Pranayama
    1. Suryanuloma –Viloma
    2. Chandranuloma-Viloma
    3. Suryabhedana
    4. Chandra Bhedana
    5. Nadishodhana

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

1. Describe the meaning, aim and objectives of Yoga
2. Perform Suryanamaskar and able to analyze its benefits
3. Exhibit the different Asanas by name, its importance, methods and benefits
4. Perform Kapalabhati
5. Perform the different types of Pranayama by its name, precautions, procedure and uses

Textbooks:

1. Ajitkumar ,"YogaPravesha in Kannada" 1st Edition, Raashtroththaana Saahithya, 2017,ISBN-13: 978-8175310124
2. BKS Iyengar, "Light on Yoga", 1st Edition, Thorsons, 2017, ISBN-13: 978-0008267919
3. Dr. M L Gharote& Dr. S K Ganguly,"Teaching Methods for Yogic practices", 1st Edition, Kaivalyadhama, 2001, ISBN-13 : 978-8189485252

Reference Book:

YaminiMuthanna, "Yoga for Children step by step", 1st Edition, Om Books International, 2022, ISBN-13: 978-9394547018

Web links:

1. My Life My Yoga: https://youtu.be/KB-TYlgd1wE
2. Adiyoga: https://youtu.be/aa-TG0Wg1Ls

Physical Education-II			
Semester	**IV**	CIE Marks	**100**
Course Code	**23AUCC226**	SEE Marks	**-**
Teaching Hrs/Week (L:T: P)	**0:0:1**	Exam Hrs	**-**
Total Hrs	**13**	Credits	**-**

Course Learning Objectives: This course is designed to

1. Impart the fundamental concepts and skills of Physical Education, Health, Nutrition and Fitness
2. Familiarization of health-related Exercises, Sports for overall growth and development
3. Build a strong foundation for the professionals in Physical Education and Sports

Contents	**No. of Hrs: 13**

- Training Components: Strength, Speed, Endurance, Flexibility, Agility & Coordinative abilities
- Basic rules and strategies of chosen team sports. (Practical Sessions)
- Causes & Prevention of Sports Injuries: Sprain, Strain, Cramps, Fractures and Dislocation
- Specific Games (Any one to be selected by the student)

Basic Training

Basket ball	Dribbling with both hands - Layup shot - Chest pass - Proper footwork and body positioning - Basic jump shot technique
Cricket	Holding the bat grip - Stance and footwork - Basic batting shots (defense & hitting) - Bowling grip and action - Fielding techniques (catching & throwing)
Football	Dribbling with both feet - Passing with accuracy (short and long) - Controlling the ball (laces, inside of foot) - Shooting technique - Stopping the ball - Basic heading technique
Hockey	Dribbling the ball with a stick - Stopping the ball with the stick - Basic passing techniques (forehand, backhand) - Shooting technique (push shot, flick shot) - Body positioning and balance
Table Tennis	Holding the paddle grip - Forehand and backhand grip changes - Basic strokes (forehand drive, backhand push) - Footwork and positioning - Serving technique (underhand serve)
Throwball	One-handed chest pass - Two-handed overhead pass - Pivoting with the ball Footwork and movement - Shooting technique (one-handed and two-handed throws) - Catching the ball safely
Volleyball	Overhand serve - Proper hand setting technique (bump pass) - Forearm pass
Badminton	Holding the racquet grip :Forehand , backhand, universal and panhandle grip changes ,Basic serves (high serve, low serve),Stance and Strokes

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

1. Design a basic training program incorporating various training components to improve specific physical fitness aspects
2. Identify common sports injuries, explain their causes, and implement preventative measures
3. Perform in the selected sports or athletic events

Textbooks:

1. Muller J. P., "Health, Exercise and Fitness", 1st Edition, Sports Publication, 2018
2. Uppal A.K., "Physical Fitness", Friends Publication New Delhi, 1992
3. Russell R.P., "Health & Fitness through Physical Education: Human Kinematics",Human Kinetics Publishers, 1994

Reference Books:

1. Anaika, "Play Field Manual", Friends Publication New Delhi, 2005
2. IAAF Manual
3. Pinto John & Roshan Kumar Shetty, "Introduction to Physical Education"

Web links:

1. Football: https://www.youtube.com/watch?v=wvlztaJYKYI
2. Basketball Basics:https://www.youtube.com/watch?v=d0z7QqblJaM
3. Cricket with the correct grip: https://www.youtube.com/watch?v=UxX4IQL03UU
4. Basics of Dribbling: https://www.youtube.com/watch?v=naEccnjzLxM
5. Karate Training: https://www.youtube.com/watch?v=br89-xhWezs

National Service Scheme-II			
Semester	**IV**	CIE Marks	**100**
Course Code	**23AUCC227**	SEE Marks	**-**
Teaching Hrs/Week (L:T: P)	**0:0:1**	Exam Hrs	**-**
Total Hrs	**13**	Credits	**-**

Course Learning Objectives: This course is designed to

1. Develop discipline, character, brotherhood, the spirit of adventure and ideals of selfless service amongst young citizens
2. Develop youth leadership in the students
3. Induce social consciousness among students through various societal activities
4. Impart knowledge in finding practical solutions to individual and community problems

NSS -Contents	**No. of Hrs: 13**

Introduction:

- Youth development programmes
- Health, hygiene and sanitation awareness programs
- Peer leadership training

Activities:

- Social and economic activities to support the society
- Water conservation – awareness sessions on water conservation, rain water harvesting, maintaining the surroundings, safeguarding water sources, etc.

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

1. Understand the importance of nation building and individual contribution to the betterment of the society
2. Discover grassroots challenges of community and solve them by technological intervention
3. Create societal impact by upholding the value of one for all and all for one
4. Maintain discipline and team spirit

Textbooks:

1. Ministry of Youth Affairs & Sports, Government of India, "National Service Scheme Manual", 2022
2. Rajiv Gandhi National Institute of Youth Development, Ministry of Youth Affairs & Sports, Government of India, "Introduction Training Module for National Service Scheme (NSS) Program officers", 2017
3. Gurmeet Hans, "Case material as Training Aid for field workers" TISS, 1996

Reference Books:

1. Dr. G R Bannerjee,Social service opportunities in Hospitals, TISS, 2012
2. Ram Ahuja, Social Problems in India, Rawat publications, 3rd Edition2014

Web links:

1. History of NSS :https://thebetterindia.com/140/national-service-scheme-nss/
2. NSS – an introduction: https://www.youtube.com/@nationalserviceschemeoffic4034/videos

Arts-II			
Semester	**IV**	CIE Marks	**100**
Course Code	**23AUCC228**	SEE Marks	**-**
Teaching Hrs/Week (L:T: P)	**0:0:1**	Exam Hrs	**-**
Total Hrs	**13**	Credits	**-**

Course Learning Objectives: This course is designed to

1. To impart an understanding of the creative process from initial concept to final execution
2. Create and demonstrate proficiency in a chosen arts discipline through practical application
3. Analyze and appreciate diverse art forms and styles
4. To participate in art competitions at regional, state, national, and international levels, as well as in cultural events

Contents	**No. of Hrs: 13**

Note: Student shall continue the arts form selected in previous semester

Performing Arts (Dance)	Orientation, Head to Toe Exercise, Contemporary /filmy dance, Basic expression and choreography, Zumba and aerobics, Dance practice and Group Performance, Evaluation
Music	Orientation, Introduction to Musical Instruments, Basic Instrumental Practice, Singing Genres Demo, Niche Mapping, Folk Singing with instrument, Group Song Practice, Group Presentation, Evaluation
Arts & Crafts	Orientation, Sketching lifestyle and modelling, Pencil Shading-practical, Brush/Crayon Techniques, Charcoal Drawing, water color practical, collage, Group Presentation, Evaluation
Theatre	Orientation, Realistic Acting: input and output applications, Stylized Acting, Absurd acting, Group Rehearsal, Basics of Costume Design, Prop Usage, Group Presentation, Evaluation

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

1. To be capable of creating choreography and delivering live performances for an audience
2. Employ a range of acting techniques and use them to create a performance
3. Evolve into creative, effective, independent, and reflective individuals capable of making informed decisions in both process and performance
4. Acquire knowledge and comprehension of the roles and processes used in current theatre arts practice

Textbooks:

1. Bruce Benward and Marilyn Sake, "Music in Theory and Practice", McGraw-Hill Education, 2014
2. Otto G. Ocvirk, Robert E. Stinson, Philip R. Wigg, Robert Bone, and David L. Cayton, "Art Fundamentals: Theory and Practice", McGraw-Hill Education, 2012
3. Anne Bogart and Tina Landau, "The Viewpoints Book: A Practical Guide to Viewpoints and Composition", Theatre Communications Group, 2004

Reference Books:

1. Jacqueline M. Smith, "Dance Composition: A practical guide to creative success in dance making"
2. Ralph Mayer, "The Artist's handbook of method and materials"
3. Dr. Arun Bangre, "Glimpses of Indian music and dance"

Web link:

Audio visual catalogue:https://ccrtindia.gov.in/audio-visual-catalogue/