Academic Program - UG

Academic Year 2024-25

Syllabus III & IV Semester B.E.

(Under NEP 2020)

Branch: Artificial Intelligence & Machine Learning

SHRI DHARMASTHALA MANJUNATHESHWARA COLLEGE OF ENGINEERING & TECHNOLOGY,

DHARWAD – 580 002

(An Autonomous Institution approved by AICTE & Affiliated to VTU, Belagavi)

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SDM College of Engineering & Technology, Dharwad

It is certified that the scheme and syllabus for III & IV Semesters of UG program in Artificial Intelligence and Machine Learning is recommended by Board of Studies of Artificial Intelligence and Machine Learning Department and approved by the Academic Council, SDM College of Engineering & Technology, Dharwad. This scheme and syllabus will be in force from the academic year 2024-25 till further revision.

Principal Chairman BoS & HoD

College Vision and Mission

Vision

To develop competent professionals with human values

Mission

- To have contextually relevant Curricula.
- To promote effective Teaching Learning Practices supported by Modern Educational Tools and Techniques.
- To enhance Research Culture.
- To involve the Industrial Expertise for connecting Classroom contents to real-life situations.
- To inculcate Ethics and soft-skills leading to overall personality development.

QUALITY POLICY:

In its quest to be a role model institution, committed to meet or exceed the utmost interest of all the stake holders.

Core Values:

- Competency
- Commitment
- Equity
- Team work and Trust

Vision and Mission of the Department

Vision

To develop expert AIML professionals to serve the society by practicing values

Mission

1. To incorporate relevant Curricula.
2. To practice appropriate Teaching Learning techniques using modern teaching technological tools.
3. To enhance and embrace Research Culture.
4. To involve Industrial Expertise for exposure to the industrial environment.
5. To inculcate Ethical values and provide soft-skill leading to well rounded Personality Development

Program educational Objectives (PEO)

I. Develop into Artificial Intelligence and Machine Learning Professionals with expertise in providing solutions to Artificial Intelligence and Machine Learning problems

II. Pursue higher studies with a sound knowledge of basic concepts and skills in basic science, humanities, Artificial Intelligence and Machine Learning disciplines

III. Exhibit professionalism and teamwork by providing the environment for exploring current technology trends through collaborative and complementary work ethics

Programme Outcomes (POs) and Programme Specific Outcomes (PSOs)

Program Outcomes (POs):

1. **Engineering knowledge:** Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
2. **Problem analysis:** Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.
3. **Design/development of solutions:** Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.
4. **Conduct investigations of complex problems:** Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.
5. **Modern tool usage:** Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations.
6. **The engineer and society:** Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice.
7. **Environment and sustainability:** Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.
8. **Ethics:** Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.
9. **Individual and team work:** Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.
10. **Communication:** Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.

11. **Project management and finance:** Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.
12. **Life-long learning:** Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.

Program Specific outcomes (PSOs):

13. An ability to develop logical reasoning, coding skills, analysis and mathematical modeling.
14. An ability to modify, debug, test and adapt software modules for varied applications.

SDM COLLEGE OF ENGINEERING AND TECHNOLOGY, DHARWAD
Department of Artificial Intelligence & Machine Learning
III Semester
Scheme of Teaching and Examinations 2024 – 25

Sl No	Course	Course Code	Course Title	Teaching Department	Teaching Hrs/Week			Examination				Credits
					Lecture	Tutorial	Practical	Duration in Hrs	CIE Marks	SEE Marks	Total Marks	
					L	T	P					
1	ASC	22MAC300	Engineering Mathematics – III	BS	2	2	0	3	50	100	100	3
2	PCC	22UAIC300	Data Structures	AIML	4	0	0	3	50	100	100	4
3	PCC	22UAIC301	Introduction to Artificial Intelligence	AIML	3	0	0	3	50	100	100	3
4	PCC	22UAIC302	Digital Systems and Computer Architecture	CSE	3	0	0	3	50	100	100	3
5	PCCL	22UAIL303	Data Structures Laboratory	AIML	0	0	2	3	50	50	100	1
6	PCCL	22UAIL304	Digital Systems Laboratory	CSE	0	0	2	3	50	50	100	1
7	ESC	22USAIC305	Operating Systems	AIML	3	0	0	3	50	100	100	3
8	UHV	22UHVK306	Universal Human Values - I	ISE	1	0	0	1	50	50	100	1
9	SEC	22UAIE321	Introduction to Web Technology	AIML	0	0	2	3	50	50	100	1
10	ASC	22UMBA301	Mathematics	BS	3	0	0	Audit	50	-	50	-
11	MC	22UPYK307	Physical Education and Yoga	PE&Y	0	0	2	-	50	-	50	Audit
										Total	**1000**	**20**

ASC (IC): Applied Science Course (Integrated Course), **AEC:** Ability Enhancement Course, **ESC:** Engineering Science Course, **ETC:** Emerging Technology Course, **PLC:** Programming Language Course, **HSMS:** Humanity and Social Science and Management Course, **CIE:** Continuous Internal Evaluation, **SEE:** Semester End Examination. Semester End Examination conducted for 100 marks will be reduced to 50 marks.

Physical Education and Yoga: All students have to register for the course namely National Service Scheme (NSS) with the concerned course coordinator during the first week of respective semester. Activities shall be carried out during III Semester to VI Semester. Successful completion of the registered course and requisite CIE score are mandatory for the award of the degree. The events shall be appropriately scheduled by the colleges and the same shall be reflected in the calendar prepared for the PE & Y activities. This courses shall not be considered for vertical progression as well as for the calculation of SGPA and CGPA, but completion of the course is mandatory for the award of the degree.
AICTE activity point: Every regular student, who is admitted to the 4-year degree program, is required to earn 100 activity points in addition to the total credits earned for the program. The activity points earned by the student shall be reflected on the student's VIII semester grade card. The activities to earn the points can be spread over the duration of the program. However, minimum prescribed duration should be fulfilled. Activity points (non-credit) have no effect on SGPA/CGPA and shall not be considered for vertical progression. In case student fails to earn the prescribed activity points; VIII semester grade card shall be issued only after earning the required activity Points. Students shall be eligible for the award of degree only after the release of the VIII semester grade card.

SDM COLLEGE OF ENGINEERING AND TECHNOLOGY, DHARWAD
Department of Artificial Intelligence & Machine Learning
IV Semester
Scheme of Teaching and Examinations 2024 – 25

Sl No	Course	Course Code	Course Title	Teaching Department	Teaching Hrs/Week			Examination				Credits
					Lecture	Tutorial	Practical	Duration in Hrs	CIE Marks	SEE Marks	Total Marks	
					L	T	P					
1	ASC	22UMAC400	Engineering Mathematics - IV	BS	2	2	0	3	50	100	100	3
2	PCC	22UAIC400	Introduction to Machine Learning	AIML	3	0	0	3	50	100	100	3
3	PCC	22UAIC401	Database Management Systems	AIML	3	0	0	3	50	100	100	3
4	PCC	22UAIC402	Object Oriented Programming with Java	CSE	3	0	0	3	50	100	100	3
5	PCCL	22UAIL403	Database Management Systems Laboratory	AIML	0	0	2	3	50	50	100	1
6	PCCL	22UAIL404	Object Oriented Programming Laboratory	CSE	0	0	2	3	50	50	100	1
7	ESC	22UPAIC405	Design and Analysis of Algorithms	AIML	3	0	0	3	50	100	100	3
8	UHV	22UHVK406	Universal Human Values - II	ISE	1	0	0	1	50	50	100	1
9	SEC	22UAIE421	Mobile Application Development	AIML	0	0	2	3	50	50	100	1
10	MC	22UBEK407	Biology for Engineers	ISE	1	0	0	1	50	50	100	1
11	ASC	22UMBA401	Mathematics	BS	3	0	0	Audit	50	-	50	-
12	MC	22UPYK408	Physical Education and Yoga	PE&Y	0	0	2	-	50	-	50	Audit
										Total	**1100**	**20**

ASC (IC): Applied Science Course (Integrated Course), **AEC:** Ability Enhancement Course, **ESC:** Engineering Science Course, **ETC:** Emerging Technology Course, **PLC:** Programming Language Course, **HSMS:** Humanity and Social Science and Management Course, **CIE:** Continuous Internal Evaluation, **SEE:** Semester End Examination. Semester End Examination conducted for 100 marks will be reduced to 50 marks.

Physical Education and Yoga: All students have to register for the course namely National Service Scheme (NSS) with the concerned course coordinator during the first week of respective semester. Activities shall be carried out during III Semester to VI Semester. Successful completion of the registered course and requisite CIE score are mandatory for the award of the degree. The events shall be appropriately scheduled by the colleges and the same shall be reflected in the calendar prepared for the PE & Y activities. This courses shall not be considered for vertical progression as well as for the calculation of SGPA and CGPA, but completion of the course is mandatory for the award of the degree..
AICTE activity point: Every regular student, who is admitted to the 4-year degree program, is required to earn 100 activity points in addition to the total credits earned for the program. The activity points earned by the student shall be reflected on the student's VIII semester grade card. The activities to earn the points can be spread over the duration of the program. However, minimum prescribed duration should be fulfilled. Activity points (non-credit) have no effect on SGPA/CGPA and shall not be considered for vertical progression. In case student fails to earn the prescribed activity points; VIII semester grade card shall be issued only after earning the required activity Points. Students shall be eligible for the award of degree only after the release of the VIII semester grade card.

22UMAC300	Engineering Mathematics - III	(2-2-0) 3

Contact Hours: 39

Course Learning Objectives (CLOs):

To have an insight into Fourier series, Fourier transforms, Z-transforms. To solve algebraic, transcendental and ordinary differential equations arising in engineering applications using numerical methods.

Course Outcomes (COs):

Description of the Course Outcome: At the end of the course the student will be able to:		**Mapping to POs(1-12)**		
		Substantial Level (3)	**Moderate Level (2)**	**Slight Level (1)**
CO-1	**Express** periodic function as a Fourier series and obtain the various harmonics of the Fourier series expansion for the given numerical data.	-	-	1, 2
CO-2	**Transform** the given function using Fourier transforms depending on the nature of engineering applications. **Apply** Z-transform for series of mathematical conversion to mathematical framework used as digital filter. **Solve** difference equations using Z-transform.	-	-	1, 2
CO-3	**Obtain** series solution of ordinary differential equations.	-	-	1, 2
CO-4	**Make** use of the correlation and regression analysis to fit a suitable mathematical model for the statistical data.	-	1, 2, 12	-
CO-5	Formulate LPP and obtain optimal solutions using different tools.	-	1, 2, 12	-

PO's	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**14**
Mapping Level	1.4	1.4	-	-	-	-	-	-	-	-	-	2.0	-	-

Prerequisites: Knowledge of fundamentals of calculus and Statistical Averages.

Contents:

Unit I

Fourier Series: Periodic functions, Dirichlet's condition. Fourier series of periodic functions of period 2π and arbitrary period. Half- range Fourier series. Practical harmonic analysis, Examples from engineering field. **8 Hrs**

Unit II

Fourier Transforms: Infinite Fourier transforms, Fourier sine and cosine transforms. Inverse Fourier transforms.(Simple problems).

Z - Transforms and Difference Equations : Z-transform- definition, Standard Z-transforms, Damping and shifting rules, Initial value and Final value theorems (without proof) problems. Inverse Z-transform. Simple problems. Difference equations-basic definition. Application of Z-transform to solve Difference equations. **9 Hrs**

Unit III

Special functions: Series solution of Bessel's differential equation leading to Jn(x)- Bessel's function of first kind, Recurrence relations, Generating function of Bessel's functions, orthogonality of Bessel's function. **8 Hrs**

Unit IV

Curve Fitting: Curve fitting by the method of least squares- fitting the curves of the form $= ax + b; y = ax^2 + bx + c; y = ax^b.$ $= ax + b; y = ax^2 + bx + c; y = ax^b.$.

Statistical Methods: Correlation and regression-Karl Pearson's coefficient of correlation -problems. Regression analysis- lines of regression–problems. **7 Hrs**

Unit V

Linear and Non-Linear programming: Introduction, Mathematical formulation of a L.P.P, basic solution. Geometric (or graphical) method, Simplex method.

Non Linear Programming – Constrained extremal problems-Lagrange's multiplier method. **7 Hrs**

Reference Books:

1) B.S. Grewal, “Higher Engineering Mathematics”, 44/E, Khanna Publishers, 2017.
2) E.Kreyszig, “Advanced Engineering Mathematics”, 10/E, John Wiley &Sons, 2016.
3) Srimanta Pal et al, “Engineering Mathematics”, 3/E, Oxford University Press,2016.
4) B. V. Ramana, "Higher Engineering Mathematics", 11/E, Tata McGraw-Hill,2010.
5) Er. Premkumar Gupta, Dr. D. S. Hira., “Operations Research”, 7/E, S. Chand Publications, 2014.

22UAIC300	Data Structures	(4-0-0) 4

Contact Hours: 52

Course Learning Objectives (CLOs):

The objective of the course is to realize the fundamental data structures like stacks, queues, linked list, trees and graphs. And to compare and contrast the benefits of dynamic and static data structure implementations. Students should be able to select an appropriate data structure for designing a given problem.

Course Outcomes (COs):

Description of the Course Outcome: At the end of the course the student will be able to:		**Mapping to POs(1 to 12) / PSO (13-14)**		
		Substantial Level (3)	**Moderate Level (2)**	**Slight Level (1)**
CO-1	Illustrate pointers, structures, unions and Write programs on that.	1	2,13	12,14
CO-2	Illustrate dynamic memory allocation and recursive solutions and Write programs on that.	1	2,13	12,14
CO-3	Implement stack, queue and use them in various applications.	1,2,13	-	12,14
CO-4	Implement various linked structures and use them in applications.	1,2,13	-	12,14
CO-5	Implement binary trees and use them in various applications.	1,2,13	-	12,14

PO’s	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**14**
Mapping Level	3.0	2.6	-	-	-	-	-	-	-	-	-	1.0	2.6	1.0

Prerequisites: 1. Knowledge of C programming

Contents:

Unit I

Pointers: Introduction, Understanding Pointers, Accessing the address of a variable, Declaration and Initialization of Pointers, Accessing a variable through its pointer, Chain of pointers, Pointer expressions, Pointer Increments and scale factor, Pointers and arrays, Pointers and character strings, Pointers as Function arguments, Functions returning pointers.

Structures and Unions: Introduction, Defining a Structure, Declaring structure variables, Accessing structure members, structure initialization, copying and comparing structure variables, Operations on Individual Members, Arrays of structures, Arrays within structures, Structures within structures, Structures and Functions, Self-referential structures, Unions. **12 Hrs**

Unit II

Dynamic Memory allocation: Motivation for dynamic memory requirement, Allocating a block of memory – malloc, allocating multiple blocks of memory – calloc, Releasing the used memory – free, Altering the size of a block – realloc. **8 Hrs**

Unit III

Stacks: ADT Stack and its operations, Linked representation of Stack, Different applications of Stacks and corresponding algorithms.

Queues: ADT queue, Types of Queues, Linked representation of Queue, Circular Queue and Priority Queue: Different operations on each type of Queues and their applications. **12 Hrs**

Unit-IV

Linked Lists: Singly linked lists: Representation in memory, Header node, Algorithms for several operations: Traversing, Searching, Insertion into, Deletion from linked list, doubly linked list and Circular Linked Lists, Different operations on it. **10 Hrs**

Unit V

Trees: Basic concept of trees, binary tree, applications, Basic Tree Terminologies and different types of binary trees: Binary Tree, Binary Search Tree, Construction of Binary search tree, different operations on binary search tree and their applications. **10 Hrs**

Reference Books:

1) Aaron M Tenenbaum, Yedidyah Langsam and Moshe J. Augenstein, “Data Structures using C”, 13/E, Pearson education, 2019.
2) Reema Thareja, “Data structures using C”, 2/E, OXFORD University Press, 2018.
3) Ellis Horowitz and Sartaj Sahni, “Fundamentals of Data Structures in C”, 2/E, Universities Press, 2014.
4) Richar F. Gilberg and Behronz A. Forouzan: Data Structures, A Pseudocode Approach with C”, 2/E, Thomson, 2015.

22UAIC301 Introduction to Artificial Intelligence (3-0-0) 3

Contact Hours: 39

Course Learning Objectives (CLOs): Artificial Intelligence is a theory course at Undergraduate III semester level. This course provides an in-depth knowledge of the structure of artificial agents, search algorithms, uninformed and informed search strategies, game playing algorithms, agents that reason logically. The objective of the course is to familiarize students with working of artificial agents, understanding AI, Idea behind search algorithms, analyzing Uninformed and Informed search, Understanding and analyzing game playing algorithms and agents that reason logically.

Course Outcomes (COs):

Description of the Course Outcome: At the end of the course the student will be able to:		**Mapping to POs(1-12)/ PSOs(13-14)**		
		Substantial Level (3)	**Moderate Level (2)**	**Slight Level (1)**
CO-1	**Identify** and **formulate** appropriate AI methods for solving a problem.	1	-	12, 13, 14
CO-2	**Design** the logic for knowledge representation and reasoning in AI based systems.	1	2, 5	12, 13, 14
CO-3	**Identify** the algorithms for planning and solving problems using Bayes rule.	1, 2	3, 5	12, 13, 14
CO-4	**Compare** different AI learning algorithms in terms of design issues, computational complexity, and assumptions	1	2, 3, 5	12, 13, 14
CO-5	**Illustrate** natural language processing using language models.	1, 2	3, 5	12, 13, 14

POs/PSOs	1	2	3	4	5	6	7	8	9	10	11	12	13	14
Mapping Level	3.0	2.5	2.0	-	2.0	-	-	-	-	-	-	1.0	1.0	1.0

Pre-Requisites:

1) Knowledge of Statistics, Calculus and Linear Algebra.
2) Programming knowledge.

Contents:

Unit I

Introduction to Artificial Intelligence: What is AI? Foundations of Artificial Intelligence The Turing test, Applications of AI, History of AI, Types of AI, Intelligent Agents: How agent should act, Structure of Intelligent Agents and Environments. Problem Solving: Formulating problems, Example problems, Uniformed-search strategies: Search Algorithms, Uniformed-search strategies: Breadth-First Search, Uniform Cost Search, Depth-First Search, Depth Limited Search, A* search Iterative Deepening Search. Heuristic Search Strategies: Generate-and-Test, Hill Climbing, Best-first Search, Problem Reduction, Constraint Satisfaction, Means-ends Analysis. **9 Hrs**

Unit II

Knowledge Reasoning: Knowledge-based agents, The wumpus world; Logic, propositional logic; Agent based on propositional logic. First-Order Logic: Representation revisited, Syntax and semantics of first order logic, Knowledge engineering in first order logic. Inference in First-Order Logic: Propositional verses first-order interference, Unification and lifting, Forward Chaining and backward chaining. **8 Hrs**

Unit III

Uncertain Knowledge and Reasoning: Acting under uncertainty; Inference using full joint distributions, Independence, Bayes's rule and its use. Planning: Planning problems, planning with state space search, planning graphs, planning with propositional logic Probabilistic Reasoning: Representing knowledge in an uncertain domain, The semantic of Bayesian networks, Efficient representation of conditional distribtion, exact interference in Bayesian Network. **8 Hrs**

Unit IV

Learning: Forms of Learning Examples Forms of Learning, Supervised Learning, Learning Decision Trees, Evaluating and Choosing the Best Hypothesis, The Theory of Learning, Regression and Classification with Linear Models, Artificial Neural Networks, Nonparametric Models, Support Vector Machines, Ensemble Learning, Practical Machine Learning Knowledge in Learning A Logical Formulation of Learning, Knowledge in Learning, Explanation-Based Learning, Learning Using Relevant Information. **7 Hrs**

Unit V

Natural Language Processing: Language models, Text Classification, Information retrieval, information extraction, phrase structure grammars, Syntactic analysing, machine translation, speech recognition. **7 Hrs**

Reference Books:

1. Elaine Rich, Kevin Knight, Shivashankar B. Nair, “Artificial Intelligence”, 3/E, McGraw Hill Education, 2017.
2. Stuart Russell and Peter Norvig, “Artificial Intelligence - A Modern Approach”, 3/E, Pearson, 2014.
3. Deepak Khemani, “A First Course in Artificial Intelligence”, McGraw Hill Education (India), 2013.
4. Stefan Edelkamp, Stefan Schroedl, “Heuristic Search: Theory and Applications”, Morgan Kaufmann, 2011.
5. George F. Luger, “Artificial Intelligence: Structures and Strategies for Complex Problem Solving”, 6/E, Pearson Education, 2008.
6. Pamela McCorduck, “Machines Who Think: A Personal Inquiry into the History and Prospects of Artificial Intelligences”, 2/E, A. K. Peters / CRC Press, 2004.

22UAIC302 Digital Systems and Computer Architecture (3-0-0) 3

Contact Hours: 39

Course Learning Objectives (CLOs): This course focuses on the following learning perspectives:

- To introduce the fundamental principles of digital electronics commonly used in Combinational and Sequential circuits.
- To provide the student with an understanding of basic abstractions on which analysis and design of electronic circuits/systems are based and the capability to model and analyse complex circuits.

- To introduce the basics of sub systems of a computer, their organization, structure, and operation.

Course Outcomes (COs):

Description of the Course Outcome: At the end of the course the student will be able to:		**Mapping to POs(1-12) / PSOs (13-16)**		
		Substantial Level (3)	**Moderate Level (2)**	**Slight Level (1)**
CO-1	**Conceptualize** and **solve** the given real time application by employing suitable combinational circuits.	2	4	-
CO-2	**Conceptualize** and **solve** the given real time application by employing suitable Sequential circuits.	2, 13	3	14
CO-3	**Design** the required memory bank using basic memory units.	-	2,3	5
CO-4	**Explain** the working principles of different subsystems, such as processor, Input/output.	-	3	1,2,13
CO-5	**Design** simple arithmetic and logical units for a given operational features.	4	1,2,3	-

POs	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**14**
Mapping Level	2.0	3.0	2.5	2.0	1.0	-	-	-	-	-	-	-	2.3	1.0

Prerequisites: Knowledge of Basic Electronics.

Contents:

Unit-I

Introduction: Revision of Boolean laws, Simplification of Boolean expressions – Minterm and Maxterm representations.

Design of Combinational Logic Circuits: Karnaugh Maps and Simplification, Sum-of-Products and Product-of-sums simplification, Simplification by Quine-McCluskey Method, Multiplexers, De-multiplexers, Decoders, Encoders, Magnitude Comparators

7 Hrs

Unit-II

Design of Sequential Logic Circuits: Clock Waveforms, Edge-triggered D Flip-Flop, Edge-triggered JK Flip-Flop, Flip-Flop Timing, JK Master-slave Flip-Flop, Registers: Types of Registers, Applications of Shift Registers.

Counters: Synchronous Counter design, Asynchronous Counter design, Decade Counters. **8 Hrs**

Unit-III

Basic Structure: Basic Operational Concepts, Bus Structures, Performance - Processor Clock, Basic Performance Equation, Clock Rate

Memory System: Basic Concepts, Semiconductor RAM and ROM Memories, Speed, Size and Cost, Memory Location and Addresses, Memory Operations, Instructions and Instruction Sequencing. **8 Hrs**

Unit-IV

Input / Output Organization: Basic Input and Output Operations, Accessing I/O Devices, Interrupts – Interrupt Hardware, Enabling and Disabling Interrupts, Handling Multiple Devices, Controlling Device Requests, Execution of a Complete Instruction, Multiple Bus Organization, Hard-wired Control, Micro programmed Control. **8 Hrs**

Unit-V

Arithmetic: Numbers, Arithmetic Operations and Characters, 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. **8 Hrs**

Reference Books:

1) M Morris Mano, “Digital Logic and Computer Design”, 12/E, Pearson Education, 2016.
2) R D Sudhaker Samuel, “Illustrative Approach to Logic Design”, Sanguine-Pearson, 2010.
3) Carl Hamacher, Zvonko Vranesic & Safwat Zaky, “Computer Organization”, 5/E, Tata Mc Graw Hill, 2011.
4) William Stallings, “Computer Organization & Architecture”, 9/E, Prentice Hall of India, 2012.

22UAIL303	Data Structures Laboratory	(0-0-2) 1

Contact Hours: **26**

Course Learning Objectives (CLOs):

The lab course is designed to strengthen the analytical and programming skills of students. It enables students to get practical experience in design, develop, implement, analyse and testing of Linear, Nonlinear data structures and their applications.

Course Outcomes (COs):

Description of the Course Outcome: At the end of the course the student will be able to:		**Mapping to POs (1-12)/PSOs (13-14)**		
		Substantial Level (3)	**Moderate Level (2)**	**Slight Level (1)**
CO-1	Write programs using basic C techniques to develop solutions for particular problem.	13	14	1,8,12
CO-2	Demonstrate the concepts and algorithms/code to perform various operations on linear data structures using static and dynamic memory allocation.	2,13,14	4	1,8,12
CO-3	Apply the concepts and algorithms/code to carry out various operations on non - linear data structures.	2,13,14	4	1,8,12

POs	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**14**
Mapping Level	1.0	3.0	-	2.0	-	-	-	1.0	-	-	-	1.0	3.0	2.6

Prerequisites: Knowledge of C programming

Contents:

Implement the programs on the following concepts in ‘C’ Programming Language:

1. Arrays, String manipulation, Structure, Union, dynamic memory allocation
2. Functions and Recursive functions
3. Stack, Queue, Circular queue, Priority queue and Double ended queue
4. Linked list: Singly, Doubly Linked List, Circular linked list
5. Tree: Binary tree, Binary Search tree: construction and various operation on Binary Search Tree

Reference Books:

1. E Balagurusamy, “Programming in ANSI C”, 7/E, McGraw Hill Education India Private Limited, 2017.
2. Aaron M Tenenbaum, Yedidyah Langsam and Moshe J. Augenstein, “Data Structures using C”, 13/E, Pearson education, 2019.
3. Reema Thareja, “Data structures using C”, 2/E, OXFORD University Press, 2018.
4. Ellis Horowitz and Sartaj Sahni, “Fundamentals of Data Structures in C”, 2/E, Universities Press, 2014.
5. Richar F. Gilberg and Behronz A. Forouzan: Data Structures, A Pseudocode Approach with C, Thomson, Second edition,5th Indian Reprint 2015.

22UAIL304 Digital Systems Laboratory (0-0-2) 1

Contact Hours: 26

Course Learning Objectives (CLOs): This laboratory course focuses on the following learning perspectives:

- Combinational circuit design and simplification techniques used for realizing them.
- Sequential circuit design and working of a basic storage element.
- Simple circuits using passive elements (resistors, capacitors, inductors).

Course Outcomes (COs):

Description of the Course Outcome: At the end of the course the student will be able to:		**Mapping to POs(1-12) / PSOs (13-16)**		
		Substantial Level (3)	**Moderate Level (2)**	**Slight Level (1)**
CO-1	**Design and implement** combinational circuit for the problem scenarios.	1,13	2,3	12
CO-2	**Design and implement** sequential circuit for problem scenarios.	1,13	2,3	12
CO-3	**Design and implement** an application circuit to simulate given problem.	1,2	14	14

POs	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**14**
Mapping Level	3.0	2.3	2.0	-	-	-	-	-	-	-	-	1.0	3.0	2.5

Prerequisites: Basic Electronics.

List of Experiments:

1 Study and verification of the truth table of various logic gates.

2 Realization of Boolean Functions:

i) Simplify the given Boolean expression and to realize it using Basic gates and Universal gates.
ii) Realize the adder and subtract or circuits using basic gates and universal gates.
iii) Simplify given Boolean expression using Map Entered Variable (MEV) technique and realize the simplified expression using 8:1 Multiplexers.
iv) To implement given Boolean function using decoders.
v) To design and realize the following code converters using basic gates.
vi) To realize Two Bit Comparator using basic gates

3 Flip-Flops (Sequential Circuits):

i) To realize flip-flop conversions.
ii) Applications Flip-Flops: To design and implement mod-n synchronous counter.

Reference Books:

1. Donald P Leach, Albert Paul Malvino and Goutam Saha, “Digital Principles and Applications”, 7/E, Tata McGraw Hill, 2010.
2. R D Sudhaker Samuel, “Illustrative Approach to Logic Design”, Sanguine-Pearson, 2010.
3. Charles H. Roth, “Fundamentals of Logic Design”, 5/E, Cengage Learning, 2004.
4. M Morris Mano, “Digital Logic and Computer Design”, 10/E, Pearson Education, 2008.

22USAIC305	Operating Systems	(3-0-0) 3

Contact Hours: 39

Course Learning Objectives (CLOs): This course focuses on the following learning perspectives:

- Structure and working principles of generic operating systems.
- Processes – Scheduling and Operations, Multithreading, Synchronization.
- Deadlocks – Detection, Prevention, and Avoidance.
- Memory Management strategies and File System organization.
- Architecture and Programming aspects of Android OS.

Course Outcomes (COs):

Description of the Course Outcome: At the end of the course the student will be able to:		Mapping to POs(1-12) / PSOs (13-16)		
		Substantial Level (3)	Moderate Level (2)	Slight Level (1)
CO-1	**Explain** the fundamental concepts of operating system and **Write** programs to demonstrate working principles of process/threads, related issues using system calls and standard libraries.	-	13,14	1
CO-2	**Compare** different process scheduling algorithms.	-	2	3,13
CO-3	**Describe** methods that an operating system can use to prevent or deal with the deadlocks.	-	2	3,13
CO-4	**Compare** and contrast various memory allocation strategies.	-	2	3,13
CO-5	**Explain** the structure and working principles of a file organization and **Write** programs to demonstrate the various file operations using system calls.	-	13,14	1
CO-6	**Explain** the architecture and working principles of industry standard OS.	-	13	1

POs/PSOs	1	2	3	4	5	6	7	8	9	10	11	12	13	14
Mapping Level	1.0	2.0	1.0	-	-	-	-	-	-	-	-	-	1.7	2.0

Prerequisites: Computer Programming at introductory level.

Contents:

Unit-I

Introduction: What operating systems do, Computer System organization, Computer System architecture, Operating System structure, Operating System operations, Process management, Memory management, Storage management, Protection and security.

Process Management: Overview, Process scheduling, Operations on processes, Interprocess Communication, Case Study – Andriod OS. **8 Hrs**

Unit-II

Multithreaded Programming: Overview, Multithreading models, Thread Libraries, Threading issues, Case Study – Andriod OS.

Process Scheduling: Overview, Scheduling Criteria, Scheduling Algorithms, Multiple-Processor Scheduling, Thread Scheduling, Case Study – Andriod OS. **8 Hrs**

Unit-III

Process Synchronization: Background, The Critical section problem, Peterson's solution, Synchronization hardware, Semaphores, Classical problems of synchronization, Monitors, Case Study – Andriod OS. **8 Hrs**

Unit-IV

Deadlocks: System model, Deadlock characterization, Methods for handling deadlocks, Deadlock prevention, Deadlock avoidance, Deadlock detection, Recovery from deadlock, Case Study – Andriod OS. **8 Hrs**

Unit-V

Memory Management Strategies: Background, Swapping, Contiguous memory allocation, Paging, Structure of page table, Segmentation, Case Study – Andriod OS.

File System: Concept, Access methods, Directory structure, File system mounting, File sharing, Protection, Case Study – Andriod OS. **7 Hrs**

Reference Books:

1. Abraham Silberschatz, Peter Baer Galvin, and Greg Gagne, "Operating System Principles", 8/E, Wiley India, 2009
2. William Stallings, "Operating Systems: Internals and Design Principles", 6/E, Prentice Hall, 2013.

22UHVK306	Universal Human Values - I	(1-0-0) 1

Contact Hours: 13

Course Learning Objectives (CLOs):

This course provides an opportunity for the students to enhance their life skills like right understanding leading to the harmonious living in relationship with the self and family enhancing holistic development of the students.

Course Outcomes (COs):

Description of the course outcome: At the end of course the student should be able to:		Mapping to POs (1-12) / PSOs(13-14)		
		Substantial Level (3)	Moderate Level (2)	Slight Level (1)
CO-1	Recite and follow interpersonal relations with peers and the others	6	-	-
CO-2	Comprehend happiness, prosperity and distinguish between body and self	-	6,9	-
CO-3	Comprehend harmony and practice Sanyam and Svasthya	-	9	-
CO-4	Demonstrate the values of human-human interaction and universal values such as *Nyaya*, *Visvasa*, and *Sammana*	7	-	-
CO-5	Clearly visualize the co-relation between lack of Human Values and the prevailing problems and use tangible steps and a roadmap for moving in the cherished direction.	8	9	-

POs/PSOs	1	2	3	4	5	6	7	8	9	10	11	12	13	14
Mapping Level	-	-	-	-	-	2.5	3	3	2	-	-	-	-	-

Contents:

Unit I

Introduction to Value Education: Understanding Value Education: Living a Fulfilling Life, Education for Fulfilling Life, Priority of Values over Skills, Appreciating the Need and Implications of Value Education, Guidelines for Value Education – Self-exploration – its content and process; 'Natural Acceptance', Basic Human Aspirations and their fulfillment. **04 Hrs**

Unit II

Understanding Happiness and Prosperity: Exploring the meaning of Happiness and Prosperity, Programme for continuity of Happiness, A look at the prevailing Notions of Happiness, The programme for Happiness, Natural outcome of the programme. **02 Hrs**

Unit III

Understanding Harmony at Various Levels: Harmony in the Self – Understanding Myself: Understanding human being as a co-existence of the sentient 'I' and the material 'Body' and the needs of Self ('I') and 'Body' – Sukh and Suvidhã, Understanding the Body as an instrument of 'I' (I being the doer, seer and enjoyer). **03 Hrs**

Unit IV

Harmony in the Family- Understanding the Values in Human Relationships: Understanding the Family as the basic unit of human interaction, Understanding values in human-human relationship; meaning of Nyãya and program for its ulfilment to ensure Ubhaya –tripti; Trust (Visvãsa) and Respect (Sammãna) as the foundational values of relationship. **02 Hrs**

Unit V

Understanding Intention and Competence: Distinguish between Intention and Competence, Understanding the meaning of Nine Values. **02 Hrs**

Reference Books:

1) R.R.Gaur, R Asthana, and G.P Bagaria, "A Foundation Course in HUMAN VALUES and professional Ethics" 2nd Revised Edition. EXCEL BOOKS, New Delhi. 2019

22UAIE321	Introduction to Web Technology	(0-0-2) 1

Contact Hours: 26

Course Learning Objectives (CLOs): Students should understand the structure of world wide web and should be able to develop static and dynamic web pages using HTML5, CSS and validate them using Java Script.

Course Outcomes (COs):

Description of the Course Outcome: At the end of the course the student will be able to:		**Mapping to POs(1-12)/ PSOs(13-14)**		
		Substantial Level (3)	**Moderate Level (2)**	**Slight Level (1)**
CO-1	**Create** Web pages using HTML/XHTML	5	2,3,13,14	12
CO-2	**Illustrate** the application of CSS to style the web pages	5	2,3,13,14	12
CO-3	**Apply** the constructs of JavaScript to perform event handling	5	2,3,13,14	12

CO-4	**Create** dynamic web pages using JavaScript	5	2,3,13,14	12

POs	1	2	3	4	5	6	7	8	9	10	11	12	13	14
Mapping Level	-	2.0	2.0	-	3.0	-	-	-	-	-	-	1.0	2.0	2.0

Contents: Develop the websites using the following tools and technology:

1. HTML
2. CSS
3. JavaScript

Reference Books:

1) Robert W. Sebesta : Programming the World Wide Web, 8th Edition, Pearson Education
2) Thomas A. Powell : HTML & CSS: The Complete Reference, 5th Edition, McGraw Hill

22UMBA301 Mathematics (3-0-0) Audit

Contact Hours: 39

Course Learning Objectives (CLOs):

This course will enable students to master the basic tools of differential & integral calculus, differential equations and partial differential equations and become skilled to formulate, solve and analyze science and engineering problems.

Course Outcomes (COs):

Description of the Course Outcome: At the end of the course the student will be able to:		**Mapping to POs(1-12)**		
		Substantial Level (3)	**Moderate Level (2)**	**Slight Level (1)**
CO-1	**Apply** the knowledge of calculus to solve problems related to polar curves, curvature and its applications in determining the bentness of a curve.	-	-	1, 2
CO-2	**Solve** multiple integration and use Beta and Gamma function to solve definite integrals	-	1, 2	-

CO-3	**Solve** first order linear differential equations analytically using standard methods.	-	1, 2	-
CO-4	**Solve** higher order differential equations with constant coefficients and variable coefficients.	-	1, 2	-
CO-5	**Learn** partial differentiation to calculate rates of change of multivariate functions. Solve problems related to composite functions and Jacobians. Solve problems on partial differential equations by method of separation of variables.	-	-	1, 2

POs	1	2	3	4	5	6	7	8	9	10	11	12	13	14
Mapping Level	1.6	1.6	-	-	-	-	-	-		-	-	-		

Pre-requisites:

1. Differentiation of function

2. Integration of function.

Course Content:

Unit I

Differential Calculus: n^{th} order differentiation of standard functions. Leibnitz theorem (Statement only & illustrative examples), Taylor's series for single variable (Statement only & illustrative examples), Maclaurin's series for single variable (Statement only & illustrative examples).Polar curves-angle between the radius vector and tangent (Formula & illustrative examples), angle between two curves (Formula & illustrative examples). Definition of Curvature and radius of curvature.-Radius of curvature for Cartesian and polar curves (Formulas & illustrative examples) **10 Hrs**

Unit II

Integral Calculus: Reduction formula for $\int_0^{\pi/2} sin^n\, x dx \int_0^{\pi/2} sin^n\, x dx \int_0^{\pi/2} cos^n\, x dx$, $\int_0^{\pi/2} cos^n\, x dx$ and $\int_0^{\pi/2} sin^n\, x cos^m x dx \int_0^{\pi/2} sin^n\, x cos^m x dx$ (Formula &illustrative examples). Definition of Beta and Gamma functions (illustrative examples).Relation between Beta and Gamma functions (No Proof) (illustrative examples).Evaluation of Double integral (direct and region given), Change of variables. Evaluation of Triple integral (direct examples). **10 Hrs**

Unit III

Ordinary Differential Equations of first order: Libnitz's Linear differential equation, Bernoulli's differential equation, Exact differential equations. Orthogonal trajectories. **05 Hrs**

Unit VI

Differential Equations of higher order: Solution of Second order Linear ordinary differential equation with constant coefficients. Method of variation of parameters. Legendre's homogeneous equations. **08 Hrs**

Unit V

Partial Differentiation: Definition of Partial derivative (illustrative examples), Total differentiation (illustrative examples), Differentiation of Composite functions (illustrative examples).Jacobians and its properties (No Proof) (illustrative examples).Partial Differential Equations (PDE's):Formation of PDE's by elimination of arbitrary constants /functions. Solution of PDE by variable separable method**.** **06 Hrs**

Reference Books:

1) **B.S. Grewal**: Higher Engineering Mathematics, Khanna Publishers, 44th edition,2017.
2) **H.K.Dass & Rajnish Verma**,Higher Engineering Mathematics,3rd edition, 2014.

Note: 1. Grades (i) PP (ii) NP
2. No semester End Examination
3. Audit (Bridge course).

1. The mandatory non – credit courses Mathematics for III and IV semesters respectively, to the lateral entry Diploma holders admitted to III semester of BE/B.Tech., programs, shall attend the classes during the respective semesters to complete all the formalities of the course and appear for the Continuous Internal Evaluation (CIE). In case, any student fails to register for the said course/fails to secure the minimum 40% of the prescribed CIE marks, he/she shall be deemed to have secured an F grade. In such a case, the student has to fulfill the requirements during subsequent semester/s to appear for CIE.
2. These Courses shall not be considered for vertical progression, but completion of the courses shall be mandatory for the award of degree.

22UPYK307	Physical Education and Yoga	(0-0-2) Audit

Contact Hours: 24

Course Learning Objectives:

1. The course focuses on overall development and important of Physical Education & Yoga day to day life.

Course Outcomes (COs):

Description of the Course Outcome: At the end of the course the student will be able to:		Mapping to POs(1-12)		
		Substantial Level (3)	Moderate Level (2)	Slight Level (1)
CO1	Gaining the importance of Physical Education & yoga	12		8, 9
CO2	Understanding the benefits & preventive measures of health	12	6	8, 9
CO3	Gaining the knowledge of yoga	12		8, 9
CO4	Understanding the importance of Human Body conditioning & Sports training	12		8, 9
CO5	Get awareness of Modern technology in sports	12		5, 8, 9

POs	1	2	3	4	5	6	7	8	9	10	11	12
Mapping Level	-	-	-	-	1	2	-	1	1	-	-	3

Contents

Unit-I

Introduction to Physical Education: Meaning and importance, definition, components, benefits of Physical Education. **04Hrs**

Unit-II

Health and wellness, Anatomy and Physiology: Meaning and importance, definition, components, benefits, ealth habits, basics of diseases and preventive measures, mental health, physical health, social health, spiritual health. Meaning and definition, first aid, injuries and preventions. **05Hrs**

Unit-III

Introduction of Yoga: Origin and history of Yoga, meaning and definition, benefits, importance, prayer, Suryanamaskara,

Asana:- Vrikshasana, Padmasana, Bhujangasana, Halasana.
Pranayama:-Anuloma viloma praanayama,
Mudras:- China mudra, Bhrama Mudra. **05Hrs**

Unit-IV

Sports Training: Meaning and definitions, warming up, cooldown, methods of exercises, stretching, speed, endurance, flexibility, agility, Athletics, Karata, Caracket, Basketball, Handball, Kho Kho & Volleyball Rules and regulation of all games. **05 Hrs**

Unit-V

Modern Technology in Sports and Games: Meaning and definitions, objectives, assisting umpires, referees, hawk-eye technology, sports specific, computer software, technology in playfields, athletes clothing and equipment, graphics of sports and games, artificial intelligence. **05Hrs**

Reference Books:

1) Petipus, et al., Athlete's Guide to Career Planning, Human Kinetics, 1997
2) The Human Body in Health and Disease with Access 8th Edition 2023.
3) Anatomy and Physiology, Shri K.G. Nadgir College of Physical Education. Dharwad.
4) Health & Wellness Shri K.G. Nadgir College of Physical Education. Dharwad.
5) Nagendra HR., The art and science of Pranayama, 2009
6) Iyengar BKS., The illustrated Light on Yoga(English), 2005

IV Semester

22UMAC400	Engineering Mathematics- IV	(2-2-0) 3

Contact Hours:39

Course Learning Objectives (CLOs):

To provide an insight into applications of conformal mapping, integration of complex functions and application of probability distributions in Engineering.

Course Outcomes (COs):

Description of the Course Outcome: At the end of the course the student will be able to:		**Mapping to Pos(1-12)**		
		Substantial Level (3)	**Moderate Level (2)**	**Slight Level (1)**
CO-1	**Construct** and use the concepts of analytic function to solve the problems arising in Engineering field.	-	-	1, 2
CO-2	**Utilize** conformal transformation and complex integral to transform irregular domain onto a relatively simple domain.	-	-	1, 2
CO-3	**Apply** discrete and continuous probability distributions in analyzing the probability models arising in engineering field.	-	-	1, 2
CO-4	**Estimate** the correlation, covariance using joint probability distributions. **Recite** Markov chains and describe stochastic process.	-	-	1, 2
CO-5	**Use** student's t-distribution, Chi-square distribution as a test of goodness of fit .	-	-	1, 2

POs/PSOs	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**14**
Mapping Level	1.0	1.0	-	-	-	-	-	-		-	-	-	-	-

Pre-requisites: 1.Differentiation of function.
2. Integration of function.
3. Basic Probability theory.

Contents:

Unit I

Calculus of complex functions: Review of function of a complex variable, limits, continuity, and differentiability. Analytic functions: Cauchy-Riemann equations in Cartesian and polar forms. Construction of analytic functions: Milne-Thomson method-Problems**.** **7 Hrs**

Unit II

Conformal transformations: Introduction. Discussion of transformations:**w** $= e^z; w = z^2, w = z + \frac{1}{z}, z \neq o).$ $= e^z; w = z^2, w = z + \frac{1}{z}, z \neq o).$ Bilinear transformations- Problems.

Complex integration: Line integral of a complex function, Cauchy's theorem and Cauchy's Integral theorem. **8 Hrs**

Unit III

Probability Distributions: Random variables (discrete and continuous), probability mass/density functions. Binomial, Poisson, exponential and normal distributions-problems (No derivation for mean and standard deviation)-Illustrative examples**.** **8 Hrs**

Unit VI

Joint probability distribution: Joint Probability distribution for two discrete random variables, expectation and covariance. **Markov chains** – Introduction, probability vectors, Stochastic Matrices, Fixed points and Regular stochastic matrices, Markov chains, higher transition probabilities, stationary distribution of regular Markov chains and absorbing states. **8 Hrs**

Unit V

Sampling Theory: Introduction to sampling distributions, standard error, Type-I and Type-II errors. Test of hypothesis for means, student's t-distribution, Chi-square distribution as a test of goodness of fit. **8 Hrs**

Reference Books:

1. B.S. Grewal, "Higher Engineering Mathematics", Khanna Publishers, 44/E, 2017.
2. E. Kreyszig, "Advanced Engineering Mathematics", John Wiley & Sons, 10/E, 2016.
3. Peter V.O'Neil, "Advanced Engineering Mathematics", International students edition,2011.
4. Kishor S. Trivedi, "Probabilty & Statistics with Reliabilty, Queuing, and Computer Science Applications", Prentice-Hall of India, 2005.

22UAIC400	Introduction to Machine Learning	(3-0-0) 3

Contact Hours: 39

Course Learning Objectives (CLOs): Machine learning is a theory course offered at Undergraduate IV semester level. The main objective is to introduce the basic concepts and techniques of Machine learning, to be familiar with a set of well known supervised and unsupervised learning algorithms, to employ machine learning techniques to solve problems,to improve their mathematical thinking and acquire skills required for sustained life long learning.

Course Outcomes (COs):

Description of the Course Outcome: At the end of the course the student will be able to:		**Mapping to POs(1-12)/ PSOs(13-14)**		
		Substantial Level (3)	**Moderate Level (2)**	**Slight Level (1)**
CO-1	**Identify** and **formulate** appropriate Machine Learning methods for solving a problem.	1	-	12, 13, 14
CO-2	**Apply** the concept of Machine learning, various classification methods and Training models for the real world problems.	1	2, 5	12, 13, 14
CO-3	**Apply** Unsupervised Machine Learning techniques and implementation of SVM algorithm.	1, 2	3, 5	12, 13, 14
CO-4	**Apply** the ML concept in a decision tree structure and implementation of Ensemble learning and Random Forest.	1	2, 3, 5	12, 13, 14
CO-5	**Apply** Bayes techniques and explore more about the classification in Machine Learning.	1, 2	3, 5	12, 13, 14

POs/PSOs	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**14**
Mapping Level	3.0	2.5	2.0	-	2.0	-	-	-	-	-	-	1.0	1.0	1.0

Pre-Requisites:

1. Understanding of mathematics, statistics and Calculus, Linear Algebra.
2. Programming knowledge.

Contents:

Unit I

Introduction to Machine learning: What is Machine learning (ML)? Machine learning applications, life cycle of a machine learning, AI vs Machine learning, How to get datasets, data preprocessing, Frame the Problem, Select the Performance Measure, Prepare the Data for ML Algorithms, Training and Evaluating the Data Set, Bayesian Decision Theory, Supervised learning, Unsupervised learning, Supervised learning vs Unsupervised learning. **9 Hrs**

Unit II

Classification: MNIST, Training Binary Classifier, Performance Measures, Multiclass classification, Error Analysis, Multi label & Multi output Classifications. **Training Models**: Linear Regression, Gradient Descent, Regularized Linear models, Ridge & Lasso Regression, Logistic Regression. **8 Hrs**

Unit III

Dimensionality Reduction: The Curse of Dimensionality, Main Approaches for Dimensionality, PCA, Kernel PCA, LLE, Linear Discriminant Analysis (LDA). Support Vector Machines: Linear SVM Classification, Nonlinear SVM, SVM Regression, Kernelized SVMs. **7 Hrs**

Unit IV

Decision Trees: Univariate Trees: classification & Regression Trees, Training and Visualizing a Decision Tree, Pruning, Rule Extraction from Trees, Learning Rules from Data, Making Predictions, CART Training Algorithm, Computational Complexity, Gini Impurity, Entropy Regularization Hyper parameters, Multivariate Trees.

Ensemble Learning and Random Forests: Voting Classifiers, Bagging and Pasting, Random Patches and Random Subspaces, Random Forests **8 Hrs**

Unit V

Bayes Theorem: Concept Learning – Maximum Likelihood, Minimum Description Length Principle, Bayes Optimal Classifier, Gibbs Algorithm, Naïve Bayes Classifier, example, Bayesian Belief Network, EM Algorithm **7 Hrs**

Reference Books:

1. Saikat Dutt, Subramanian Chandramouli, Amit Kumar Das, " Machine Learning", 1/e, Pearson,2020.
2. Aurelien Geron, "Hands-on Machine Learning with Scikit-Learn &TensorFlow", O'Reilly, Shroff Publishers and Distributors Pvt. Ltd , 2019.
3. Manaranjan Pradhan, U Dinesh Kumar, "Machine Learning using Python" , 1/e, Wiley, 2019.
4. Stephan Marsland, "Machine Learning, An algorithmic Perspective", 2/e, Chapman & Hall/CRC Machine Learning & Pattern Recognition) CRC Press 2015.
5. Ethem Alpaydin, Introduction to Machine Learning, 2/e, PHI Learning Pvt.

Ltd, 2013.
6. Tom M. Mitchell, “Machine Learning”, McGraw-Hill Education, 2013.

22UAIC401	Database Management Systems	(3-0-0) 3

Contact Hours: **39**

Course Learning Objectives (CLOs): The main objective of this course is to provide students with the background to design, implement, and use database management systems.

Course Outcomes (COs):

Description of the Course Outcome: At the end of the course the student will be able to:		**Mapping to POs(1-12)/ PSOs(13-14)**		
		Substantial Level (3)	**Moderate Level (2)**	**Slight Level (1)**
CO-1	**Illustrate** the basics of DBMS.	-	-	1
CO-2	**Design** Entity Relationship Diagrams.	-	3	2
CO-3	**Analyze** the basics of relational model and Formulate data retrieval queries in relational algebra.	-	13	14
CO-4	**Analyze** and **Formulate** data retrieval queries in Structured Query Language (SQL).	13	-	-
CO-5	**Design** a database using the normal forms.	3	-	-

POs/PSOs	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**14**
Mapping Level	1.0	1.0	2.5	-	-	-	-	-	-	-	-	-	2.5	1.0

Contents:

Unit-I

Introduction to Databases:

Databases and Database Users: An Example, Characteristics of the Database Approach, Actors on the Scene, Advantages of Using the DBMS Approach, A Brief History of Database Applications, When Not to Use a DBMS.

Database System Concepts and Architecture: Data Models, Schemas, and Instances, Three-Schema Architecture and Data Independence, Database **Languages** and Interfaces, The Database System Environment. **8 Hrs**

Unit-II

The Relational Data Model and SQL

The Relational Data Model and Relational Database Constraints: Relational Model Concepts, Relational Model Constraints and Relational Database Schemas, Update Operations, Transactions, and Dealing with Constraint Violations.

The Relational Algebra and Relational Calculus: Unary Relational Operations: SELECT and PROJECT, Relational Algebra Operations from Set Theory, Binary Relational Operations: JOIN and DIVISION, Additional Relational Operations, Examples of Queries in Relational Algebra **8 Hrs**

Unit-III

SQL Structured Query Language: Basic SQL, SQL Data Definition and Data Types, Specifying Constraints in SQL, Basic Retrieval Queries in SQL, INSERT, DELETE, and UPDATE Statements in SQL, Additional Features of SQL

More SQL: Complex Queries, Triggers, Views, and Schema Modification: More Complex SQL Retrieval Queries, Specifying Constraints as Assertions and Actions as Triggers, Views (Virtual Tables) in SQL. **8 Hrs**

Unit-IV

Conceptual Modeling and Database Design

Data Modeling Using the Entity-Relationship (ER) Model: Using High-Level Conceptual Data Models for Database Design, A Sample Database Application, Entity Types, Entity Sets, Attributes, and Keys, Relationship Types, Relationship Sets, Roles, and Structural Constraints, Weak Entity Type, Refining the ER Design for the COMPANY Database, ER Diagrams, Naming Conventions, and Design Issues.

Basics of Functional Dependencies and Normalization for Relational Databases : Informal Design Guidelines for Relation Schemas, Functional Dependencies, Normal Forms Based on Primary Keys, General Definitions of Second and Third Normal Forms, Boyce-Codd Normal Form **8 Hrs**

Unit-V

Transaction Processing, Concurrency Control, and Recovery

Introduction to Transaction Processing Concepts and Theory: Transaction and System Concepts Desirable Properties of Transactions Concurrency Control Techniques.

Database Recovery Techniques: Recovery Concepts, NO-UNDO/REDO Recovery Based on Deferred Update, Recovery Techniques Based on Immediate Update, Shadow Paging, The ARIES Recovery Algorithm, Database security. **7 Hrs**

Reference books:

1) Elmasri and Navathe: "Fundamentals of Database Systems",6/e, Pearson Education, 2011.
2) Silberschatz, Korth and Sudharshan, "Data Base System Concepts", 5/e, Mc-GrawHill, 2006.
3) C.J.Date, A. Kannan, S. Swamynatham, "An Introduction to Database Systems", 8/e Pearson Education, 2006.
4) Raghu Ramakrishnan and Johannes Gehrke,"Database Management Systems", 3/e, McGraw-Hill, 2008

22UAIC402 Object Oriented Programming with Java (3-0-0) 3

Contact Hours: 39

Course Learning Objectives (CLOs):

Students should be able to write object-oriented code for a given problem applying the Java language features.

Course Outcomes (COs):

Description of the Course Outcome: At the end of the course the student will be able to:		**Mapping to POs(1 to 12) / PSO (13-14)**		
		Substantial Level (3)	**Moderate Level (2)**	**Slight Level (1)**
CO-1	**Implement** the concepts of object-oriented programming using Java language	1	2	3,12,13,14
CO-2	**Illustrate** the concept of Interface and Packages and Apply multi-threaded programming and exception handling in Java programs.	13	1,2,3	12,14
CO-3	**Write** programs to solve a given problem using Generics and Collection Frameworks.	1	2	3,12,13,14
CO-4	**Use** JDBC to write programs that can interact with the database and **Develop** simple web applications using servlets.	1	2,13,5	12,14

CO-5	**Apply** the extended features in problem solving	1	2	3,12,13,14

PO's	1	2	3	4	5	6	7	8	9	10	11	12	13	14
Mapping Level	3.0	2.0	1.3	-	2.0	-	-	-	-	-	-	1.0	1.6	1.0

Prerequisites: 1. Basic programming skills

Contents:

Unit-I

Introduction to Java: Salient features of Java, Object-Oriented Programming Approach, Byte Code, JVM; Basic constructs of the language, Type casting; Arrays, String and String Buffer.

Classes: Class Fundamentals, Declaring objects, Object Reference Variables, constructors, this keyword, Garbage collection, finalize( ) method.

Inheritance: Inheritance basics, super keyword, Multi-level hierarchy, Method overriding, Dynamic Method Dispatch. **8 Hrs**

Unit-II

Packages and Interfaces: Packages, Access Protection, Importing packages, Interfaces.

Exception handling in Java: Exception-handling fundamentals, Exception types, Uncaught Exceptions, Using try and catch, Multiple catch clauses; throw, throws and finally clauses, Java's built-in exceptions, Creating Own Exception Subclasses.

Multi-threaded Programming: Java Thread Lifecycle, Creation of threads with different approaches: Extending Thread, Implementing Runnable, Thread Priorities, Synchronization. **8 Hrs**

Unit-III

Generics: What are generics, a simple generics example, a generic class with two type parameters, general form of a generic class, bounded types, using wildcard arguments, creating a generic method.

Collections Framework: Collections overview, the collection interfaces, the collection classes, accessing a collection via an iterator, for-each alternative to iterators, storing user-defined classes in collections. **8 Hrs**

Unit-IV

JDBC: Introduction, JDBC driver types, JDBC Process, Statement Objects, ResultSet, Reading the ResultSet.

Servlets: Background, The Life Cycle of a Servlet, Using tomcat for servlet development, A simple servlet – creating and compiling the servlet source code, Reading servlet parameters, The Cookie class, Handling HTTP Requests and Responses, Using Cookies, Session Tracking. **8 Hrs**

Unit-V

Extended features of Java: Running Java Files**,** Switch Expressions**,** Sealed classes, Functional Interfaces, Lambda Expressions, Miscellaneous changes **7 Hrs**

Reference Books:

1) Herbert Schildt, "Java The Complete Reference", 11th Edition, Tata McGraw-Hill Education.
2) E. Balagurusamy, "Programming with Java - A Primer", 6th Edition, McGraw Hill Education, 2019.
3) Jim Keogh, "J2EE The Complete Reference", McGraw Hill Education, 2011.

22UAIL403	**Database Management Systems Laboratory**	**(0-0-2) 1**

Contact Hours: 26

Course Learning Objectives (CLOs): The major objective of this lab is to provide a strong formal foundation in database concepts, technology and practice to the participants, to groom them into well-informed database application developers. Rather than imparting isolated knowledge/experience fragments in each of concepts, technology and practice, the course will aim at achieving a good blend of the three. The overriding concern, therefore, is to include just enough concepts and theory to motivate and enrich the practical component, and to include technology component to maximize the relevance of the course to the industry without sacrificing the long-term objectives of rigor and foundational strength that can withstand the vagaries of technological advance.

Course Outcomes (COs):

Description of the Course Outcome: At the end of the course the student will be able to:		**Mapping to POs(1-12)/ PSOs (13-14)**		
		Substantial Level (3)	**Moderate Level (2)**	**Slight Level (1)**
CO-1	**Design** and **implement** a database schema for a given problem-domain.	3,13,14	1,2	12
CO-2	**Analyze** the given database and **apply** the normalization.	13,14	1,2,3	12
CO-3	**Demonstrate** SQL, DML/DDL commands.	5,13,14	4	12
CO-4	**Design** and **build** a GUI using a GUI building tool.	5,13,14	3	12
CO-5	**Develop** solutions for real life problems by working in teams.	6,7,13,14	10,11,12	8,9

POs/PSOs	1	2	3	4	5	6	7	8	9	10	11	12	13	14
Mapping Level	2.0	2.0	2.33	2.0	3.0	3.0	3.0	1.0	1.0	2.0	2.0	1.2	3.0	3.0

Prerequisites: Knowledge of

1. Basic Programming
2. Language Logical reasoning

Contents:

PART-A: Analyze the given data and implement the following:

- Create the database
- Design ER models and tables
- Create constraints/ inserting the records
- Write queries in SQL using DDL,DML commands
- Write queries using aggregate functions, group by, having clause/union, intersect, minus.
- Subqueries returning single/multiple rows.
- Co-related sub queries.
- Joins,Views.

PART-B:

- Design and implement a real-world database application in the form of a project

Reference Books:

1. Elmasri and Navathe: “Fundamentals of Database Systems”, 7/E, Pearson Education, 2011.
2. Raghu Ramakrishnan and Johannes Gehrke,“Database Management Systems”, 3/E, McGraw-Hill, 2011.
3. Silberschatz, Korth and Sudharshan, “Data Base System Concepts”, 5/E, Mc-GrawHill, 2008.
4. C.J.Date, A. Kannan, S. Swamynatham, “An Introduction to Database Systems”, 8/E, Pearson Education, 2006

22UAIL404 Object Oriented Programming Laboratory (0-0-2) 1

Contact Hours: 26

Course Learning Objectives (CLOs):

Students should be able to write object-oriented code for a given problem applying the Java language features.

Course Outcomes (COs):

Description of the Course Outcome: At the end of the course the student will be able to:		**Mapping to POs(1 to 12) / PSOs (13-14)**		
		Substantial Level (3)	**Moderate Level (2)**	**Slight Level (1)**
CO-1	**Implement** the concepts of object oriented programming, Multi-threaded programming, Interfaces and Packages using Java language	13,14	1, 2	8,12
CO-2	**Demonstrate** the use of JDBC and MySQL database to build **Java applications that interact with databases**	2,13	1,14	5,8,12
CO-3	Use exception handling mechanisms.	13	1,4	1,2,8

POs/PSOs	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**14**
Mapping Level	1.7	2.0	-	-	1.0	-	-	1.0	-	-	-	1.0	3.0	2.0

Prerequisites: 1. Basic programming skills

Contents:

1. Programs on Classes
2. Programs on Inheritance
3. Programs on Interface and Packages
4. Programs on Exception Handling
5. Programs on Multi-threaded Programming
6. Programs on MySQL and JDBC

Reference Books:

1) Herbert Schildt, “Java The Complete Reference”, 11/E, Tata McGraw-Hill Education
2) E. Balagurusamy, “Programming with Java - A Primer”, 6/E, McGraw Hill Education, 2019
3) Jim Keogh, “J2EE The Complete Reference”, McGraw Hill Education, 2011.

22UPAIC405	Design and Analysis of Algorithms	(3-0-0) 3

Contact Hours: 39

Course Learning Objectives (CLOs):

The objectives of the course are that the student should develop the analytical skills, learn to design and analyze algorithm, and determine complexity/efficiency for various algorithms and choose appropriate data structure and algorithm design method for various applications.

Course Outcomes (COs):

Description of the Course Outcome: At the end of the course the student will be able to:		**Mapping to POs (1-12)/ PSOs (13-14)**		
		Substantial Level (3)	**Moderate Level (2)**	**Slight Level (1)**
CO-1	**Infer** the correctness of algorithms using inductive proofs, Illustrate and analyze the mathematical analysis of recursive and non-recursive algorithms.	1	2,13	12,14
CO-2	**Describe, Design** and **analyze** algorithms using Brute force, Divide and Conquer techniques and apply the techniques to solve real world problems.	2, 13	1, 3	12,14
CO-3	**Design and analyze** algorithms using Decrease and Conquer, Transform and Conquer techniques and apply the techniques to solve real world problems.	2, 13	1, 3	12,14
CO-4	**Design and analyze** algorithms using Dynamic Programming, Input Enhancement techniques and apply the techniques to solve real world problems.	2, 13	1, 3	12,14
CO-5	**Design and analyze** algorithms using Back tracking, Greedy, Branch-bound techniques and apply the techniques to solve real world problems.	2, 13	1, 3	12,14

POs/PSOs	1	2	3	4	5	6	7	8	9	10	11	12	13	14
Mapping Level	2.2	2.8	2.0	-	-	-	-	-	-	-	-	1.0	2.8	1.0

Pre-requisites: 1. Introduction to proofs, discrete mathematics and probability
2. Knowledge of Data Structures and programming skills

Contents:

Unit I

Introduction: Definition of an Algorithm, Fundamentals of Algorithmic Problem Solving, Analysis Framework, Asymptotic Notations and Basic Efficiency Classes, Mathematical Analysis of Non-Recursive and Recursive algorithms. **7 Hrs**

Unit II

Brute Force: Sequential Search, Selection Sort and Bubble Sort
Divide-and-Conquer: Merge sort, Quick sort. **8 Hrs**

Unit III

Decrease-and-Conquer: Binary Search, Depth First Search, Breadth First Search.
Transform-and-Conquer: AVL trees, Heaps and Heap sort. **8 Hrs**

Unit IV

Dynamic Programming: Computing Binomial Coefficient, Warshall's algorithm, Floyd's Algorithm, Knapsack problem. **8 Hrs**

Unit V

Greedy Technique: Prim's Algorithm, Kruslkal's algorithm, Huffman Trees.
Branch – and – Bound: Assignment problem, Knapsack problem.
Backtracking: n – Queens problem, Sum-of-Subsets problem. **8 Hrs**

Reference Books:

1. Anany Levitin, "Introduction to The Design and Analysis of Algorithms", 2/E, Pearson Education, 2011.
2. Thomas H. Cormen, Charles E. Leiserson, Ronal L. Rivest and Clifford Stein, "Introduction to Algorithms", 2/E, Prentice-Hall India, 2009.
3. Horowitz E., Sahni S., RajasekaranS.,"Computer Algorithms", 2/E, Universities Press, 2013.

22UHVK406	Universal Human Values - II	(1-0-0) 1

Contact Hours: 13

Course Learning Objectives (CLOs):

This course provides an opportunity for the students to enhance their life skills like right understanding leading to the harmonious living in relationship with the society and environment enhancing holistic development of the students.

Course Outcomes (COs):

Description of the course outcome: At the end of course the student should be able to:		Mapping to POs (1-12)		
		Substantial Level (3)	Moderate Level (2)	Slight Level (1)
CO-1	Recite and follow interpersonal relations with peers and the society.	6	-	-
CO-2	Demonstrate the concept of harmony in nature and need of self-regulation.	-	6,9	-
CO-3	Recite and follow Natural Acceptance and Differentiate between Intention and Competence.	-	9	-
CO-4	Differentiate between the characteristics and activities of different orders existing in Nature and demonstrate the role of human beings in mutual fulfillment with all the orders of Nature.	7	-	-
CO-5	Visualize and involve in the strategic preparation for Universal Human Order.	8	9	-

POs/PSOs	1	2	3	4	5	6	7	8	9	10	11	12	13	14
Mapping Level	-	-	-	-	-	2.5	3	3	2	-	-	-	-	-

CONTENTS:

Unit I

Harmony in the Society: Understanding Universal Human Order: Understanding Human Goal, Appraisal of the Current Status, The Way Ahead, Dimensions of Human Order. **2 Hrs**

Unit II

Harmony in the Nature: Nature as Collection of Units: Understanding the harmony in the Nature, Interconnectedness and mutual fulfilment among the four orders of nature – recyclability and self-regulation in nature, Understanding existence as co-existence (Sah-astitva) of mutually interacting units in all-pervasive space, Dependence of the Human Being on the Other Three Orders. **3 Hrs**

Unit III

Harmony in Existence: Understanding Co-existence at Various Levels: Existence as Units in Space, Understanding Submergence, Existence as Co-existence – Units Submerged in Space, Development in the Existential Sense, Expression of Co-existence at Different Levels, Understanding Role of Human Being in Existence. **3 Hrs**

Unit VI

Ethical Human Conduct and Professional Ethics in the Light of Right Understanding: Universal Values Naturally Emerging from the Right Understanding, Definitiveness of Ethical Human Conduct, Development of Human Consciousness, Implications of Value-based Living, Profession – in Context with the Comprehensive Human Goal, Ensuring Ethical Competence, Issues in Professional Ethics – The Current Scenario, Prevailing Approaches towards, Promotion of Professional Ethics – their Inadequacy, Inherent Contradictions and Dilemmas and Their Resolution. **3 Hrs**

Unit V

Holistic Development towards Universal Human Order: Visualization of Comprehensive Human Goal, Vision for Holistic Technologies, Production Systems and Management Models, Journey towards Universal Human Order – The Road Ahead. **2 Hrs**

Reference Books:

R.R.Gaur, R Asthana, and G.P Bagaria., “A Foundation Course in HUMAN VALUES and professional Ethics”, 2/E (Revised), EXCEL BOOKS, New Delhi. 2019.

22UAIE421	Mobile Applications Development	(0-0-2) 1

Contact Hours: 26

Course Learning Objectives: This course focuses on how to setup an Android application development environment. Illustrate user interfaces for interacting with apps and triggering actions. It interprets tasks used in handling multiple activities, identify options to save persistent application data and appraise the role of security and performance in Android applications.

Course Outcomes:

Description of the Course Outcome: At the end of the course the student will be able to:		**Mapping to POs(1-12) / PSOs (13-14)**		
		Substantial Level (3)	**Moderate Level (2)**	**Slight Level (1)**
CO - 1	**Create**, **test**, and **debug** Android applications by setting up Android development environment.	1	2, 3	-
CO - 2	**Implement** adaptive, responsive user interfaces that work across a wide range of devices.	1	2, 3	13,14
CO - 3	**Infer** long-running tasks and background work in Android applications. **Demonstrate** methods for storing, sharing, and retrieving data in Android applications.	1	2, 3	13
CO - 4	**Analyze** performance of Android applications and understand the role of permissions and security.	1	2, 3	14
CO - 5	**Describe** the steps involved in publishing an Android application to share with the world.	1	2, 3	-

POs/PSOs	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**14**
Mapping Level	3.0	2.0	2.0	-	-	-	-	-	-	-	-	-	1.0	1.0

Contents:

1 Get started, Build your first app, Activities, Testing, debugging and using support libraries

2 User Interaction, Delightful user experience, Testing your UI

3 Background Tasks, Triggering, scheduling and optimizing background tasks

4 All about data, Preferences and Settings, storing data using SQLite, Sharing data with content providers, Loading data using Loaders

5 Permissions, Performance and Security, Firebase and AdMob, Publish

Reference Books:

1. Rap Payne, “Beginning App Development with Flutter: Create Cross-Platform Mobile Apps”, Apress Publication.
2. Marco L. Napoli, “Beginning Flutter: A Hands - on Guide to App Development”, Wiley Publication.
3. Thomas Bailey, Alessandro Biessek, “Flutter for Beginners: An introductory guide to building cross-platform mobile applications with Flutter 2.5 and Dart”, 2/E PACKT Publication.
4. Eric Windmill, “Flutter in Action”, Manning Publication.
5. Prajyot Mainkar, Salvatore Giordano, “Google Flutter Mobile Development Quick Start Guide”, PACKT Publication.

22UBEK407	Biology for Engineers	(1-0-0) 1

Contact Hours: 13

Course Learning Objective (CLO):

1. Gain a fundamental understanding of basic biological concepts and their relevance to engineering applications.

Course Outcomes (COs):

Description of the Course Outcome: At the end of the course the student will be able to		**Mapping to POs (1-12) /PSOs(13-15)**		
		Substantial Level (3)	**Moderate Level (2)**	**Slight Level (1)**
CO-1	Demonstrate an understanding of the diverse applications of biomolecules.	1	2,3	12
CO-2	Demonstrate an understanding of the architecture and functioning of the brain, eye, and heart as integral systems in the human body.	2,3	1	-
CO-3	Understand the structure, functions, and bioengineering approaches related to the lungs, kidneys, muscular system, and skeletal system.	12	2,3	1

CO-4	Understand nature-inspired materials and mechanisms.	12	2,3	1
CO-5	Understand the latest trends in bioengineering.	2,3	1	12

POs/PSOs	1	2	3	4	5	6	7	8	9	10	11	12	13	14
Mapping Level	1.8	2.4	2.4	-	-	-	-	-	-	-	-	2.7	-	-

Course content:

Unit-I

Biomolecules and their applications: Carbohydrates, Nucleic acids, Proteins, lipids, and Enzymes. **03Hrs**.

Unit-II

Human organ systems and bio designs - 1: Brain as a CPU system, Eye as a Camera system, Heart as a pump system **03Hrs.**

Unit-III

Human organ systems and bio-designs - 2: Lungs as purification system, Kidney as a filtration system, Muscular and Skeletal Systems as scaffolds. **02Hrs.**

Unit-IV

Nature-bioinspired materials and mechanisms: Echolocation, Photosynthesis, Bird flying (GPS and aircrafts), Shark skin (Friction reducing swim suits), Kingfisher beak (Bullet train). Human Blood substitutes. **03Hrs.**

Unit-V

Trends in bioengineering: Bioprinting techniques and materials, 3D printing of ear, bone, and skin. Electrical tongue and electrical nose in food science, Bioimaging and Artificial Intelligence for disease diagnosis. **02Hrs.**

Reference Books:

1. Stuart Fox, Krista Rompolski, “Human Physiology”, McGraw-Hill eBook. 16/E, 2022
2. Thyagarajan S., Selvamurugan N., Rajesh M.P., Nazeer R.A., Thilagaraj W., Barathi S., and Jaganthan M.K., “Biology for Engineers”, Tata McGraw-Hill, New Delhi, 2012.

3. Leslie Cromwell, “Biomedical Instrumentation”, Prentice Hall 2011.
4. Sohini Singh, Tanu Allen, “Biology for Engineers”, Vayu Education of India, New Delhi, 2014.
5. C R Sunilkumar, N Geetha A. C.Udayashankar, “Bioremediation of heavy metals: Bacterial participation”, Lambert Academic Publishing, 2019.
6. Maria Rodriguez Mende, “Electronic Noses and Tongues in Food Science”, Academic Press, 2016

22UMBA401	Mathematics	(3-0-0)

Contact Hours: 39

Course Learning Objectives (CLOs): This audit course will enable students to use Laplace transform to solve differential equations. Also, it enables students to analyze and solve system of linear equation. Further, it makes students to understand the concept of vector differentiation and vector integration.

Course Outcomes (COs):

Description of the Course Outcome: At the end of the course the student will be able to:		**Mapping to POs(1-12) / PSOs (13-16)**		
		Substantial Level (3)	**Moderate Level (2)**	**Slight Level (1)**
CO-1	**Transform** the given function using Laplace transforms and study their properties.	-	-	1,2
CO-2	**Apply** Laplace transform to solve differential equations.	-	-	1,2
CO-3	**Compute** the solution of system of equations. **Evaluate** Eigen values and Eigen vectors for a matrix.	-	1,2	
CO-4	**Study** vector calculus and **compute** gradient, divergence, curl of a single valued function**.**	-		1,2
CO-5	**Study** vector integration and **evaluate** Linear Integrals, Surface Integrals and Volume Integrals	-		1,2

POs	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**14**	**15**	**16**
Mapping Level	1.2	1.2	-	-	-	-	-	-	-	-	-	-	-	-	-	-

Pre-requisites: Knowledge of Differentiation and Integration of functions, Elementary row transformation of matrix, Vector Algebra.

Contents:

Unit-I

Laplace Transforms:
Definition and Properties. Laplace transform of elementary functions. Laplace transform of $e^{at}f(t)e^{at}f(t)$ Laplace transform of $t^n f(t)t^n f(t)$, Laplace transform of $\frac{f(t)f(t)}{t \quad t}$,Laplace transforms of Periodic functions and unit-step function–problems **8 Hrs**

Unit-II

Inverse Laplace Transforms: Problems with standard, Convolution theorem (without proof) to find the inverse Laplace transform and problems. Solution of linear differential equations using Laplace transform. **8 Hrs**

Unit-III

Elementary Linear Algebra: Rank ofa matrix - Row Echelon form. Test for consistency for system of linear equations. Solution of system of linear equations – Gauss-elimination method(consistency), Gauss-Seidel iterative method. Eigen values and Eigen vectors- Rayleigh's power method. **8 Hrs**

Unit-IV

Vector Differentiation: Scalar point function and vector point functions. Gradient, Directional Derivative; Curl and Divergence - physical interpretation. Solenoidal and irrotational vectors. Illustrative problems. **8 Hrs**

Unit-V

Vector Integration: Line integrals, Surface integrals and Volume integrals.Green's theorem, Gauss divergence theorem and Stoke's theorem (only statements).

7 Hrs

Reference Books:

1. **B.S. Grewal**: Higher Engineering Mathematics, Khanna Publishers, 44th Edition, 2017.
2. **H. K. Dass & Rajnish Verma:** Higher Engineering Mathematics, 3rd Edition, 2014.

Note: 1. Grades (i) PP (ii) NP
2. No semester End Examination
3. Audit (Bridge course).

1. The mandatory non – credit courses Mathematics for III and IV semesters respectively, to the lateral entry Diploma holders admitted to III semester of

BE/B.Tech., programs, shall attend the classes during the respective semesters to complete all the formalities of the course and appear for the Continuous Internal Evaluation (CIE). In case, any student fails to register for the said course/fails to secure the minimum 40% of the prescribed CIE marks, he/she shall be deemed to have secured an F grade. In such a case, the student has to fulfill the requirements during subsequent semester/s to appear for CIE.

2. These Courses shall not be considered for vertical progression, but completion of the courses shall be mandatory for the award of degree.

22UPYK408 Physical Education and Yoga (0-0-2) Audit

Contact Hours: 24

Course Learning Objectives:

1. The course focuses on overall development and importance of Physical Education & Yoga day to day life.

Course Outcomes (COs):

Description of the Course Outcome: At the end of the course the student will be able to:		Mapping to POs(1-12)		
		Substantial Level (3)	Moderate Level (2)	Slight Level (1)
CO1	Gaining the importance of Physical Education & yoga	12		8, 9
CO2	Understanding the benefits & preventive measures of health	12	6	8, 9
CO3	Gaining the knowledge of yoga	12		8, 9
CO4	Understanding the importance of Human Body conditioning & Sports training	12		8, 9
CO5	Get awareness of Modern technology in sports	12		5, 8, 9

POs	1	2	3	4	5	6	7	8	9	10	11	12
Mapping Level	-	-	-	-	1	2	-	1	1	-	-	3

Contents

Unit-I

Introduction to Physical Education: Meaning and importance, definition, components, benefits of physical education. **04Hrs**

Unit-II

Health and Wellness, Anatomy and Physiology: Meaning and importance, definition, components, benefits, health habits, basics of diseases and preventive measures, mental health, physical health, social health, spiritual health. Meaning and definition, first aid, injuries and preventions. **05Hrs**

Unit-III

Introduction of Yoga: Origin and history of Yoga, meaning and definition, benefits, importance prayer Suryanamaskara,

Asana:- Ardha chakrasana, Vajrasana, Supta vajrasana, Dhanurasana.

Pranayama:- Surya Anuloma Viloma & Chandra Anuloma Viloma.

Mudras:- Jnana mudra & Vayu mudra. **05Hrs**

Unit-IV

Sports Training: Meaning and definitions, warming up, cooldown, methods of exercises, stretching, speed, endurance, flexibility, agility, Athletics, Table Tennis, Hockey, Cross country, Archery Rules and regulation of all games. **05Hrs**

Unit-V

Modern Technology in Sports and Games: Meaning and definitions, objectives, assisting umpires/ referees, hawk-eye technology, sports specific, computer software, technology in playfields, athletes clothing and equipment, graphics of sports and games, artificial intelligence. **05Hrs**

Reference Books:

1) Petipus, et al., Athlete's Guide to Career Planning, Human Kinetics, 1997
2) The Human Body in Health and Disease with Access 8th Edition 2023.
3) Anatomy and Physiology, Shri K.G. Nadgir College of Physical Education. Dharwad.
4) Health & Wellness Shri K.G. Nadgir College of Physical Education. Dharwad.
5) Nagendra HR., The art and science of Pranayama, 2009
6) Iyengar BKS., The illustrated Light on Yoga(English), 2005

CIE and SEE Evaluation (from 2023-24batch)

Courses with LTP 3-0-0 and 4-0-0 or 2-2-0/3-2-0

Continuous Internal Evaluation (CIE):

- Two Internal Assessment and one Improvement test each of 20 marks and one hour duration.
- Two higher scores from three tests are taken representing 40 marks.
- Question Paper pattern for Internal Assessment: 3 questions of 10 marks each with maximum of two sub divisions. Q.3 is compulsory and one question to be answered from Q.1 and Q.2.
- Course Teacher Assessment (CTA): Minimum two components such as quiz, seminar, written assignment, any technical activity related to course each of 5marks. Total CTA marks-10
- CIE=40 (from tests)+10(from CTA) =50 marks

Semester End Examination (SEE):

- SEE is conducted for100 marks with 3 hours duration. It is reduced to 50 marks.
- Question Paper pattern for SEE: Five units with built in choice. Each question with maximum of three sub divisions.
- Two questions are to be set from each unit with built in choice, for example Q1 or Q2 in unit –I, Q 3 or Q 4 in unit-II and so on.
- A total of 5 full questions to be answered choosing one full question from each unit. All five units are to be answered compulsorily.
- Each question is of 20 marks.
- The Question paper is to be set for duration of 3 hours both for 3 and 4 credits courses.
- The Question paper is to be set for 100 marks for 3 and 4 credits courses.

ASC(IC)/PCC with LTP 2-0-2, 3-0-2 and 2-2-2

Continuous Internal Evaluation (CIE):

Theory CIE component:

- Two Internal Assessment and one Improvement test each of 20 marks and one hour duration.
- Two higher scores from three tests are taken representing 40 marks.
- Question Paper pattern for Internal Assessment: 3 questions of 10 marks each with maximum of two sub divisions. Q.3 is compulsory and one question to be answered from Q.1 and Q.2.

Course Teacher Assessment (CTA): Totally based on conduction of experiments as set by the course teacher.

Laboratory component assessment:

- 5 marks: for conduction, regularity, involvement, journal writing, etc. Minimum 75% of attendance is compulsory. If the performance is not satisfactory in laboratory the student shall be detained and required to reregister for the course as a whole whenever offered next.
- 5 marks: Lab Test. A Lab test as per the class time table has to be conducted at the end for50 marks and scale down to 5 marks.
- CIE for integrated course =40 (from IA tests)+10 (from CTA i.e. lab component) =50 marks.
- There will not be any remuneration for Final Lab Test since it is CTA of integrated course.
- Copy of the Marks list to be sent to the concerned course instructor immediately after the completion of test for that batch. Original Marks list to be maintained in the department.
- CIE=40(from tests)+10(from CTA i.e. lab component) =50 marks

Semester End Examination (SEE):

- SEE is conducted for100 marks with 3 hours duration. It is reduced to 50 marks.
- Question Paper pattern for SEE: Five units with built in choice. Each question with maximum of three sub divisions.
- Two questions are to be set from each unit with built in choice, for example Q1 or Q2 in unit –I, Q 3 or Q 4 in unit-II and so on.
- A total of 5 full questions to be answered choosing one full question from each unit. All five units are to be answered compulsorily.
- Each question is of 20 marks.
- The Question paper is to be set for duration of 3 hours both for 3 and 4 credits courses.
- The Question paper is to be set for 100 marks for 3 and 4 credits courses.

AEC/HSMS/UHV Courses with LTP 1-0-0:

Continuous Internal Evaluation (CIE)

- Two Internal Assessment and one Improvement test each of 20 marks and one hour duration.
- Two higher scores from three tests are taken representing 40 marks.
- Question Paper pattern for Internal Assessment: MCQ 20 questions

- Course Teacher Assessment (CTA): Minimum two components such as quiz, seminar, written assignment, any technical activity related to course etc. each of 5marks. Total CTA marks-10
- CIE=40(from tests)+10(from CTA) =50 marks

Semester End Examination (SEE):

- SEE is conducted for 50 marks of 1 hour duration. There will be 50 MCQs.
- Question Paper pattern for SEE: The question paper will contain 12 MCQ questions drawn from each Unit.
- Students have to answer maximum of 10 questions from each unit.
- All five units are to be answered compulsorily.

For NSS/Physical Education/Yoga Audit Courses with LTP 0-0-2
Continuous Internal Evaluation (CIE)

- All students have to register for any one course in each semester of III to VI with concerned course instructor.
- The department must make a faculty coordinator for the above audit courses and the details of the students must be maintained.
- The concerned course instructor must define the set of activities and its schedule of the conduction in NSS, PE and Yoga by taking approval from Dean Academic Program.
- The course instructor has to conduct the events as per the schedule and maintain the attendance for the same. 75% attendance is mandatory.
- The course instructor must assess the students by conducting the MCQ test for 50 marks to be conducted during the improvement test for other courses.
- The course instructor must send the marks and attendance register to the respective departments.
- The faculty coordinator of the department must maintain the same and arrange for sending the marks to CoE.